Functional Servicing and Stormwater Management Report 221 Fox Street Residential Development Queen's Court Homes Town of Penetanguishene

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Prepared by

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1.0 Introduction

1.1 General

WMI & Associates Limited has been retained by Queen's Court Homes to prepare a Functional Servicing and Stormwater Management Report in support of a draft plan of subdivision in the Town of Penetanguishene, Ontario. The proposed development is located east of Fox Street, south of Broad Street, and west of Church Street.

This Report has been based on our discussions with Town of Penetanguishene (Town) Staff. Our work conforms to the current Town Engineering Design Standards, and Ministry of the Environment (MOE) stormwater management design guidelines.

1.2 Background

The subject property comprises a total of 12.01ha and is legally described as part of Lots 104 to 113, West Side of Church Street, Registered Plan 70, Town of Penetanguishene, County of Simcoe.

This residential development portion of the property is 5.84ha in size and comprises 87 Single Family Residential Lots, and 28 units within a medium density residential block. The roadways, a SWM block, open space lands and environmental protection lands comprise the remaining 6.17ha. The site is irregular in shape, and is currently a wooded area. The lands to the north, east and west are developed with residential lots containing residential dwellings, as well as some vacant lots predominantly to the east along church street. The lands to south (Bay Moorings Development) are a private residential development comprising single family lots and townhouse units. A future extension of Beck Boulevard (Municipal Roadway) is also proposed as a part of that development although it has not yet been constructed at the time of writing this report.

This report is in support of a planning application and is based upon topographic information obtained from the Town and a topographic survey prepared by WMI & Associates Ltd., and a Draft Plan of Proposed Subdivision prepared by Lucas & Associates Ltd. Refer to **Appendix A** for the Site Location Plan (Figure 1), and the Draft Plan of Proposed Subdivision.

2.0 Existing Conditions

2.1 Topography and Drainage Patterns

There are currently no stormwater controls on the site, and all runoff is in the form of sheet flow. The site drains predominantly from east to west, towards the existing lots fronting onto Fox Street. There is an existing 975mm diameter concrete storm sewer located to the south west of this site which collects and conveys drainage from Fox Street, the subject lands, and external areas prior to outletting to Georgian Bay.

The predominant topographic feature within the site is a bluff which traverses the site in the north-south direction, within the east half of the site. Due to the steep topography of the ridge, the developed portion of the site is situated to the west of it.

The highest elevation within the site boundary is above the ridge along the boundary with lots fronting onto Church Street. The lowest elevation within the site is located at the south west corner of the site, within the proposed medium density residential block.

2.2 External Drainage

There is approximately 13.92ha of external area which drains into the subject site. The primary outlet for these lands is from a set of catchbasins and a 300mm diameter culvert from Church Street which outlets into the subject site at the north east end, into open space Block 92. Through the subject lands, this runoff is conveyed by a ditch which traverses the bluff then translates to sheet flow as the ditch flattens out and terminates partway through the site, at the toe of the bluff slope.

Smaller portions of these external lands sheet flow onto the subject site from existing and vacant residential lots fronting onto Church Street, further to the south, and along the east boundary.

For pre-development drainage details, refer to the Pre-Development Drainage Plan, **Figure 2** in **Appendix A**.

2.3 Existing Water and Sanitary Services

The subject site currently does not contain any water or sanitary services. However municipal sanitary sewers and watermains are existing on Fox Street, Broad Street, and Church Street which surround the site. There are new water and sanitary services that are to be constructed on the extension of Beck Boulevard from the existing development to the south. The subject development will connect to the Beck Boulevard sanitary sewer at the north boundary of the adjacent development. A watermain connection is also proposed at this location on Beck Boulevard, as well as to the Broad Street watermain at the north limit of the site.

2.4 Soil Conditions

According to the Soils Map of Simcoe County, Ontario, Soil Survey Report prepared for the Department of Agriculture, the subject site and external areas consists of Tioga loamy sand and Alliston sandy loam. These soils have been identified as being within hydrologic soils group 'A' and 'AB' respectively; and are considered to have good to imperfect drainage. This information has been used to determine the composite runoff Curve number for the drainage areas within and external to the 221 Fox Street Development, in order to define the hydrologic losses in the SWMHYMO model.

A Preliminary Geotechnical Investigation has also been prepared by Peto MacCallum Ltd. (PML) for the subject development. From the soils sampling and testing conducted from three boreholes, this report finds that the predominant soil deposit below the topsoil layer is sand, with some seams of clayey silt and till. The groundwater table is approximately 1.9m to 4.4m below existing grades (average of 2.0m in depth), as measured from standpipes installed at the borehole locations. This high groundwater table may require the need for trench dewatering in some locations to facilitate sewer construction.

