Project Highlights

The Village of Doaktown is a rural community with approximately 900 residents located north of Moncton, N.B. This project focused on upgrading the existing Wastewater Treatment Facility to provide properly treated water into the Southwest Miramichi River. The River is renown as the "world's greatest Atlantic salmon producer". The improved treatment on the wastewater treatment facility would improve the overall water quality of the river. Thus provide a better environment for the salmon population, which directly affects the tourist and commercial industry as well as other recreational activities in that area. Crandall Engineering Ltd. was retained by the Village of Doaktown to design and manage the construction of this project.

The construction of the Village of Doaktown Wastewater Treatment Facility consisted of a 640 m^3/day ultimate design flow entering one (1) aerated cell (primary treatment) followed by an aerated polishing cell (secondary treatment) and finally an aerated nitrification system (final treatment), which was the first system to be built in New Brunswick and in Atlantic Canada.

The project underwent an Environmental Impact Assessment which included the revision of the project details and requirements through the New Brunswick Department of Environment (NBDENV). Any issues and concerns pertaining to the project were resolved during this initial phase. This also involved a public consultation for any unease as viewed by the residences of the Village of Doaktown. Therefore, all parties that may have been affected by the project are given the opportunity to voice their opinions on the project before the start of construction.

The existing facility was limited to the North by the Southwest Miramichi River. Due to the location of the existing facility footprint and the increase in flow being received by the facility the purchase of land to the west was required. With this land acquisition between the Owner and the Village of Doaktown it was possible to expand the size of the existing facility to be able to handle future flows and to promote additional growth within the Village. Promoting growth within the small Village would encourage industrial and business development that would potentially provide employment opportunities for residences within or surrounding the Village of Doaktown.

The existing facility was also limited to the northwest as delineated wetlands were found within this area. Due to the limited space for expansion of the facility the lagoon dikes were located within a 30 m buffer area of provincially significant wetlands. Therefore, a Wetland and Watercourse Alteration (WAWA) permit was required for the project. This included special construction methods involving procedures to protect the surrounding environment. The Contractor followed an Environmental Management Plan (EMP) as a guideline in order to follow emergency procedures and environmental guidelines during the course of the project.

Before construction of the new aerated nitrification chamber the sludge material located in this area of the upgrade which had been accumulating since the lagoon was built in 1980's had to be removed. The water was drained from the lagoon until bulldozers and excavators could enter the lagoon in order to remove the sludge material. The sludge material was stored within the existing lagoon footprint to the east of the new aerated nitrification chamber.

As mentioned above, due to the limited area for this project, the existing facultative lagoon was expanded (excavation and installation of dikes for the aerated cell to the west of existing lagoon) and existing lagoon was divided into two (2) separate cells (the aerated polishing cell and aerated nitrification chamber). In order to divide the existing cell into two (2) separate cells a dividing dike was created with acceptably tested imported, impermeable clay material. The dividing dike is a key component to the facility as it acts as a partition between the different treatments of the process.

Before construction of the new aerated cell, done outside and to the west of the existing lagoon, the area had to undergo an archaeological study. The archaeological study determined the potential of finding any archaeological artifacts or features during the construction activities of the facility upgrade. The Contractor and his workers were made aware that in discovering an artifact all work was to stop and an archaeologist was to be called to further inspect the discover. However, no such discoveries were encountered.

Furthermore, prior to any construction activities within the facility footprint, a bird survey and a species at risk and sensitive habitat survey were also conducted. The bird survey was conducted in order to determine if there were any species considered endangered, threatened or species of special concern. In this case it was found that few species would appear to breed within the area to be upgraded and all species observed in the area were common and not endangered. Similar observations were made concerning species at risk. Wildlife observations in this area were found to be very few due to cool wet weather. However, the wood turtle species were most likely to be encountered and the construction personnel were made aware of their probable presence. They were also directed to carefully remove them from the construction site and be placed near the river shore.

This facility was constructed on soft and high groundwater table soils. Special construction methods including a sub-surface drainage system and HDPE liner were required. The sub-surface drainage system included the installation of pipes beneath an HDPE liner. This installation would prevent the high groundwater table from lifting the HDPE liner as well as remove any naturally released gases from beneath the soil. The HDPE liner will also help in preventing the treated water from reaching the cleaner groundwater.

The aerated nitrification chamber, also known as SAGR (Submerged Attached Growth Reactor) was installed at the end of the entire process for several reasons. The final treatment process can remove the nutrients (total ammonia nitrogen and phosphorus) that have not been removed during the initial treatments. Due to the favorable niche for salmon within the Southwest Miramichi River it was of high priority that nutrient enrichment be prevented in order not to harm the fish habitat within this area of the River. The system can also further reduce the $CBOD_5$ (carbonaceous biological oxygen demand) and TSS (total suspended solids), two main components involved in water pollution, and continue to have consistent results during cooler months due to easy adaptable operational control of the system. As the system is installed below the ground, the temperature of the treated effluent will also be decreased to a much more favorable temperature for the receiving water benefiting the salmon population. Furthermore, as an additional bonus from the system, it also provides for disinfection treatment year round, which is beneficial in this location as the river is used for recreational activities.

The project cost was approximately **$2.5 million** and was separated into two (2) contracts that were individually undertaken due to the complexity of each contract:

Contract No. 1 incorporated all of the earthworks and piping related to the project. This included approximately 570 m of gravity pipe sanitary sewer, approximately 440 m of buried aeration systems, approximately 740 m of pipe for the sub-drainage system, construction of the dikes including the use of borrow material, clay material for the division of the existing lagoon, sludge removal, installation of aeration system, installation of aerated nitrification chamber, the excavation of approximately 4 m deep structures, the construction of a new access road and installation of a new security fence.

Contract No. 2 incorporated all of the construction required for the blower building and lift station upgrade related to the project. This included the complete construction of a new blower building (building foundation, structure, architecture, mechanical and electrical) and an upgrade to the existing lift station building (architecture and electrical).

CANADIAN CONSULTING ENGINEERING AWARDS 2012

Presented to:
Bronwen Parsons, Editor
Canadian Consulting Engineer magazine
80 Valleybrook Drive
Toronto, Ontario
M3B 2S9

VILLAGE OF DOAKTOWN UPGRADE TO WASTEWATER TREATMENT FACILITY

Village of Doaktown, N.B.

Presented by:
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March 8, 2012

Table of Contents

Section 1.0 - Introduction

The construction for the upgrade of the wastewater treatment facility for the Village of Doaktown was done over 14 months and completed by July of 2011 (no construction work was conducted during the winter months). The following sections describe the general background of this project, the different elements involved, special details and concerns, the project cost and firm involvement and the outcomes of this project.

The ultimate goal of this project was to ensure that the water from the wastewater treatment facility was properly treated to make certain that the salmon population in the Southwest Miramichi River was protected from high nutrient concentrations and warmer temperatures from the facility. As well as ensure that the water quality treated and discharged within the Southwest Miramichi River was safe for leisure and recreational activities. The Southwest Miramichi River is renown as the "world's greatest Atlantic salmon producer" and therefore requires special effluent treatment in order to continue to encourage salmon growth within this important river found adjacent to the facility.

Figure 1 shows the existing conditions of the facility prior to any construction activities. The facultative (stabilization pond) facility can be viewed at the left. The facultative lagoon is so large that it is possible to retain the water for a large period of time, thus permitting the effluent water temperature to rise. In effect, this causes the treated effluent to be at a warmer temperature than the receiving water that is unfavorable for the salmon population found in this area. Also, as seen to the right, the facility was built over 30 years ago which results in degraded structures that no longer function effectively or are as structurally secure as they were first constructed.

