APPENDIX D

400,000 tpy Scenario Upgrade Requirements

1.0 INTRODUCTION

The Proposed Thermal Treatment Facility (the Facility) in the Clarington Energy Business Park has an initial design capacity of 140,000 tonnes per year (tpy). If approved, construction of this Facility is scheduled to occur between 2010 and 2013. It is anticipated that waste production may continue to increase in the future and that this Facility may be expanded to a projected maximum design capacity of 400,000 tpy.

This technical appendix has been prepared to address the likely effects of the increased capacity Facility on water resources. The optional expansion/upgrade would affect the water supply requirements, wastewater discharge volumes and stormwater management features located both on- and offsite. As these upgrades may be constrained by future area restrictions and may include sub-surface activities, it may be prudent to consider integrating some of the recommended measures or incorporating contingency planning into the initial design capacity of 140,000 tpy (140,000 tpy scenario) Facility design.

2.0 STORMWATER MANAGEMENT

In order for the increased capacity Facility to accommodate a projected maximum design capacity of 400,000 tpy (400,000 tpy scenario), access roads, refuse storage areas and the number of waste processing buildings would need to be increased from the current 140,000 tpy scenario (See Figure 2-1 for the 400,000 tpy scenario Facility Site plan and Figure 4-1 in the Main Report for the 140,000 tpy scenario Facility Site plan). The addition of these Facility upgrades would lead to an increase in impervious area which in turn would necessitate an upgrade to the stormwater management features onsite. This section provides the results from the 400,000 tpy scenario stormwater runoff modeling and subsequently makes stormwater management recommendations necessary to mitigate the effects of upgrading the 140,000 tpy scenario Facility.

2.1 Post-Development Stormwater Runoff Modelling

A 400,000 tpy scenario hydrologic model was developed using similar methodologies as outlined in Section 3.4.3 of the Report. The 400,000 tpy scenario conditions were simulated by increasing the SCS curve number and percent imperviousness from the 140,000 tpy scenario. These changes subsequently influence the average Time of Concentration, storage coefficient and ultimately runoff coefficients. The same suite of storm events used for the pre-development and 140,000 tpy scenarios were used in this model.

The increased capacity Facility would include the paved access roads, an aggregate top dressing over storage areas and the introduction of additional permanent building structures. It is assumed that the development would best be represented by a SCS curve number of 86 for a hydrological soil group B with an industrial setting introducing impervious conditions over 55% of a 12.4 ha developed area. The percent impervious was determined through assessment of the

400,000 tpy scenario Facility Site plan (Figure 2-1) and represents an increase in site imperviousness of 10% from the 45% imperviousness of the 140,000 tpy scenario.

According to the preferred vendor's increased capacity Site drawing (Figure 2-1), the entire 12.4 ha would contain some type of development and therefore would require stormwater management. It is assumed that the slope would remain similar to that of existing conditions. A similar slope incorporating increased imperviousness would cause a decrease in Time of Concentration values used in the hydrological model. However, the storage coefficient would not be affected by above grade activities.

A summary of increased capacity post-development hydrologic input parameters are included in Table 2-1.

Table 2-1 - Post-Development Model Input Parameters

Parameter	Post-Development
Area (ha)	12.4
Hydraulic Length (m)	390
Average Slope %	1.9
Hydrologic Soil Group	B
Time of Concentration (hr)	0.38
Storage Coefficient (hr)	0.49
% Imperviousness	55
SCS Curve #	86
Initial Abstraction (mm)	3