The investigation also reveals that the native sand soils are in a loose to very loose state which will require 1.5m of engineered fill below house foundations, or deep pilings/ piers incorporated into footing designs to overcome low bearing pressures afforded by the native soils.

2.5 Hydrogeologic Conditions

A Hydrogeologic Function Analysis has been conducted by Ian D. Wilson & Associates, to determine the impacts that the development will have on the groundwater regime and the woodlot area that is to be preserved (Block 90).

The study indicates a westerly flow of groundwater towards Penetang Bay, with water table depths being within approximately 2.0m of the existing ground surface in the low-lowing western portion of the site (based on PML borehole records).

A water budget analysis that was completed as a part of this report identifies that the pre-development on-site infiltration for the 12.01ha site area is 3.9×10^7 L/yr, using a water surplus of 466mm/yr, and based on runoff and infiltration coefficients they have determined are appropriate for the existing condition. The report further identifies that the post-development on-site infiltration is 2.7×10^7 L/yr.

To minimize the effects of urbanization of the groundwater regime and facilitate development, the report recommends that on-site infiltration and surface water retention be employed.

3.0 Post-Development Conditions

3.1 Sanitary Servicing

The development is to be provided with a network of 200mm diameter sanitary sewers and service laterals. Sanitary sewer drainage will flow southward and connect to the new sanitary manhole located in the new extension of Beck Boulevard, at the shared boundary with the development to the south. This sewer drains southward onto Hunter Road, then onto Fox Street and southward to a pumping station. It should be noted that trench dewatering will likely be required to facilitate construction of the sewer, based on available groundwater table information.

It is understood that the Town is currently assessing the capacity of the Fox St. sewer to determine if it can accommodate flows generated by the proposed development. A preliminary Sanitary Sewer Design sheet is contained in Appendix B for reference.

3.2 Water Servicing

The development is to be provided with a network of 150mm municipal watermains that will provide potable water and fire flow distribution. Municipally accepted fire hydrants will be provided for fire fighting. The watermain terminations at the ends of streets 'A' and 'B' will be looped onto each other. The medium density residential block will be provided with a 150mm stub and blow-off for future connection.

It is proposed to connect to the new watermain at the south limit of the site at the future extension of Beck Boulevard, and possibly connect to the existing watermain on Broad street at the proposed intersection with of Beck Boulevard. Watermain disinfection and pressure testing will be conducted in accordance with municipal criteria.

From recent fire hydrant service records provided by the Town of Penetanguishene, static pressures from existing fire hydrants to the south of the development area on Fox Street and Hunter Road are in the range of 70 - 80 P.S.I. On this basis, it is presumed that adequate fire flow pressures will be available in the watermains that are proposed to be extended into the subject development.

For further water and sanitary servicing details refer to the General Servicing Concept Plan contained in **Appendix D**.

3.3 Utilities

Since the development is situated within an existing residential community that is serviced with telephone, cable TV, hydro, and gas services, it is presumed that the various utilities servicing the area can service the proposed development without extensive area network upgrades.

3.4 Internal Grading & Drainage

To accommodate steep slopes across the east portion of the site, roads will be graded to a maximum of 7.0%. To achieve adequate drainage to the SWM facility from the north and south extremity areas of the site, a saw-toothed road grading pattern is proposed along certain sections of Beck Boulevard. This grading method keeps roadway slopes to a minimum of 0.5% and positive drainage to all catchbasins, and utilizes a series of declining 'peaks' along the road profile in order to keep overall slopes measured from 'peak' to 'peak' lower than 0.5% as needed to match site boundary grades and still provide an adequate overland flow route for major storm drainage.

The lots will be graded primarily by split drainage in low lying areas, with the front yards being sloped towards the proposed right-of-way and the backyards being directed towards the rear of the lots. For lots adjacent to the bluff, walk-up lots with Rear lot swales will be required. Rear lot catchbasins will be provided in certain critical areas to provide adequate rear to front drainage.

For further grading and drainage details refer to the Lot Grading Concept Plan contained in **Appendix D**.

3.5 Foundations & Groundwater Considerations

As noted in the Preliminary Geotechnical Investigation, it is noted that house footing grades should be kept to a minimum of 0.6m above the seasonally high groundwater table. In this regard, proposed grades shown on the Concept Lot Grading Plan have been set as high as possible in certain critical areas, while also taking into consideration the desire to cut/fill balance the site and provide positive drainage to the drainage outlet. Future groundwater monitoring and detailed lot grading during the detailed design phase will identify particular concern areas to address this issue.

