1 TASK 3.4: EFFLUENT SPILL BASIN

1.1 FOCUS REPORT TASK DESCRIPTION

Provide the following information regarding the spill basin:

- Submit information to assess the sizing and appropriateness of the design of the spill basin. The EARD indicates a retention time of 10-13 hours at a design capacity of 35,000 m^3. The basis of this design has not been provided. If flows exceed 85,000 m^3 per day on a consistent basis (e.g., during summer months), confirm that there will be sufficient recovery time in the treatment system to empty the basin before the additional volume is required;
- Explain where the overflow will be directed in the event of unforeseen scenarios (e.g., power outage).

1.2 APPROPRIATENESS OF SPILL BASIN SIZING

1.2.1 Basis of Design

It is not uncommon for a mill that operates an activated sludge system (AST) to have a spill basin incorporated into the design. Spill basins offer a measure of protection for the treatment biology to absorb upset conditions from the manufacturing process that could negatively affect them. Upset conditions that can be effectively mitigated with the use of a spill basin include changes in hydraulic (flow), solids or organic loading. The use of a spill basin is considered best practice in the industry but is not a regulatory requirement. It is important to note that there are Canadian mills with ASTs that do not have spill basins who effectively manage system upsets and discharge effluent that is well within regulatory parameters. Table 1-1, below, shows the presence and size of spill basins for all Pulp and Paper ASTs in Canada, including mills that produce chemical pulp, mechanical pulp and recycled deinked pulp (DIP) a few of which are currently not operational.

Table 1-1 – Survey of Spill Basins in Canadian Mills with ASTs

Mill	Production Type	Spill Basin?	Design Retention Time (hours)
A	DIP/Mech	NO	0.0
B	Chemical	YES	9.1
C	Chemical	YES	3.6
D	Mechanical	NO	0.0
E	Chemical	YES	3.8
F	DIP/Mech	YES	3.8
G	DIP/Mech	NO	0.0
H	Mechanical	YES	127.7
I	Mechanical	NO	0.0
J	DIP/Mech	YES	9.1
K	Mechanical	YES	3.2
L	Chemical	YES	23.0
M	Chemical	NO	0.0
N	Chemical	YES	30.2
O	DIP/Mech	YES	12.3
P	Chemical	YES	3.9
Q	Mechanical	YES	10.4
R	Mechanical	YES	10.3
S	Chemical	YES	33.6
T	Mechanical	YES	4.1
U	Mechanical	YES	4.0
V	DIP/Mech	YES	6.5
W	Mechanical	YES	7.1
X	Chemical	YES	39.5
Y	Chemical	YES	10.3
Z	DIP/Mech	NO	0.0
AA	Mechanical	YES	2.1
AB	Mechanical	YES	1.5
AC	DIP/Mech	YES	14.7

Mill	Production Type	Spill Basin?	Retention Time (hours)
AD	Mechanical	NO	0.0
AE	Chemical	NO	0.0
AF	Chemical	YES	33.3
AG	Chemical	NO	0.0
AH	DIP/Mech	YES	28.8

Average design retention times for installed spill basins are as follows:

- Chemical mills: 14.6 hours
- Deinked/mechanical pulp mills: 8.4 hours
- Mechanical Pulp Mills: 14.2 hours
- Average for Industry: 12.8 hours

The new 35,000 m^3 raw effluent spill basin has been sized to provide 13 hours (based on the current annual average effluent flow of approximately 62,000 m^3/day) and 10 hours (based on operating at the design flow of 85,000 m^3/day) of full mill effluent diversion, given that the spill basin is kept empty other than during upset conditions. The sizing of the NPNS spill basin is in line with others across the country.

An effluent flow analysis was requested to be included in the focus report. KSH Report No. 11 1112D rev. 2 (June 2019) entitled "*Focus Report Task 3.2: Effluent Treatment Plant Replacement, Flowrate Data Analysis*" provides a review of effluent flowrates for the last three calendar years (2016, 2017 and 2018). That report, in part, informs the recovery time to empty the basin and re-introduce it to the system during the summer months when effluent flow is the highest. Review of the operating effluent flow data indicates that the average monthly summer (July and August) effluent flows for the past three years fall between 70,000 – 75,000 m^3/day. As the new ETF is designed to process flows of 85,000 m^3/day and above, the mill will have the inherent capacity to draw down the volume in the spill basin even during the summer months.

An evaluation of the TME effluent pumps was undertaken as part of the project. In the future the pumps will feed the new primary clarifier instead of pumping to the current BHETF. There are no pump upgrades required as the pumps will have more discharge pressure than is the case currently. Therefore, the effluent pumping capacity will increase slightly in the future. In other words, the pumps are capable of pumping significantly more than 85,000 m^3/day meaning the pumps will not be limiting.