Figure 1: Existing Conditions of the Facility Prior to Construction Upgrade

Section 2.0 - Background

2.1 Description of the Region

The Village of Doaktown is a rural community found in the Northumberland County of New Brunswick, which includes areas for farming with a population of 900 people. The region consists mostly of farmland with some areas of wetlands and is situated at the south edge of the Southwest Miramichi River. A large attraction, which is well known around the world within the Village of Doaktown, is the great salmon fishing within the Southwest Miramichi River.

2.2 Reasons for Undertaking This Project

The Village of Doaktown's existing wastewater treatment facility was not able to meet the new government regulations with regards to its effluent being directed into the Southwest Miramichi River, which could have negative effects on the salmon population in that area, as well as the overall water quality of the river.

The facility was originally designed as a seasonal discharge lagoon, meaning that it would retain sewage flows from the months of June until September before they were released into the Southwest Miramichi River. The existing facultative lagoon was constructed in the early 1980's.

However, due to an increase in the Village population and increased flow since its construction, the lagoon was no longer capable of operating in this manner and was discharging flow into the river year-round. The effluent temperature of this continuous discharge could possibly have a negative impact on the salmon population in the river and directly affect the tourist and commercial industry as well as other recreational activities.

It has been recommended that the existing municipal lagoon be expanded and upgraded to an aerated (treatment pond with artificial aeration) facility. The addition of an aerated nitrification system also known as SAGR (Submerged Attached Growth Reactor) will serve to lower the effluent nutrient concentration and temperature of flow being discharged. Following this recommendation, the protection of the environment, more specifically the Southwest Miramichi River, and thus the environment for the salmon population will be improved.

A "do-nothing" approach is not acceptable in this case, as the existing structure will continue to have a negative impact on the local environment.

2.3 Resident's Position

Residents of this area were in favor of this project. The Village and Crandall held a public consultation meeting on September 28, 2009 to obtain their feedback and any concerns related to this project. They were aware of the potential public health hazards in the area and wanted to ensure that their wastewater was properly treated before being released into the environment.

Section 3.0 - General Description of the Project

3.1 Project Registration Process

The project underwent an Environmental Impact Assessment (EIA) which included the revision of the project details and requirements through the New Brunswick Department of Environment (NBDENV). Any issues and concerns pertaining to the project were resolved during this initial phase. This also involved a public consultation for any unease as viewed by the residences of the Village of Doaktown. Therefore, all parties that may have been affected by the project are given the opportunity to voice their opinions on the project before the start of construction.

The existing facility was limited to the North by the Southwest Miramichi River. Due to the location of the existing facility footprint and the increase in flow being received by the facility the purchase of land to the west was required. With this land acquisition between the Owner and the Village of Doaktown it was possible to expand the size of the existing facility to be able to handle future flows and to promote additional growth within the Village.

Promoting growth within the small Village would encourage industrial and business development that would potentially provide employment opportunities for residences within or surrounding the Village of Doaktown.

The existing facility was also limited to the northwest as delineated wetlands were found within this area. Due to the limited space for expansion of the facility the lagoon dikes were located within a 30 m buffer area of provincially significant wetlands. Therefore, a Wetland and Watercourse Alteration (WAWA) permit was required for the project. This included special construction methods involving procedures to protect the surrounding environment. The Contractor followed an Environmental Management plan (EMP) as a guideline in order to follow emergency procedures and environmental guidelines during the course of the project.

3.2 Lagoon Construction

Before construction of the new aerated nitrification chamber the sludge material located in this area of the upgrade which had been accumulating since the lagoon was built in 1980's had to be removed. The water was drained from the lagoon until bulldozers and excavators could enter the lagoon in order to remove the sludge material. The sludge material was stored within the existing lagoon footprint to the east of the new aerated nitrification chamber.

Figure 2: Sludge Removal

The lagoon construction upgrade consisted of one (1) aerated cell constructed outside and west of the existing lagoon (with the addition of land bought by the Village of Doaktown), one (1) polishing cell complete with aeration and one (1) aerated nitrification system which were constructed inside the existing lagoon footprint. The total volume available for treatment within the aerated cell was approximately 8,560 m^3 and was approximately 29,990 m^3 for the aerated polishing cell. The aerated nitrification system receives the water from the aerated polishing cell and removes the nutrients and pathogens and allows the treated water to cool before releasing it to the Southwest Miramichi River.

This facility is designed to treat the municipal wastewater and to lower the concentrations of carbonaceous 5-day biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), nutrients (including total ammonia nitrogen and phosphorous) and pathogens (more specifically the *Escherichia coli* and Fecal coli forms) as required by the new government regulations; as well as cool the treated effluent prior to being released to the receiving environment. This is very important in order to continue to favor the salmon population that is found within this region.

The different components being released to the environment are different forms of pollution and need to be treated in order to prevent nutrient enrichment within the niche of the salmon population found within the Southwest Miramichi River. The pathogens are forms of bacteria that can be dangerous to human health especially in this area as it is used by the public for recreational purposes.

The lagoon construction was limited in size due to certain land restrictions within this area. In order to construct the aerated cell land acquisition was required to the west of the existing facility between the land Owner and the Village of Doaktown. The existing facility was also limited to the North by the Southwest Miramichi River and further along the northwest as delineated wetlands were found within this area.

Before construction of the new aerated cell, done outside and to the west of the existing lagoon, the area had to undergo an archaeological study. The archaeological study determined the potential of finding any archaeological artifacts or features during the construction activities of the facility upgrade. The Contractor and his workers were made aware that in discovering an artifact all work was to stop and an archaeologist was to be called to further inspect the discover. However, no such discoveries were encountered.

Furthermore, prior to any construction activities within the facility footprint, a bird survey and a species at risk and sensitive habitat survey were also conducted. The bird survey was conducted in order to determine if there were any species considered endangered, threatened or species of special concern. In this case it was found that few species would appear to breed within the area to be upgraded and all species observed in the area were common and not endangered. Similar observations were made concerning species at risk. Wildlife observations in this area were found to be very few due to cool wet weather. However, the wood turtle species were most likely to be encountered and the construction personnel were made aware of their probable presence. They were also directed to carefully remove them from the construction site and be placed near the river shore.

The lagoon was constructed on a challenging site as there was a high presence of groundwater in this area. As a result, a sub-surface drainage system was constructed to control the groundwater levels during construction and special dewatering construction methods were used throughout the project duration. The dewatered water was also pumped into an appropriate sedimentation pond in order to prevent sediments from running freely into the surrounding environment. The sub-surface drainage system included the installation of pipes beneath an HDPE liner to remove excess water from the high groundwater table. This installation would prevent the high groundwater table from lifting the HDPE liner as well as remove any naturally released gases from below the soil.

Figure 3: Sub-Drainage System – Aerated Cell

The aerated cell as well as the aerated nitrification system also included a High Density Polyethylene (HDPE) liner in order to protect the surrounding environment from any possible seepage of sewage through the lagoon walls. The liner was placed at all sides of the cells including the bottom because of the high groundwater table and the location of the facility which was in close proximity to a wetland.

Figure 4: Geotextile and Sand Base Preparation for HDPE Liner – Aerated Cell

The wall division between the aerated polishing cell and the aerated nitrification chamber required the installation of compacted clay material in order to keep the dividing dike impermeable so that the levels within each lagoon would remain constant and unaffected by the other adjacent lagoon in order to function properly. The dividing dike is a key component to the facility as it acts as a partition between the different treatments of the process. The photography on the left, Figure 5, shows the first step of the dividing dike which is the placing of the sandstone material in order to create a working platform for the installation of the clay material. On the right, after placing the sandstone material, a strip in the middle is excavataed and clay material is compacted into place. Many compaction tests are required in order to make certain that the material will act as an impermeable barrier wall between the aerated polishing cell and the aerated nitrification chamber.