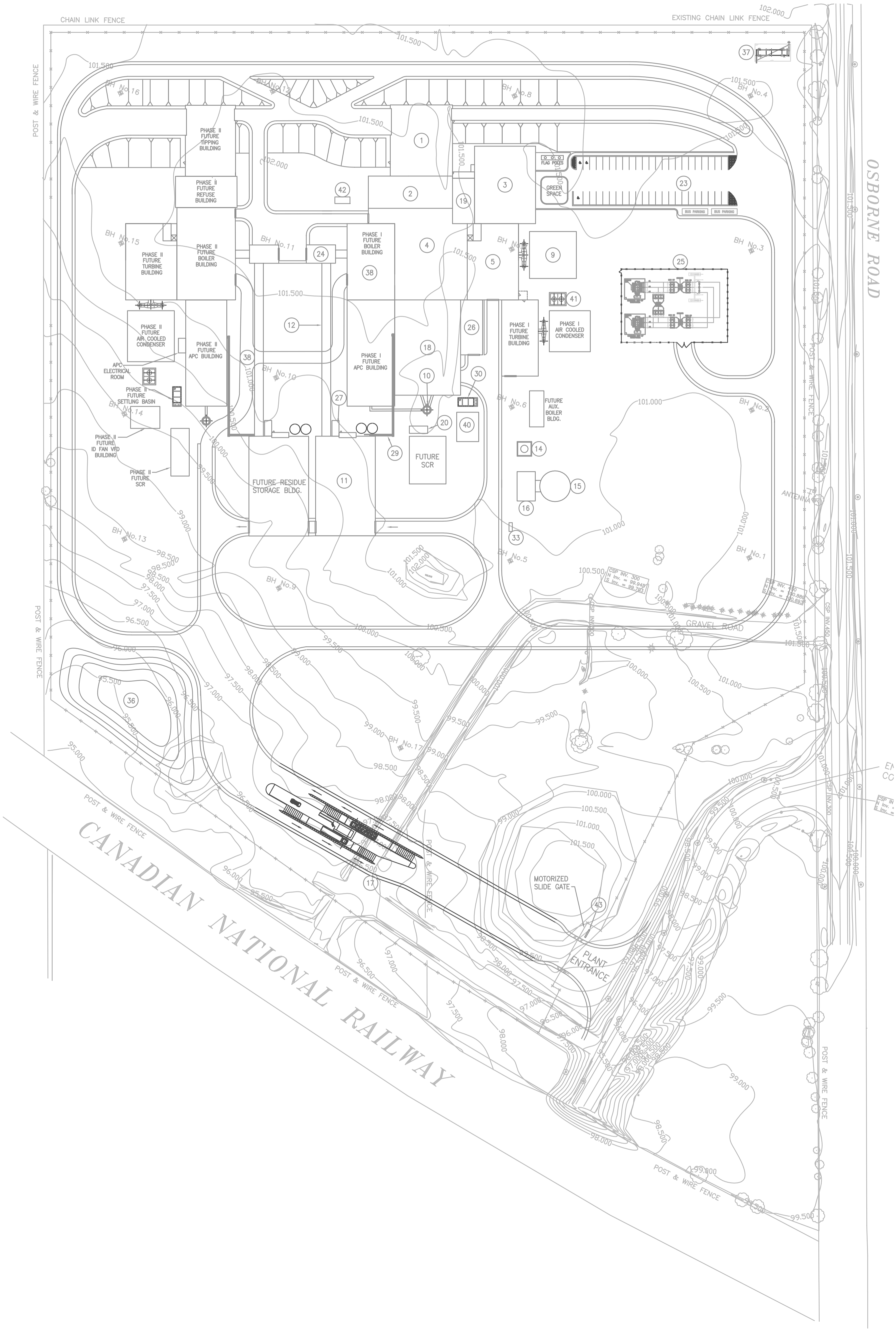
As a result of Facility upgrades, runoff volumes onsite would increase, which would also cause an increase in peak discharges when compared to the 140,000 tpy scenario. Table 2-2 provides a summary of the 400,000 tpy scenario post-development runoff volumes and peak discharges for all of the design events. Subsequent stormwater mitigation options would be designed to reduce these peak discharges to pre-development levels and attenuate flows.

Table 2-2 – 400,000 tpy Scenario Post-Development Runoff Model Results

Watershed	Parameter	10mm /4hr	25mm/ 4hr	2yr/4 hr	5yr/ 4hr	10yr/ 4hr	25yr/1 2hr	50yr/2 4hr	100yr/2 4hr	Hazel
400,000 tpy Scenario Post-Development	Peak Discharge (m^3/s)	0.11	0.31	0.39	0.54	0.66	1.18	1.15	1.28	1.56
	Runoff Volume (m^3)	739	2131	2641	3703	4471	6355	7960	8803	24047

The results presented in Table 2-2 show an increase in runoff volume which infers a decrease in ET and infiltration volumes. When compared to the 140,000 tpy post-development runoff modeling, these results suggest an increase of 128 m^3 for the 10 mm event and a 311 m^3 increase for the 25 mm event.