Also, the Investigation notes that loose to very loose native sand soils are present throughout the site, which will not provide adequate bearing resistances for typical house footing construction methods. To rectify this, 1.5m of engineered fill could be placed beneath footing levels or a pier / piling system could be implemented to bear foundations onto more suitable soils deeper underground.

Depending on the grading of the roadways that are to be finalized during the detailed design phase, pavement subgrade will comprise native soils or engineered fill. A typical a road base cross section should be sufficient for the subdivision, with the exception of frost-susceptible areas which may require additional granular base thickness. Proof-rolling of the subgrade will be required to identify such areas.

For further details pertaining to the groundwater table and foundation/ pavement design recommendations, refer to the Preliminary Geotechnical Investigation prepared by Peto MacCallum Ltd.

4.0 Stormwater Management

4.1 Design Criteria

Internal storm sewers and a stormwater management pond are proposed for the site to ensure that drainage from the subject development is safely attenuated and conveyed to the existing downstream site outlet. Drainage from external lands will be routed through a separate drainage route and into the block 90 woodlot. Runoff from all external areas and the subject development will eventually drain into the downstream 975mm diameter Fox Street storm sewer outlet.

The stormwater management design for the site will incorporate the policies and criteria of a number of agencies, including the Ministry of the Environment (MOE), and the Town of Penetanguishene.

From these, the stormwater management design criteria for the subject site are summarized below:

- Stormwater Quality controls will be provided based on the guidelines described in the <u>Ministry of the Environment 2003 Stormwater Management Planning and</u> <u>Design Manual</u> at an Enhanced Level of Protection.
- The Town's Guidelines will be used as a reference for the design of the stormwater management system.
- The 'Orillia-Brain' rainfall intensity-duration-frequency (IDF) curves will be used to determine the peak flow rates and runoff volumes generated on the site.
- Post-development peak flows from the proposed development will be controlled to pre-development levels for up to the 2- year design storm event, which are based on the governing of the 24-hour SCS Type-II storm distribution and 4-hour Chicago storm distribution.
- Post-development peak flows from the proposed development for storms in excess of the 2-year design storm event, up to and including the 100-year storm event will be controlled to a level that is within the available capacity of the 975mm diameter storm sewer outlet on Fox Street.
- Storm flows from external lands will be routed through the block 90 woodlot and by-pass the proposed SWM facility to mimic existing conditions. Excess runoff not retained within the woodlot will be directed to a storm sewer which will also serve as an outlet for the SWM facility, and subsequently into the Fox Street storm sewer outlet.
- Storm sewers will be designed to convey minor system flows (up to the 5-year design storm event), and runoff from major storm events will be conveyed overland through municipal right-of-ways.
- Erosion and sediment control shall be provided during the construction phase and until the site is fully stabilized.

4.2 **Proposed Drainage**

Post-development drainage patterns on site will be generally consistent with that of the existing conditions. Runoff from the site will be conveyed to a centrally located stormwater management facility at the west end of the site, where peak flow attenuation and quality control will be provided. The subdivision will be drained by a new municipal storm sewer system and a curb-and gutter cross section to collect and convey minor (5-year) and major system (100-year) flows, respectively.

The subject site is identified as catchment 101 for the purposes of the stormwater modelling aspects containing in this report. This area includes all of the residential lots, roadways, Block 92 & 93 woodlots, as well as the Medium Density Block 88.

The upstream external lands are divided into two (2) separate post-development drainage catchments: EXT 1 and EXT 2. These areas are currently uncontrolled and outlet through a 300mm diameter culvert on Church Street then to a downstream ditch which runs through the north east end of the subject site, within a drainage easement.

To capture drainage from these external lands, an alternate conveyance route is proposed through the rear of lots 25-27 and 33-36, which will outlet directly to the block 90 woodlot immediately west of Beck Boulevard. To avoid flooding of the existing lots to the west of the woodlot which front onto Fox Street, an interceptor swale will be graded in along the west property boundary to direct runoff not retained by the woodlot into a ditch inlet catchbasin and subsequently to a storm sewer which will outlet to the new Fox street sewer.

External drainage from smaller parcels of land fronting onto the west side of Church Street and the south side of Broad Street will be conveyed through rear lot swales and catchbasins as required, and also connect to the external storm sewer system.

A third external drainage area, EXT 3 has also been considered to the west of the subject site (downstream) since this area is also tributary to the existing 975mm diameter storm sewer on Fox Street. EXT 3 also includes the block 90 woodlot which is internal to the site, since runoff this area will continue to flow towards Fox Street and not into the proposed SWM facility (as is the case for the remainder of EXT 3).