Figure 5: Construction of the Dividing Dike – Imported Clay Material

The complete construction work was done with special environmental considerations based on the major EIA and WAWA approval process with the NBDENV. From Figure 6, all of the environmental procedures have been implemented throughout the completion of the project. This includes the level, impermeable fueling pad, silt fences and the sedimentation pond.

Figure 6: Fueling Pad (center), Silt Fences (background) and Sedimentation Pond (right) – Implementation of Environmental Management Plan

3.2 Aerated Nitrification System

The aerated nitrification system (or SAGR which stands for Submerged Attached Growth Reactor) is one of the first to be built within the Province of New Brunswick and Atlantic Canada.

It was installed, for this project, in order to remove nutrients (total ammonia nitrogen and phosphorous) to prevent nutrient enrichment within the receiving river that could potentially harm the fish. The system also further reduces $CBOD_5$ and TSS from the wastewater at this final stage of the process. These two main components are involved in water pollution. The system will also continue to have consistent results during cooler months due to easy adaptable operational control of the system. Lastly, as the SAGR is installed below the ground it can slightly lower the treated effluent water before being released into the environment. This will also benefit the salmon population within the receiving water.

The SAGR contains two (2) parallel treatment chambers. Each chamber consists of two (2) aerated gravel beds in series receiving the full design flow from the aerated polishing cell. Depending on the season, the wastewater from the polishing cell may be diverted to enter the chambers at different locations in order to have an appropriate amount of bacteria to encourage the nitrification process due to effects caused by the cooler weather. This will also allow for the proper disinfection to occur on the effluent even during the winter season.

Figure 7: Construction of SAGR Chamber

The system is also insulated with mulch which is placed over the granular bed in order to prevent freezing of the inter-cell piping and to decrease the treatment volume loss due to potential ice formation.

Historically, in order to remove nutrients from the municipal wastewater a mechanical plant would have had been installed at the facility. However, given this new technology the Village of Doaktown was able to save in costs for this project and have the same maintenance requirements as the existing facility without further training or higher Operator certifications.

3.3 Blower Building

The construction of a new 73.8 m^2 wood frame, metal cladding blower building, including a lab and storage room, was also required for this project. The blower building is located to the west of the existing lift station which is located to the south of the polishing cell. The new blower building equipped with a lab room will allow for the operator to conduct on the spot testing (which includes dissolved oxygen (DO), temperature of effluent, pH of effluent, color, odor and other general observations) and adjust the operation of the facility if required in a timely fashion instead of waiting for laboratory results from an accredited laboratory. This will provide an increased monitoring of the treated effluent and better management of the municipal waste. In turn, the environment is to receive efficiently treated effluent water from the facility that will also help protect the salmon population.

Figure 8: New Blower Building (right) and Upgraded Lift Station (left)

The blower selection for an aeration system requiring a maximum of 1,500 scfm was to install three (3) positive displacement blowers with sound enclosures and variable frequency drives with two (2) blowers rated at 628 scfm at 7.8 psi and 30 hp motors and one (1) blower (for the SAGR constantly running) rated at 302 scfm at 8.3 psi and 15 hp motor. The diffusers used for the SAGR aeration system are shown in the Figure 9 below (left).

Figure 9: Installation of Air Headers for Both Chambers of SAGR

The blower for the SAGR system will provide air that will pass through the diffuser lines found at the bottom of the chambers that is released to the entire system. The air released to the system will provide oxygen for the nitrification process. If the single blower for the SAGR system should fail the blowers for the lagoons will provide the air required.

The blowers for the aeration process within the aerated cell and aerated polishing cell provide air required to pass through the lateral diffusers. Only one (1) blower is operating at a time (alternating from time to time) at 100% capacity. The second blower acts as a spare for emergency or back-up purposes for either the lagoons or the SAGR system.

The facility is now equipped with flow sensors, data recorder, differential pressure transmitters, gauges, etc. The building also has a ventilation system, hot and cold water piping, hot water heater, backflow preventer, plumbing and drainage systems including oil-water separator, sinks and fixtures.

Figure 10: SAGR Blower (left) and One of the Aerated Cell Blower (center)

The construction of the blower building allows for the proper treatment of the municipal wastewater with aid from the aeration system. This allows the operator's to better treat the wastewater by adjusting the amount of air required for the specified treatment goal for $CBOD_5$ and TSS as required by the government regulations.

3.4 Lift Station

The upgrade to the existing lift station included electrical, pump wiring, control panel, conduit, pump controller (PLC), programming, new doors, asphalt shingles, vinyl soffit, aluminum fascia metal, paint and related works required for this project. The existing lift station is located south to the polishing cell.

Figure 11: Lift Station Electrical Upgrade

The existing lift station is already equipped with two (2) screw pumps presently capable of accepting the total flow of the system, with the possibility of adding a third (3^{rd}) screw pump for future increases in flow.

The lift station is complete with an alarm system that is directed to the Operator at all times in case of failure or emergency situations. Therefore, the Operator will receive a warning during critical conditions, which will also aid in better managing the

treatment of the municipal water. This will also further protect the receiving environment and the salmon population, by having a quicker response time to solve potentially harmful situations.

3.5 Access Road

A part of the existing access road was upgraded with new roadbed material extending from the culvert, to the area surrounding the existing lift station and around the new blower building to the new aerated lagoon. The dividing dike between the aerated polishing cell and aerated nitrification chamber was also finished with roadbed material.

The 3.6 meter wide, crushed rock and sandstone road will provide smooth access to the facility. A fence at the wastewater treatment facility was also placed around the lagoon to ensure safety at the site with a new vehicle access gate.

Section 4.0 - Project Details

4.1 Schedule

Contract No. 1 (earthworks and piping) was started in August of 2010 and was completed in mid July of 2011. The work incorporated all of the earthworks and piping related to the project. This included approximately 570 m of gravity pipe sanitary sewer, approximately 440 m of buried aeration systems, approximately 740 m of pipe for the sub-drainage system, construction of the surrounding dikes for the facility including a dividing dike between the aerated and polishing cell with clay material, approximately 1,700 m^3 sludge removal, installation of aeration system, installation of two (2) aerated nitrification chambers of approximately 3,480 m^3 total, the excavation of approximately 4 m deep structures, the construction of a new access road, installation of a new security fence, topsoil and hydroseeding.

The earthworks also included the construction of drainage system around the lagoon including ditches and installation of HDPE liner for the new aerated cells to protect surrounding environment from any seepage.

Contract No. 2 (construction of new blower building and upgrade of existing lift station) was started in mid September of 2010 and was completed by early March of 2011. The work for the construction of the new blower building included all of the construction related to the building foundation, structure, architecture, mechanical and electrical work.

The upgrade to the existing lift station included the architecture and electrical work related to the project as mentioned in greater detail in Section 3.4 – Lift Station.

4.2 Environmental Protection

Various decisions were taken in regards to this project to limit its impact on the environment.

- Sediment control ponds and ditching were used near the wastewater treatment plant to control flow direction of water;
- Silt fencing and erosion control devices were used at numerous locations in the project;
- Rip-rap installation at certain locations surrounding the dike to protect it from further erosion during flooding events due to the nearby Southwest Miramichi River;
- Hydroseeding and hay mulching was used when completed in order to prevent free soil from eroding; and,

- An Environmental Management Plan (EMP) was created to be followed by all parties involved in the project, which included the installation of a fueling pad and am emergency plan.

Figure 12: Rip Rap for Protection Against Flooding Events

Section 5.0 – Major Concerns

5.1 Soil Condition and Groundwater

The wastewater treatment plant site was located close to a wetland and had high groundwater elevations in certain areas. It is also located far from any nearby homes within the Village of Doaktown. The treated effluent from the facility is also discharged in an important recreational location within the Southwest Miramichi River.