The objective of the following sections is to indicate the stormwater management features that will require upgrades in order to transition from the 140,000 to 400,000 tpy scenarios.


CHAIN LINK FENCE
EXISTING CHAIN LINK FENCE
POST & WIRE FENCE
OSBORNE ROAD
CANADIAN NATIONAL RAILWAY
PHASE II FUTURE TIPPING BUILDING
PHASE II FUTURE REFUSE BUILDING
PHASE II FUTURE BOILER BUILDING
PHASE II FUTURE TURBINE BUILDING
PHASE II FUTURE AIR COOLED CONDENSER
PHASE II FUTURE APC BUILDING
APC ELECTRICAL ROOM
PHASE II FUTURE SETTLING BASIN
PHASE II FUTURE ID FAN VFD BUILDING
PHASE II FUTURE SCR
PHASE I FUTURE BOILER BUILDING
PHASE I FUTURE APC BUILDING
PHASE I FUTURE TURBINE BUILDING
PHASE I AIR COOLED CONDENSER
FUTURE AUX. BOILER BLDG.
FUTURE SCR
FUTURE RESIDUE STORAGE BLDG.
FLAG POLES
GREEN SPACE
BUS PARKING
GRAVEL ROAD
ANTENNA
MOTORIZED SLIDE GATE
PLANT ENTRANCE
BH No.1
BH No.2
BH No.3
BH No.4
BH No.5
BH No.6
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BH No.16
BH No.17

2.2 Construction Phase Stormwater Management

Since construction of the 400,000 tpy scenario upgrades would take place on previously developed lands it is not anticipated that site grubbing or subsurface disruption would be as extensive as the initial 140,000 tpy scenario construction phase.

Construction of the requisite buildings and access roads would occur mainly on the west side of the property. It is anticipated that the western side of the property required for infrastructure upgrades, presumably greenspace during 140,000 tpy scenario Facility operation, would be sequentially cleared, graded and developed in a similar fashion to the 140,000 tpy scenario construction. The main southern access route, central building complex and northern perimeter roads would remain relatively untouched during 400,000 tpy scenario Facility upgrades.

The following is a list of lot level mitigation measures recommended for the construction of 400,000 tpy scenario Facility upgrades.

- All cleared areas not required for equipment storage, building construction or vehicle access should be seeded as soon as possible to avoid excess soil loss;
- Sediment traps should be installed within flow paths, slope toes and surrounding drains to minimize the amount of sediment deposited in conveyance networks and detention ponds;
- Silt fencing should be installed around the perimeter of all laydown areas, disturbed working areas and the boundary of the construction Site; and,
- All laydown areas, storage areas and access roads should receive a top dressing of gravel as soon as possible after upgrade initiation.

The installation, design, material and maintenance recommendations for the above noted mitigation options are described in full within Section 5.1.1 of the Report.

It is anticipated that construction phase stormwater conveyance will be accommodated through a combination of swales and catchbasin/stormsewer infrastructure. If temporary conveyance swales are to be used, they should be located adjacent to access roads running north to south to effectively convey stormwater runoff to the SWM pond in the southwest corner of the property. For swale design guidelines refer to Section 5.1.2 of the Report. Swales running the western length of the development property should have rock check dams installed to control runoff velocities and encourage sediment retention prior to SWM pond discharge.

If additional catchbasins and stormsewers are to be installed, it is assumed that they would be constructed during the initial stages of the 400,000 tpy scenario construction. The number, location and route of sub-surface stormsewers would be determined during the detailed design of the upgrade components.

Similar to the 140,000 tpy scenario construction phase conveyance capacity, it is recommended that the five-year storm be used as the sizing criteria for any temporary conveyance infrastructure. Stormsewers or swales planned for permanent conveyance should be sized according to SWM sizing criteria described below. Conveyance infrastructure represents the minor SWM system and it is assumed that the major system (grading controlled) will have been designed and implemented during the construction of the 140,000 tpy scenario Facility.