1.2.2 Details of Design

General Arrangement Drawings 9-E-1001_Rev_D, 220-E-2105_Rev_D and 220-E-2107_Rev_B, all attached, illustrate the physical details of the processes described above, while the actual process details are shown on P&ID drawings #220-0-0301_Rev_F and 220-0-0311_Rev_E (attached).

The general arrangement drawings show the physical arrangement of the spill basin with respect to the rest of the mill and the new ETF. This new spill basin is to be constructed in the low-lying area north of the existing ash pond and east of the mill gate / parking areas. Two of the walls of the earthen basin are largely in place with fill required for the remaining sides. The inside basin walls will be earthen with a 2:1 slope, while the outside walls will have a 3:1 slope: these are standard design numbers for earthen basins throughout industry. The inside of the spill basin will be covered with a 1.9 mm thick HDPE liner to avoid leakage. A ramp will descend into the basin to empty accumulated solids should the need arise and to provide access for maintenance and inspection. The bottom profile of the basin will be designed to slope towards a sump area where the pumps will be located. The basin will be fitted with two pumps, one operating and one installed spare for redundancy. The continuous level measurement in the spill basin will be part of the operator control system and will be set up with high and low level alarming to alert operators to take appropriate actions to prevent a release to the environment.

1.3 FLOW TO/FROM SPILL BASIN – INTEGRATION INTO EXISTING SYSTEMS

Flow will be diverted from the existing TME (Total Mill Effluent) pumping station, located adjacent to the ash pond, in one of two ways:

- Pumped:
    - The TME effluent quality entering the new ETF is continuously monitored for flow, pH, temperature and conductivity and will alarm operators that one of the parameters is out of range. In cases where effluent quality is out of range, effluent can be diverted via a 12” line branching from the 36” main effluent line headed to the new ETF. This 12” line will join a new 48” gravity overflow line that runs north along the east side of the TME pumping station to the new spill basin;

- This system can also be used to create a small recirculation loop of warm effluent through the spill basin in the winter to prevent freezing of the spill basin pipelines and pumps regardless of effluent quality. The bottom profile of the spill basin is designed with a small gradient so that volume is directed to a small rectangular sump in one corner of the basin. The sump, having a volume of approximately 100 m^3 [1], will contain the two pumps and the level transmitter. Winter recirculation will be controlled within the small sump volume via level control. This is an insignificant volume compared to the available volume of the spill basin. As an additional freeze protection measure both the feed line to the spill basin and the return line from the spill basin to the process will be heat traced and insulated.

- Overflow:
  - The forebay of the TME station will be modified to add an overflow weir at elevation 29'. This will overflow to a new small sump that is drained via the 48" gravity line to the spill basin. The 29' overflow will allow the TME to drain to the spill basin, but will not reach the current overflow elevation into the ash pond which is at 30';
  - Complete diversion of untreated effluent to the spill basin via the overflow will occur if the operators take the action to shut off the TME lift pumps;
  - Complete diversion of the effluent to the spill basin via the overflow will occur without operator intervention should a failure occur, such as loss of power, at the lift pumps

The spill basin, continually monitored by the operator on duty, should never be kept full, since it would then have no capacity to absorb any system upsets. The moment the ETF is capable of reintegrating the effluent into treatment, vertical lift pumps located in the raw effluent spill basin will direct effluent back to the TME forebay for pumping back to the ETF. The return line to the ETF process will have a flow measurement controlled by the variable-speed vertical lift pumps to meter the returned effluent in a controlled manner. The return line to the ETF process will also be designed with spill-recovery in mind. The return line will have, via a tanker truck connection, the ability to remove material from the spill basin and either dispose of it or re-introduce it into the kraft pulp process following evaluation of testing that is undertaken to determine the quality. Standard operating procedures will be developed to ensure that the effluent to be re-introduced to the ETF is compatible with the treatment system before the decision to return the materials to the system is made.

[1] To be confirmed during detailed design

1.4 SPILL BASIN INTEGRITY

1.4.1 Flooding Event and Climate Change

Drawing 220-E-2105_Rev_D shows the hydraulic profile of the effluent treatment system, including existing structures such as the TME pumping station and the ash pond. The drawing shows that the northeastern wall of the spill basin, the wall that faces Pictou Harbour, will be at an elevation of 34'-6" above sea level. When considering the high flood levels in the Maritimes in 2019 (30 inches in Saint John[2]) and future climate change predictions of sea level rising, water levels would reach one tenth to one eighth the height of the spill basin,: it is highly unlikely that flood waters would be able to make their way into the spill basin, or, for that matter, the existing ash pond.