The soils encountered at the project site were found to consist of topsoil underlain by silt and sand to sand and gravel. Bedrock was not encountered during the construction of the facility.

However, there was groundwater seepage, which was monitored with the help of piezometers, throughout the project site and was found to be from 1.7 to 1.9 meters below surface grade. The groundwater flow direction was also observed to travel towards the southwest of the facility at a gradient of 0.3%. The groundwater table is also expected to fluctuate depending on precipitation events and construction activity. Due to the close proximity of the groundwater table to the bottom of the lagoon, dewatering measures and a sub-drain system was required.

While considering the design of the lagoon the following factors were taken into account: site constructability, stability of lagoon berms and settlements.

- Since construction is to take place during the wet spring and fall season, a cleaner Borrow "A" material was recommended to be used;
- There was no heavy construction traffic directed near the wetlands to protect the surrounding environment;
- The berms of the lagoon dikes were not constructed to be steeper than 3H:1V to minimize the potential of erosion;
- Due to the proximity of the facility to the Southwest Miramichi River, rip-rap was placed on the north and west facing slopes of the dikes to protect the facility from river erosion during flooding events. The rip-rap was also underlain with geotextile fabric;

- The HDPE liner was underlain with sand material free of any debris in order to provide a clean, soft working surface and to prevent penetration of the liner.
- Due to soft soils, sand and gravel found on the project site a slight settlement is expected to occur in the order of 50 to 150 mm concentrated beneath the dikes. However, the settlement was to occur during the construction process.

5.2 Sub-Drainage System

As previously mentioned, due to the high groundwater table a sub-drain system was installed below the liner to prevent the liner from floating. Also, it would allow for the gases to escape more easily. The water from the sub-drains was directed to a sump manhole for pumping if required.

Section 6.0 – Project Cost and Firm Involvement

The total project cost was approximately $2.5 million. This project was funded by the Village of Doaktown and by the Canada – New Brunswick Municipal Rural Infrastructure Fund Agreement.

The following firms were involved in this project:

- Design and project management: Crandall Engineering Ltd;
- Geotechnical Investigation: Gemtec Ltd;
- Wetland Delineation: AMEC;
- Bird Survey: Stuart I. Tingley;
- Archaeological Investigation: Archaeoconsulting;
- Species at Risk and Sensitive Habitat Survey: AMEC;
- OPTAER Wastewater Treatment System: Nelson Environmental Inc.; and,
- Structural Design: Valron Engineers Inc.

Section 7.0 – Conclusion

With the project completed in 2011, this will allow for the entire wastewater of this region to be properly treated, therefore eliminating any possible negative environmental impacts on the Southwest Miramichi River and the salmon population. Due to the installation of the SAGR system the removal of nutrients will also ensure a healthier ecosystem for different types of fish and continue to provide treated effluent that will not harm the receiving environment.

The size of the lagoon allows for population growth of the Village of Doaktown without affecting the environment or causing any further concern.

Figure 13: New Aerated Cell (left), Polishing Cell (right), SAGR System (right) and Buildings (right)

Figure 14: SAGR System

APPENDIX A:
Crandall Engineering Ltd. Construction Drawings

SOUTHWEST MIRAMICHI RIVER

AREAS TO BE FINISHED WITH 0-31.5mm CRUSHED ROCK COMPACTED TO 95% OF MAXIMUM DRY DENSITY.

AREAS TO BE FINISHED WITH 100mm THICK OF TOPSOIL AND HYDROSEEDING.

EDGE OF RIVER

TYPE "C" EROSION CONTROL STRUCTURE

LIMITS OF EXISTING FENCE REMOVAL

PROPERTY LINE

REUSE EXISTING OUTFALL PIPE

NEW MAN GATE

800mm THICK MINIMUM R-100 RIP-RAP TO BE PLACED FOR DIKE PROTECTION

EXISTING TREELINE

NEW UV DISINFECTION FACILITY (BY OTHERS)

EXISTING BERM TO BE LEFT AS IS

NEW FENCE 1.0m BEYOND DIKE EDGE

140m

LAYOUT INFORMATION					
POINT No.	EASTING (m)	NORTHING (m)	POINT No.	EASTING (m)	NORTHING (m)
1	2528304.360	7506529.164	13	2528556.142	7506550.003
2	2528344.516	7506543.083	14	2528570.384	7506554.709
3	2528376.648	7506450.381	15	2528563.970	7506634.200
4	2528336.492	7506436.463	16	2528569.702	7506635.977
5	2528524.882	7506515.680	17	2528587.978	7506561.543
6	2528492.992	7506612.190	18	2528593.074	7506565.246
7	2528517.435	7506598.297			
8	2528531.678	7506603.003			
9	2528537.944	7506605.074			
10	2528552.187	7506609.780			
11	2528535.632	7506543.226			
12	2528549.875	7506547.932			

NEW AERATED CELL NO. 1
TOP OF DIKE ELEV = +33.20m
WATER LEVEL = 32.00m
BOTTOM OF LAGOON = 30.00m

SLUDGE CONTAINMENT CELL
TOP OF DIKE/FINISHED ELEV. = 33.200m
TOP OF SLUDGE ELEV. = 31.900m
BOTTOM OF LAGOON = 30.000m (+/-VARIES)

TYPE "C" EROSION CONTROL STRUCTURE

SEDIMENT CONTROL POND SEE DWG. 0612-1D-C17 FOR DETAILS

TEMPORARY STOCKPILE AREA DURING CONSTRUCTION, C/W SILT FENCING

40mil HDPE IMPERVIOUS LINER

60mil HDPE IMPERVIOUS LINER

NEW PROPERTY LINE

NEW AERATED CELL NO. 2
TOP OF DIKE ELEV = +33.20m
WATER LEVEL = 32.00m
BOTTOM OF LAGOON = 30.00m (+/- VARIES)

90m

150mm 0-31.5mm CRUSHED ROCK

EXISTING BERM TO BE LEFT AS IS

TYPE "C" EROSION CONTROL STRUCTURE

NEW VEHICLE ACCESS GATE

EXISTING NB TRAIL

48m

NEW SEDIMENT CONTROL FENCING

EXISTING FENCE TO BE REMOVED AND REPLACED WITH NEW SECURITY FENCE

EXISTING ACCESS ROAD

EXISTING INLET STRUCTURE TO BE REMOVED AND REPLACED WITH NEW SANITARY MANHOLE

EXISTING LIFT STATION (UPGRADES REQUIRED BY OTHERS)

NEW BLOWER BUILDING (BY OTHERS)

DOAK BROOK

NOTES

1. NEW TOP OF DIKE TO BE 3.60m WIDE.
2. NEW DIKE SLOPES TO BE 3H:1V.
3. SEE DRAWING 0612-10-D-C20 FOR LINER LOCK TRENCH DETAIL.
4. SEE DRAWING 0612-1D-C18 FOR SAFETY ROPE DETAIL.
5. REMOVAL OF EXISTING FENCE IS INCIDENTAL TO THE WORK, SITE TO REMAIN SECURE DURING CONSTRUCTION.
6. ALL AREAS WHERE NEW DIKES AND SLOPES AND ANY CONSTRUCTION IS PERFORMED,AS SHOWN ON THE DRAWINGS, ARE TO BE STRIPPED 300mm THICK. MATERIAL IS TO BE SCREENED AND REUSED ON NEW SLOPES AS TOPSOIL.
7. REFER TO SPECIFICATIONS FOR SEQUENCE OF WORK.
8. CONTRACTOR TO CONSTRUCT COFFERDAM OR TEMPORARY EARTHFILL AS REQUIRED TO INSTALL NEW INLET AND OUTLET TO NEW AERATED CELL No. 2. REMOVAL AND CLEANUP INCIDENTAL TO THE WORK.
9. REFER TO 0612-1D-C17 FOR SEDIMENT CONTROL POND CONSTRUCTION DETAILS.
10. WORK FOR THE CONSTUCTION OF THE NEW AERATED CELL No. 1 WILL NOT BE PERMITTED OUTSIDE THE EXISTING TREE LINE.