The 140,000 tpy scenario SWM pond located in the southwest corner of the property is expected to serve as the ESC pond during upgrade construction. Since only a small area of the 12.4 ha property will be included in the upgrade construction, the existing SWM pond should provide adequate stormwater retention and drawdown requirements. However it is recommended that pond capacity expansion discussed below in Section 2.3 is undertaken in the early stages of the 400,000 tpy scenario expansion construction.

2.3 Operational Phase Stormwater Management

Once fully upgraded, the 400,000 tpy scenario Facility Site will comprise approximately 55% imperviousness. This is up 10% from the 140,000 tpy scenario and will therefore require conveyance and retention/detention upgrades to SWM features. Sections 2.3.1 through 2.3.4 of this appendix address the SWM upgrades necessary given the 400,000 tpy scenario.

2.3.1 Lot Level and Conveyance Controls

The 10% increase in imperviousness means that onsite infiltration will be further reduced and runoff volumes and rates will be further increased in addition to the influence the original 140,000 tpy scenario Facility had on the subject property. To offset these effects lot level and conveyance level SWM features are recommended accordingly to detain the volume and reduce the flow rate of runoff at the lot level before stormwater enters and as it routes through the conveyance system. Detention of runoff at the lot level through depression storage and reduced runoff flow rates would act to encourage ET and infiltration.

According to the existing conditions assessment in Section 2 of the Report, onsite infiltration is minimal and therefore promoting depression storage and running rooftop leaders to open greenspace should be adequate to ensure the 400,000 tpy scenario Facility maintains the Site's infiltration balance. Slowing runoff waters is also encouraged as it will act to increase ET and infiltration.

Permanent stormwater conveyance necessary for the western side of the property (area of Facility upgrades) should be designed to minimize runoff velocity and therefore reduce sediment transport to end-of-pipe facilities. Located within the Clarington Energy Business Park, the 400,000 tpy scenario Facility stormwater conveyance network should be designed to convey the 5-year precipitation event (Aecom, 2009).

It is unknown whether upgraded Facility area stormwater runoff would be routed to stormsewer infrastructure within the 140,000 tpy scenario Facility footprint. As such, it may be prudent to consider designing the 140,000 tpy scenario stormsewer infrastructure to the 400,000 scenario tpy 5-year precipitation event runoff. This pro-active design component is unlikely to bear significant financial burden yet may prevent conveyance capacity problems if the Facility were to be upgraded in the future.

2.3.2 End-of-Pipe Facilities

The increased capacity scenario would require a SWM pond with a larger storage capacity then that required for the 140,000 tpy scenario. All the minimum sizing and length to width ratios stated in Section 5.2.2.2 of the Report should still be followed under the 400,000 tpy scenario.

The SWM pond will also still need to provide at a minimum, 24 hours of drawdown to the 25 mm storm and ensure outlet discharges are below those derived from pre-development modeling in Section 3.4.3 of the Report.

For a site with approximately 55% imperviousness, the minimum permanent pool volume for a wet pond with an enhanced level of protection is 150 m^3/ha of drainage area. Similarly, the minimum extended storage volume for enhanced level of protection is 40 m^3/ha (MOE, 2003).

For the 12.4 ha Site, the minimum required extended detention storage is 496 m^3 which is considerably less than the 2131 m^3 of 400,000 tpy scenario post-development runoff generated during the 25 mm event. For this reason, the extended detention component of the SWM pond is expected to be sized to approximately 2131 m^3 or 172 m^3/ha. The recommended extended detention volume for the 140,000 tpy scenario was 1820 m^3 or 147 m^3/ha.

A conservative approach to designing the flood control volume for the stormwater pond is to assume full volumetric containment of the 100-year storm runoff event. Some stormwater above the permanent pool storage capacity would be discharged during the inflow of the flood control volume. However, to employ the above conservative approach, the total 100-year precipitation event volume was used. Based on the HEC-HMS model developed for this assessment, the 400,000 tpy scenario post-development total runoff volume for the 100-yr event was 8803 m^3. A summary of required stormwater pond storage volumes is provided in Table 2-3.