1.4.2 Monitoring, Maintenance and Redundancy

The spill basin will be fitted with an HDPE lining that can be easily inspected visually as the basin will be uncovered and usually empty.

The artificial berms that will be created on two sides of the new basin will have grass covering planted to prevent erosion of the sloping material. The other two sides of the basin are existing. Grass cover will be re-established on those sides as well to replace any grass removed during construction.

This area of the mill currently undergoes groundwater and surface water testing under the mill's Industrial Approval. Testing locations will be evaluated with input from NSE and relocated if necessary. A continued monitoring plan will ensure the integrity of the basin remains intact.

1.5 SIGNATURES

Signature

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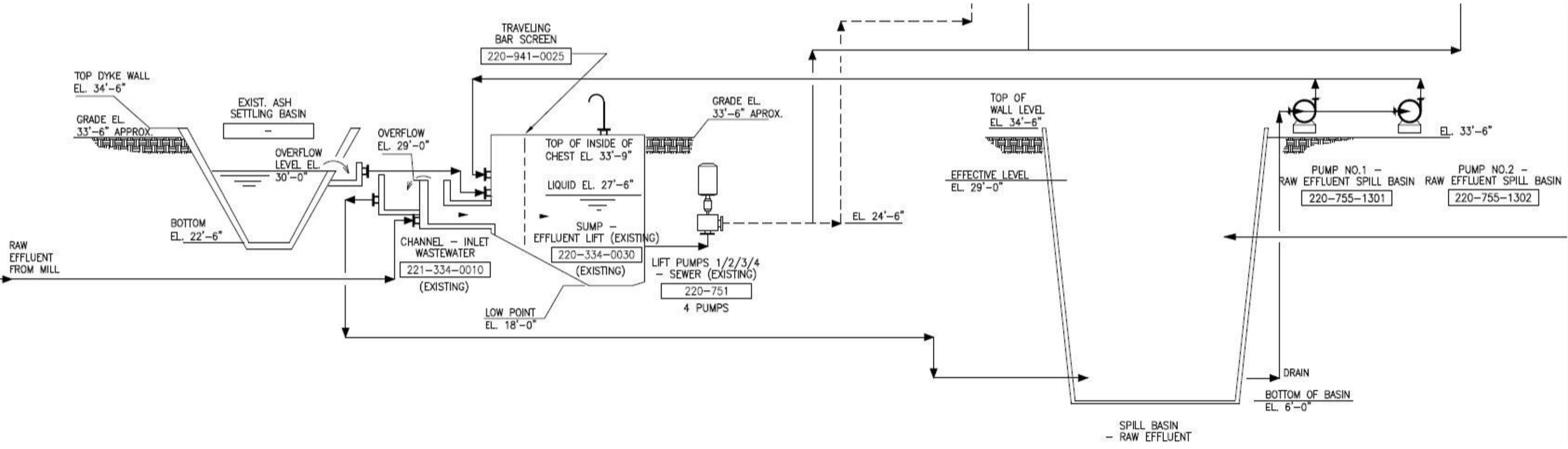
[2] https://atlantic.ctvnews.ca/southern-new-brunswick-braces-for-the-worst-as-floodwaters-continue-rising-1.4394630


TRAVELING
BAR SCREEN
220–941–0025
TOP DYKE WALL
EL. 34'–6"
GRADE EL.
33'–6" APPROX.
EXIST. ASH
SETTLING BASIN
OVERFLOW
LEVEL EL.
30'–0"
OVERFLOW
EL. 29'–0"
BOTTOM
EL. 22'–6"
RAW
EFFLUENT
FROM MILL
CHANNEL – INLET
WASTEWATER
221–334–0010
(EXISTING)
TOP OF INSIDE OF
CHEST EL. 33'–9"
LIQUID EL. 27'–6"
SUMP –
EFFLUENT LIFT (EXISTING)
220–334–0030
(EXISTING)
LOW POINT
EL. 18'–0"
GRADE EL.
33'–6" APROX.
EL. 24'–6"
LIFT PUMPS 1/2/3/4
– SEWER (EXISTING)
220–751
4 PUMPS
TOP OF
WALL LEVEL
EL. 34'–6"
EFFECTIVE LEVEL
EL. 29'–0"
EL. 33'–6"
PUMP NO.1 –
RAW EFFLUENT SPILL BASIN
220–755–1301
PUMP NO.2 –
RAW EFFLUENT SPILL BASIN
220–755–1302
DRAIN
BOTTOM OF BASIN
EL. 6'–0"
SPILL BASIN
– RAW EFFLUENT