NO.	DATE	REVISIONS	BY
01	JULY 26/10	ISSUED FOR CONSTRUCTION	DWD
00	MAY 26/10	ISSUED FOR TENDER	DWD

VILLAGE OF DOAKTOWN
NEW BRUNSWICK CANADA

crandall

REGISTERED PROFESSIONAL ENGINEER Province of New Brunswick #M6519 Pierre Plourde Jul 26, 2010 Province du Nouveau-Brunswick INGÉNIEUR IMMATRICULÉ

PROJECT TITLE

UPGRADE OF WASTEWATER TREATMENT PLANT CONTRACT #1 EARTHWORKS & PIPING

DOAKTOWN N.B.

DRAWING TITLE

IMPERVIOUS LINER LAYOUT PLAN AND SECURITY FENCING

Scale H=1:500 (FULL SCALE) 5m 0 10m	Drawn By DWD
	Checked By GVH/CTP
	Cadd Check GMG
Date MAY 26,2010	Sheet 3 of 24
File Name 0612-1D-C02-C06.DWG	
Drawing No. 0612-1D-C03	Rev. 01

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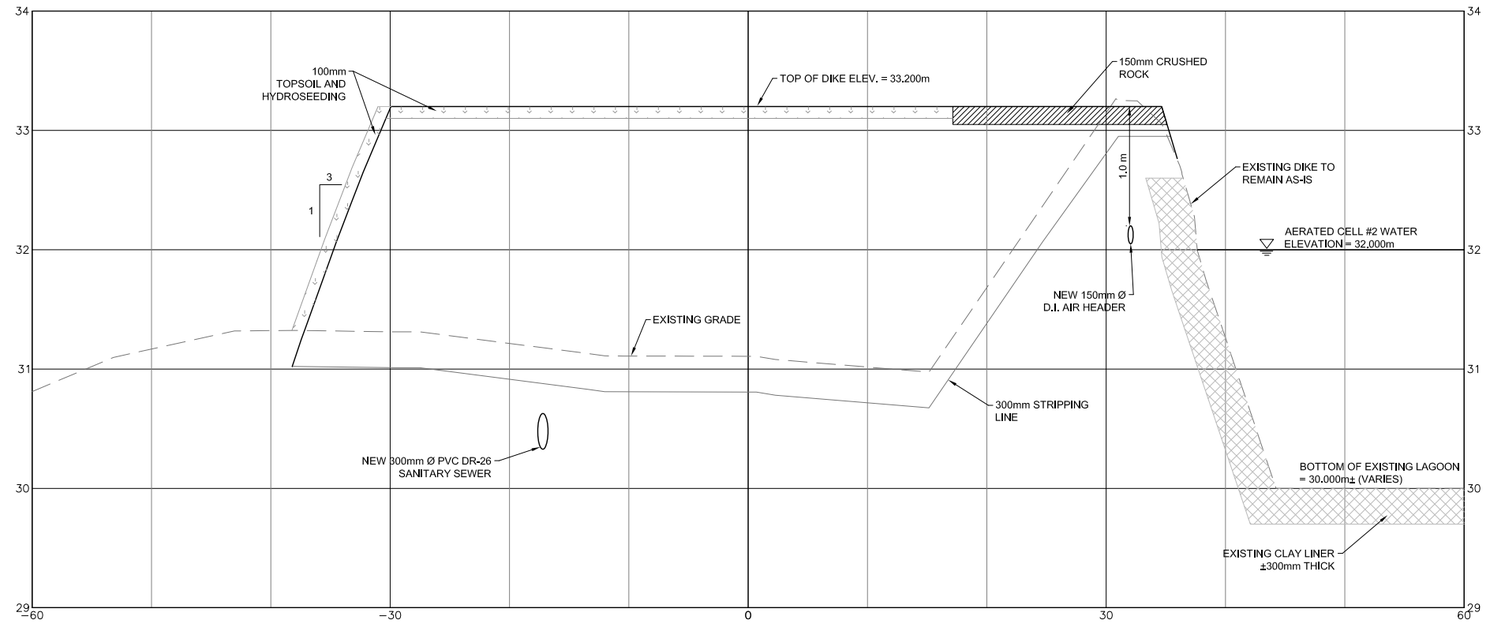
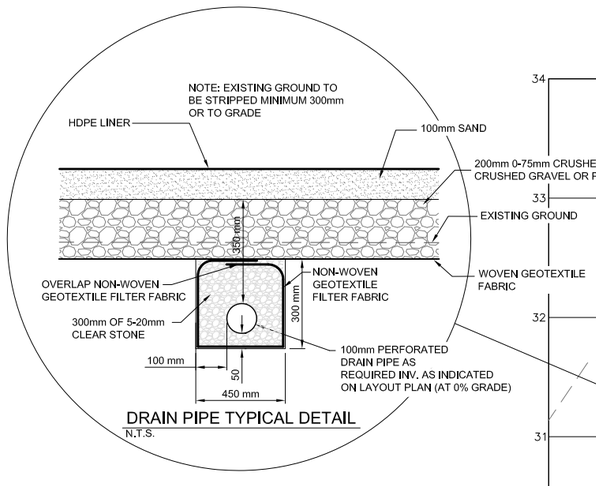
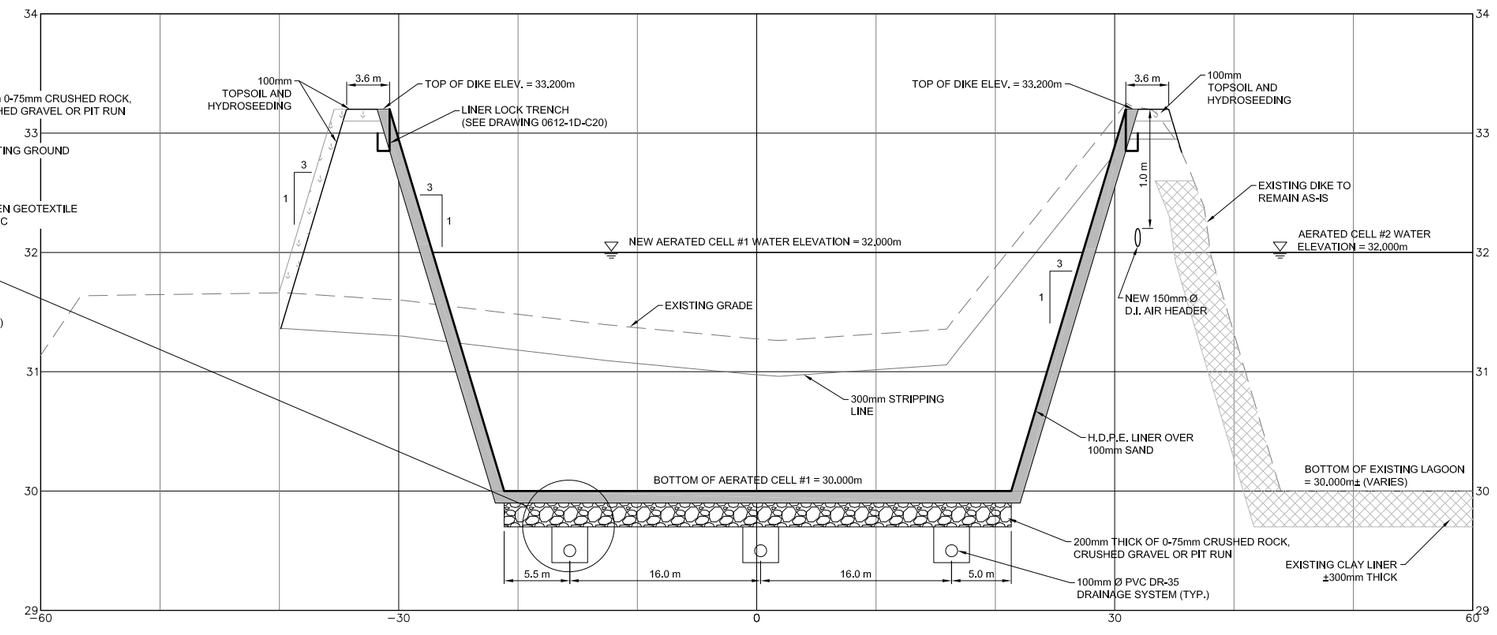