Table 2-3 - Required Pond Volumes for an Enhanced Level of Protection in a Wet Pond

Pond Volumes	Enhanced Level of Protection	
	Required Pond Volumes (m^3/ha)	Development Site Pond Volume (m^3)
Quality Control Criteria	80% SS removal	na
Permanent Pool	150	1860
Extended Storage*	25 mm event runoff	2131
Flood Control Volume	100 yr event runoff	6672 (8803-2131)
Total Stormwater Pond Volume	na	10663

*40 m^3/ha is the minimum required extended detention storage volume (MOE, 2003). The extended detention volume should ensure a minimum 24 hours of drawdown to the 25 mm precipitation event.

The 400,000 tpy scenario Facility Site plan (Figure 2-1) suggests that the 400,000 tpy scenario SWM pond will occupy approximately 2100 m^2. A pond with a total storage capacity in excess of 10,000 m^3 and minimum side wall slopes of 3 and 5 to 1 (See Section 5.2.2.2) would require a depth of over 10 m. It is recommended that the SWM pond be re-designed during detailed design to provide adequate length to width ratio and limit the overall pond depth to <3 m.

SWM ponds are regulated by the MOE through the CofA process. Any alterations to the 140,000 tpy scenario SWM pond will require that an amendment to the CofA be acquired.

2.3.3 SWM Facility Outlet

The 400,000 tpy scenario SWM end-of-pipe facility outlet would serve a similar roll to that in the 140,000 tpy scenario and therefore should be designed according to the same regulatory criteria. This suggests that a similar outlet structure, with altered elevation profile can be employed in the 400,000 tpy scenario design. This will ensure the minimum drawdown times and runoff retention capacities are maintained.

Similar to the 140,000 tpy scenario, the primary pond outlet structure is presented conceptually as a bottom-draw hickenbottom riser to discharge the extended detention volume estimated at 2131 m^3. The orifice opening configuration of the riser would ensure that stormwater receives at least a 24-hour drawdown period. The riser would inlet below the elevation of the permanent pool to reduce thermal impacts associated with discharging water from pond surfaces. The riser would also connect to a reversed slope pipe which would have an outlet invert at the elevation of the permanent pool. As such, the reversed slope pipe outlet would control discharge and ensure that the permanent pool elevation is maintained. The hickenbottom riser should be located 150 mm below the maximum expected ice depth to ensure continued functionality during winter conditions and 30 cm below the permanent pool elevation is the recommended riser height.

Subsequently, storage volumes exceeding the extended detention volume up to the flood control volume may be discharged additionally by a weir structure. The total flood control volume includes the 100-year event (8803 m^3). The combination of a primary hickenbottom riser and weir discharges must never exceed 0.5 m^3/s which equates to the pre-development peak discharge for the 100-year event.

In summary, the 400,000 tpy scenario SWM pond and outlet structures would be designed to ensure that post-development peak discharges would not exceed pre-development peak discharges for similar sized precipitation events. In addition, the SWM facility would provide at least 24-hours of drawdown to the 25 mm precipitation event. The final SWM pond and outlet configuration would be provided during detailed design of the 400,000 tpy scenario upgrades.

2.3.4 Offsite Stormwater Conveyance

The conveyance swale located immediately south of the Site alongside the CN Rail tracks will act as the receiver for all discharged stormwater from the Facility. Hydraulic modeling of the proximal reach of the CN Rail swale conducted in Section 3.4.3.1 of the Report indicated that the conveyance capacity of the watercourse was approximately 0.14 m^3/s. It was determined through existing condition stormwater runoff modeling that this was equivalent to the peak discharge of approximately the 5-yr precipitation event and that channel upgrades/widening may be necessary.

Future development of the Clarington Energy Business Park is expected to include centralization of SWM ponds (classified as phase II) and increased conveyance requirements for existing stormwater routing channels (Aecom, 2009). One of the facets of this centralized SWM system would be a large magnitude conveyance swale located in approximately the same CN Rail easement as the small vegetated swale described above. This centralized SWM swale would route stormwater from many developed properties to a large SWM pond south of the CN

Rail corridor. According to Aecom (2009), as development proceeds, SWM upgrades would be conducted as necessary. It is anticipated that this centralized SWM swale would be constructed prior to the 400,000 tpy scenario. This suggests that channel upgrades may not need to be addressed in this 400,000 tpy scenario assessment.