A C05 CROSS SECTION



DRAIN PIPE TYPICAL DETAIL
N.T.S.



B C05 CROSS SECTION

NOTES

1. MATERIAL FOR DIKE CONSTRUCTION TO BE COMPACTED TO 95% OF MAX. DRY DENSITY AS DETERMINED BY ASTM D698.
2. EXCAVATED MATERIAL TO BE RE-USED FOR DIKE CONSTRUCTION TO BE IN ACCORDANCE WITH THE SPECIFICATIONS AND COMPACTED TO 95% OF MAX. DRY DENSITY AS DETERMINED BY ASTM D698.
3. CRUSHED ROCK TO BE USED ON DIKE DRIVING SURFACE TO BE 0-31.5mm COMPACTED TO 95% OF MAX. DRY DENSITY AS PER ASTM D698.
4. ALL AREA WHERE NEW DIKES AND SLOPES AND ANY CONSTRUCTION IS PERFORMED AS SHOWN ON THE DRAWINGS ARE TO BE STRIPPED, 300mm THICK. MATERIAL TO BE SCREENED AND REUSED AS TOPSOIL.
5. DIKE TO BE CONSTRUCTED USING SUITABLE EXCAVATED MATERIAL AND IMPORTED BORROW "A" MATERIAL, COMPACTED TO 95% OF MAX. DRY DENSITY AS PER ASTM D698.
6. DIVIDING DIKE TO BE CONSTRUCTED USING IMPORTED SANDSTONE, COMPACTED TO 95% OF MAX. DRY DENSITY AS PER ASTM D698.
7. REFER TO 0612-1D-C20 FOR LINER LOCK TRENCH DETAILS.
8. SEE SPECIFICATIONS FOR SUB-DRAIN SYSTEM REQUIREMENTS.

NO.	DATE	REVISIONS	BY
01	JULY 26/10	ISSUED FOR CONSTRUCTION	DWD
00	MAY 26/10	ISSUED FOR TENDER	DWD

VILLAGE OF DOAKTOWN
NEW BRUNSWICK
CANADA

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REGISTERED PROFESSIONAL ENGINEER
Province of New Brunswick
#M6519
Pierre Plourde
Signature
July 26, 2010
Date
Province du Nouveau-Brunswick
INGÉNIEUR INSCRIT(E)

PROJECT TITLE

UPGRADE OF
WASTEWATER TREATMENT PLANT
CONTRACT #1
EARTHWORKS & PIPING

DOAKTOWN N.B.

DRAWING TITLE

LAGOON
CROSS SECTIONS
(A & B)

Scale (FULL SCALE) 2.5m 0 5m Horizontal; .25m 0 .5m Vertical
Drawn By: DWD
Checked By: GVH / CTP
Cadd Check: GMG
Date: MAY 26, 2010
Sheet 7 of 24
File Name: 0612-1D-C07-C13.DWG
Drawing No.: 0612-1D-C07
Rev.: 01

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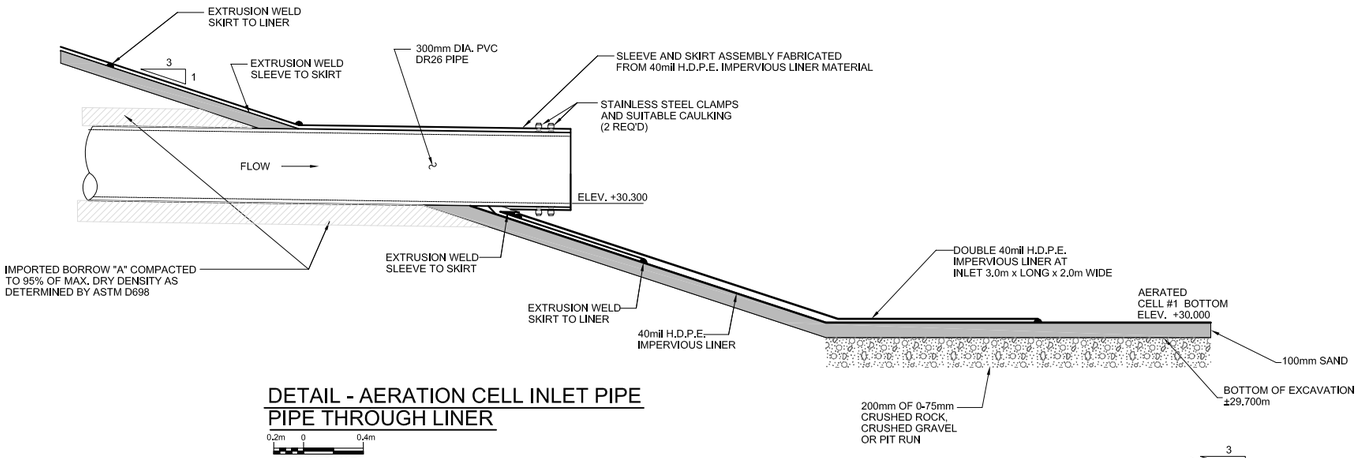
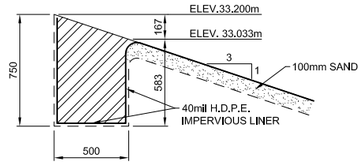


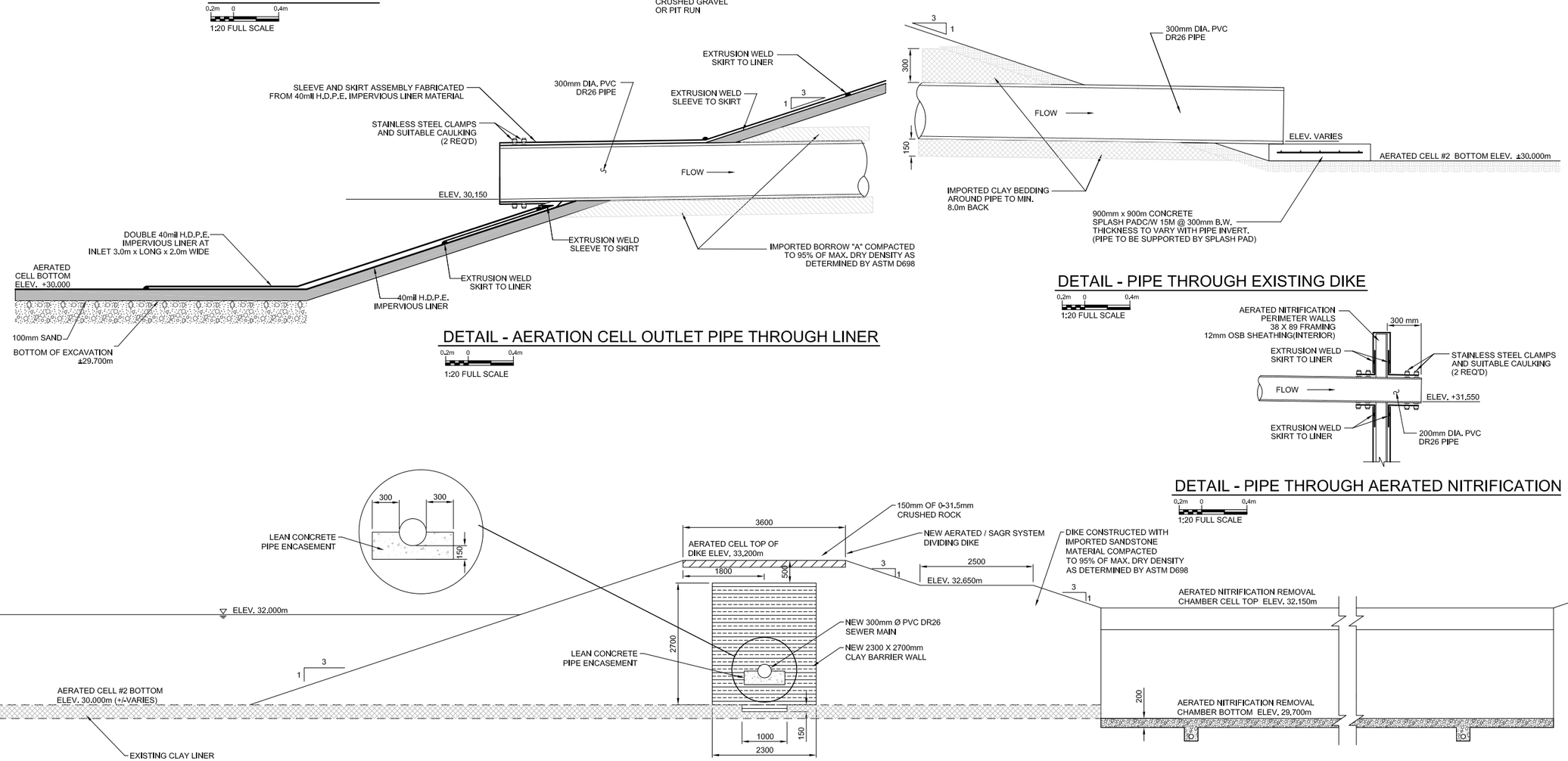
DETAIL - AERATION CELL INLET PIPE PIPE THROUGH LINER

0.2m 0 0.4m
1:20 FULL SCALE



DETAIL "A" - NEW LINER LOCK TRENCH AT TOP OF DIKES

0.2m 0 0.4m
1:20 FULL SCALE



DETAIL - AERATION CELL OUTLET PIPE THROUGH LINER

0.2m 0 0.4m
1:20 FULL SCALE

DETAIL - PIPE THROUGH EXISTING DIKE

0.2m 0 0.4m
1:20 FULL SCALE

DETAIL - PIPE THROUGH AERATED NITRIFICATION

0.2m 0 0.4m
1:20 FULL SCALE

CENTER DIKE - NEW LAGOON TYPICAL CROSS SECTION

0.5m 0 1m
1:50 FULL SCALE

NOTES

1. LINER TO BE DOUBLE THICKNESS AT LATERAL LOCATION, 1.2m WIDE X 3.0m LONG.
2. ALL STRAPS AND CLAMPS TO BE 304 STAINLESS STEEL.
3. ALL PIPE PENETRATIONS THROUGH 40 mil IMPERVIOUS LINER ARE TO INCLUDE 40 mil HDPE SLEEVES.

NO.	DATE	REVISIONS	BY
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00	MAY 26/10	ISSUED FOR TENDER	DWD

VILLAGE OF DOAKTOWN
NEW BRUNSWICK CANADA

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REGISTERED PROFESSIONAL ENGINEER Province of New Brunswick #M6519 Pierre Plourde Signature July 26,2010 Date Province du Nouveau-Brunswick INGÉNIEUR IMMATRICULÉ

PROJECT TITLE

UPGRADE OF WASTEWATER TREATMENT PLANT CONTRACT #1 EARTHWORKS & PIPING

DOAKTOWN N.B.

DRAWING TITLE

TYPICAL LINER AND PIPE THROUGH DIKE DETAILS

Scale: AS SHOWN	Drawn By: DWD		
	Checked By: GVH/CTP	Cadd Check: GMG	
Date: MAY 26, 2010	Sheet 20 of 24		
File Name: 0612-1D-C18-C23.DWG			
Drawing No.: 0612-1D-C20	Rev.: 01		

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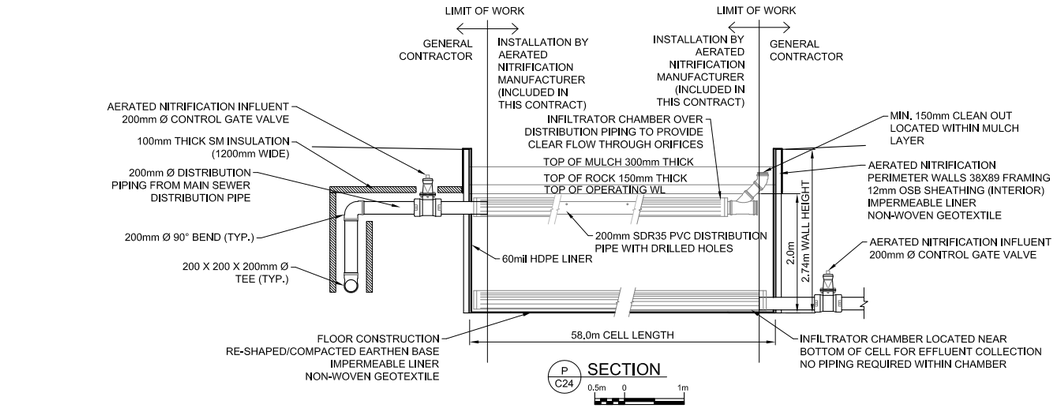
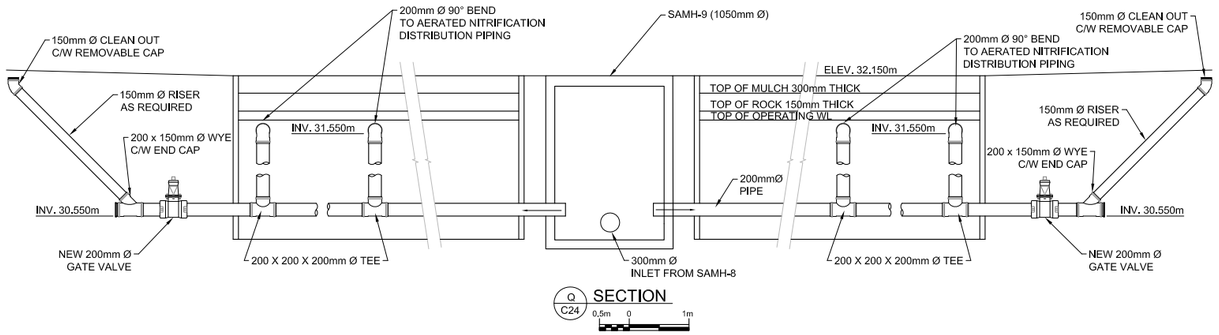
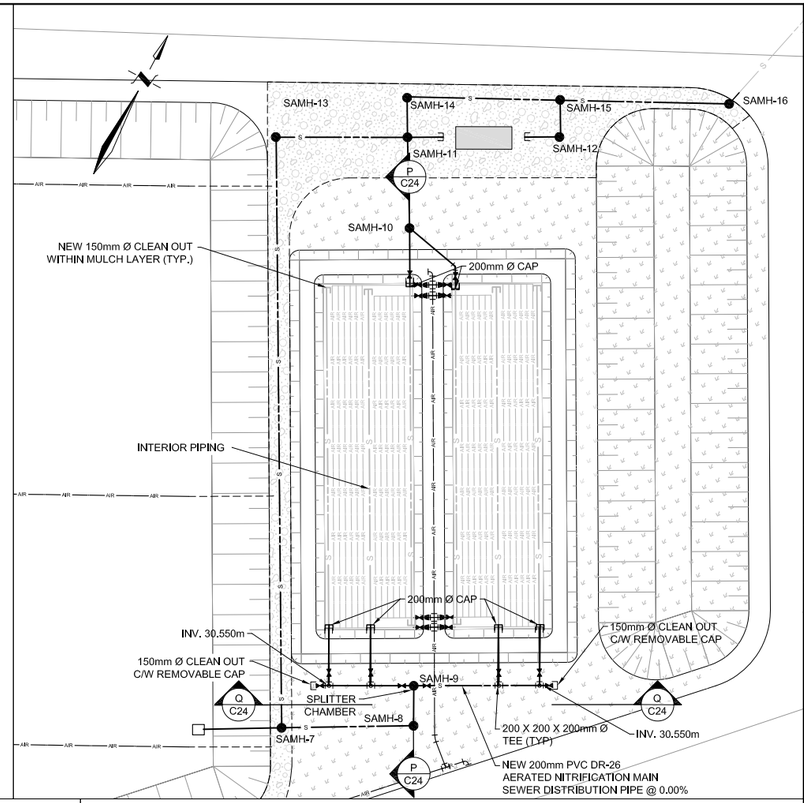