3.0 WATER SUPPLY AND WASTEWATER DISCHARGE

3.1 Water Supply Requirements

The maximum annual water demand for the 140,000 tpy scenario is estimated to be 42,000 m^3/yr or, assuming a continuous 365 day operation, 115,068 L/day or 1.3 L/s. Since precise technical specifications for the 400,000 tpy scenario are not currently available, a proration approach will be used to estimate the 400,000 tpy scenario water needs. Using a ratio of 2.86 (400,000 / 140,000) it was determined that the maximum annual water demand for the 400,000 tpy scenario would be approximately 120,120 m^3/yr or, assuming a continuous 365 day operation, 329,096 L/day or 3.8 L/s. The water needs of the 400,000 tpy scenario Facility would likely be less than a linear extrapolation from the 140,000 tpy scenario and therefore this assumption provides a conservative estimate.

Preliminary assessments (Jacques Whitford and Genivar, 2007a) assumed that a similar Facility processing up to 250,000 tpy would require approximately 100 L/s. The prorated 400,000 tpy scenario water demand is only 3.8 L/s or 3.8% of this estimated value suggesting that the Facility is considerably more water efficient than first anticipated. This study (Jacques Whitford and Genivar, 2007a) assumed that the 250,000 tpy Facility's water demand could be met by the exclusive use of one 300 mm watermain. Currently, there is a 300 mm watermain running alongside Osbourne Road that can be accessed for Facility water demands.

Considering the 400,000 tpy scenario Facility's water demand is relatively low, it is anticipated that water supply needs could be met through connection to the existing Osbourne Road watermain. A full hydraulic assessment should be carried out during detailed design to ensure the firewater and facility demands can be met. If water demands for the 400,000 tpy scenario Facility cannot be met through connection to the Osbourne Road watermain, a secondary connection to a 300 mm watermain approximately 3.5 km away would be necessary (Jacques Whitford and Genivar, 2007a).

Online firewater demand would be determined during the detailed design phase for the 400,000 tpy scenario upgrades.

3.2 Wastewater Discharge

The maximum annual wastewater discharge for the 140,000 tpy scenario Facility is proposed to be 3,000 m^3/yr or, assuming a continuous 365 day operation, 8219 L/day (0.1 L/s). This value represents almost exclusively sanitary discharge as there is expected to be very minimal to no industrial wastewater discharge from this Facility. The 140,000 tpy scenario Facility is proposed to have 33 full-time employees (Jacques Whitford, 2009). According to MMAH (1997) the average full-time employee (8-hour shifts, 5 days/week) generates approximately 125 L/day of sanitary wastewater which for 33 employees equals 4125 L/day. However, the 140,000 tpy Facility will receive refuse up to 6 days a week and a number of employee types will work 12 hour shifts (Jacques Whitford, 2009). These caveats would bring the total yearly wastewater discharge to approximately 3,000 m^3/yr.

It is anticipated that the advances in automation, expected to occur between the construction of the 140,000 tpy scenario and the 400,000 tpy scenario Facility's, would allow the 400,000 tpy scenario Facility to operate without requiring addition staff beyond the 33 necessary for the 140,000 tpy scenario. As a result, wastewater discharges for the 400,000 tpy scenario could be as low at those for the 140,000 tpy scenario. However, to provide a conservative estimate, a prorated maximum wastewater discharge was calculated. Using the proration factor of 2.86 (400,000/140,000) a maximum annual wastewater discharge of 8580 m^3/yr was estimated or, assuming a continuous 365 day operation, 23,507 L/day (0.27 L/s).

A preliminary assessment (Jacques Whitford and Genivar, 2007a) concluded that connecting a 450 mm gravity drain to the existing 1800 mm municipal sewer located north of the CN Rail tracks on Osbourne Road would be capable of conveying 63 L/s to the Courtice Water Pollution Control Plant located south of the proposed development. This capacity would be more than adequate to handle even the conservative case scenario for wastewater discharges from the 400,000 tpy scenario Facility.