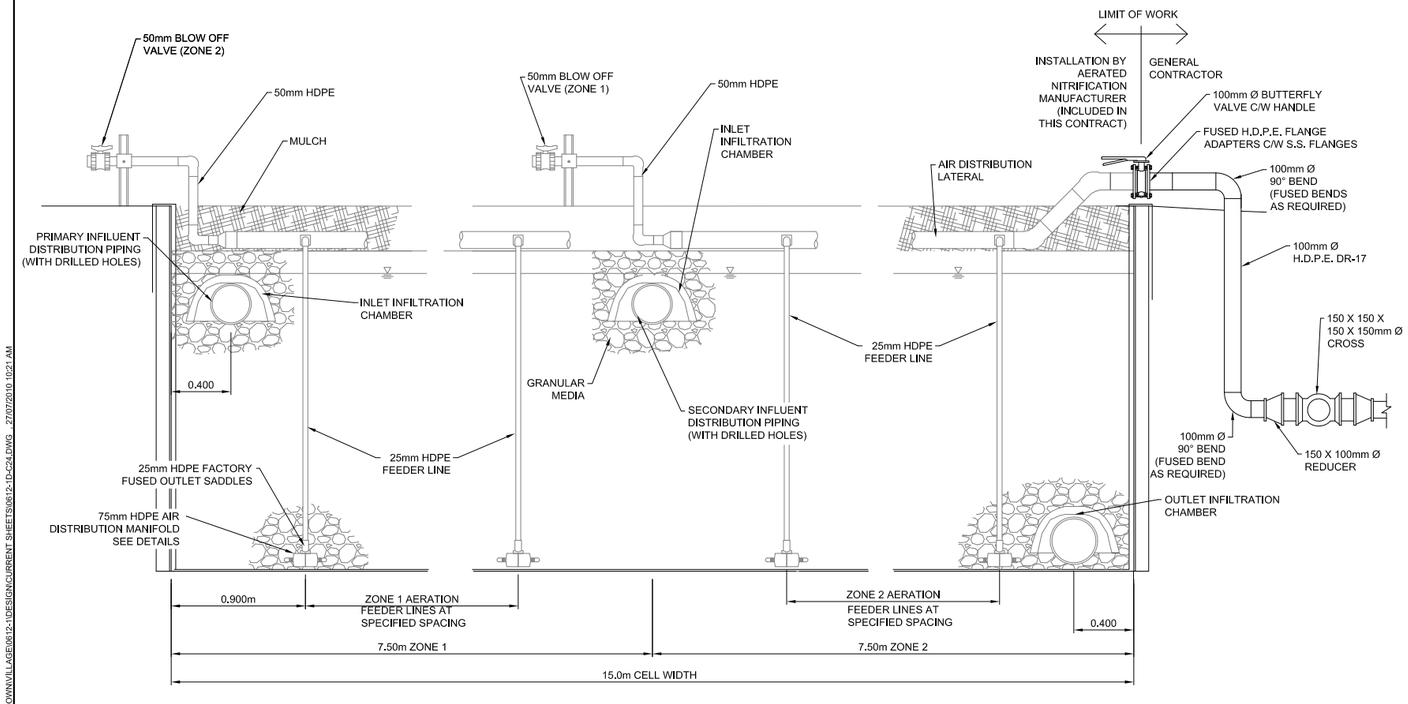


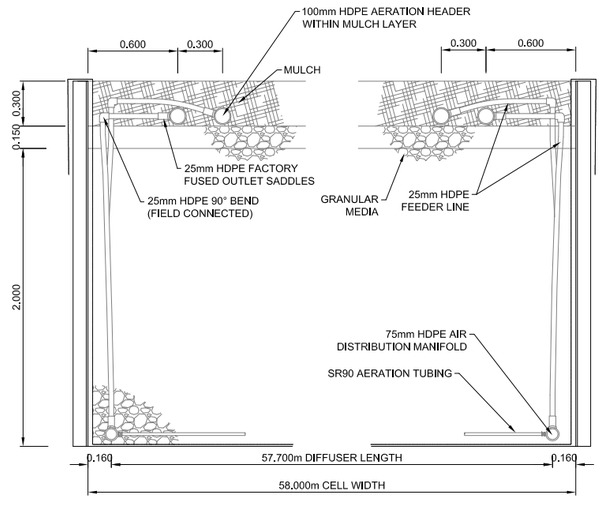
NOTES

1. ALL FITTINGS TO BE RESTRAINED, INCIDENTAL TO THE WORK.
2. WORK INSIDE AERATED NITRIFICATION CHAMBER TO BE DONE BY THE MANUFACTURER TRAINED TECHNICIANS, SEE SPECIFICATIONS FOR DETAILS, BUT INCLUDED IN THIS CONTRACT.
3. AERATION PIPING, SEWER DISTRIBUTION LINES EXACT LOCATIONS ARE TO BE CONFIRMED BY THE AERATED NITRIFICATION MANUFACTURER DURING SHOP DRAWINGS REVIEW.

NO.	DATE	REVISIONS	BY
01	JULY 26/10	ISSUED FOR CONSTRUCTION	DWD
00	MAY 26/10	ISSUED FOR TENDER	DWD

VILLAGE OF DOAKTOWN
NEW BRUNSWICK CANADA





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REGISTERED PROFESSIONAL ENGINEER Province of New Brunswick #M6519 Pierre Plourde July 26 2010 INGÉNIEUR IMMATRICULÉ

PROJECT TITLE

DOAKTOWN
UPGRADE OF
WASTEWATER TREATMENT PLANT
CONTRACT #1
EARTHWORKS & PIPING

LOCATION N.B.

DRAWING TITLE

PLAN AND SECTIONS
AERATED NITRIFICATION
CHAMBER

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AS SHOWN	DWD	
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Date MAY 26, 2010	Sheet 24 of 24	
File Name 0612-1D-C24.DWG		
Drawing No. 0612-1D-C24	Rev. 01	

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