To drain outflows from the proposed SWM facility and external flows to the existing 975mm diameter storm sewer crossing Fox Street, a 205m long external storm sewer is proposed to be constructed on Fox Street. This will provide a safe outlet for the subject development and upstream external lands while minimizing flooding risk for existing properties along Fox Street.

For further post-development drainage details, refer to the Post-Development Drainage Plan, **Figure 3**, contained in **Appendix A**.

5.0 Hydrologic Analysis

5.1 Rainfall Data

The 24-hour SCS Type-II and the 4-hour Chicago Storm rainfall distributions were used for the 1:2, 1:5, 1:25, and 1:100 year storm event calculations. The Regional storm event modelled was based on the Timmins Regional Storm. The SCS and Chicago storms were developed from the recorded rainfall data from the Orillia-Brain-Intensity-Duration-Frequency (IDF) curves/values.

5.2 Time of Concentration

The Airport Formula was used to calculate the time of concentration. The time of concentration is a function of "time to peak," which represents the time from the beginning of rainfall to the peak of the runoff hydrograph. It is indicative of the basin's response to storm events. It depends on the physical characteristics of the watershed, such as length, slope, area and surface cover. Estimates of time to peak were determined using the area's time of concentration determined by computing a travel time of an overland flow component and, where applicable, a channel/pipe travel time and then adding the respective travel times together. Refer to **Appendix B** for related calculations.

5.3 Pre-Development Condition Modelling Results

Using the site drainage area as illustrated on **Figure 2** and the hydrologic modelling program SWMHYMO, the total flows were determined for the 2-year through to 100-year storm events.

The 4-hour Chicago Storm and 24-hour SCS Type-II pre-development peak flows for the North and South Catchments are summarized in **Table 1** below.

Design Storm	Area (ha)		Pre-Development Peak Flows									
		2 yr. m³/s	5 yr. m³/s	25 yr. m³/s	100 yr. m³/s							
4-hr Chicago	29.30	0.064	0.138	0.292	0.458							
24-hr SCS II	29.30	0.121	0.226	0.429	0.634							

Table 1: 4-Hour Chicago Storm Pre-Development Peak Flows

The pre-development hydrologic model runs for the 4-hour Chicago and SCS Type-II storm distributions can be found in **Appendix C**.

5.4 **Post-Development Condition Modelling Results**

The 4-hour Chicago Storm uncontrolled post-development peak flows are summarized in **Table 2** below.

Catchment	Area (ha)		4-Hour Chicago Storm Distribution Uncontrolled Post-Development Peak Flows									
		25mm m³/s	2 yr. m³/s	5 yr. m³/s	25 yr. m³/s	100 yr. m³/s						
101	11.05	0.342	0.473	0.669	1.040	1.454						
EXT1	7.78	0.021	0.046	0.096	0.197	0.304						
EXT2	6.14	0.146	0.197	0.279	0.427	0.599						
EXT3	4.36	0.009	0.019	0.038	0.075	0.115						

 Table 2: 4-Hour Chicago Storm Post-Development Uncontrolled Peak Flows

The 24-hour SCS Type-II uncontrolled post-development peak flows are summarized in **Table 3** below.

Catchment	Area (ha)	Unc	24-Hour SCS Type-II Distribution Uncontrolled Post-Development Peak Flows									
		2 yr. m³/s	5 yr. m³/s	25 yr. m³/s	100 yr. m³/s	Timmins m³/s						
101	11.05	0.382	0.577	0.953	1.310	0.874						
EXT1	7.78	0.090	0.159	0.289	0.417	0.488						
EXT2	6.14	0.165	0.254	0.435	0.629	0.486						
EXT3	4.36	0.034	0.060	0.108	0.156	0.239						

Table 3: 24-Hr SCS Type-II Storm Post-Development Uncontrolled Peak Flows

The post-development hydrologic model runs for the SCS Type-II and 4-hour Chicago storm distributions can be found in **Appendix C**.

6.0 Quantity Control

6.1 Max Release Rate to Fox Street Sewer Outlet

Although peak flow attenuation to pre-development levels is not required for storm events in excess of the 2-year storm event, the release rate for 5-year through to 100-year storm events is required be within the allotted capacity of the existing 975mm diameter Fox Street outlet pipe.

The allotted capacity for the subject development is pipe's capacity less the storm flows from external lands which are tributary to this pipe.

The capacity of the 975mm diameter pipe is **2.338m³/s** (as noted in the Functional Servicing Report completed by RJ Burnside & Associates Limited for the Village at Bay Moorings Residential Development Located to the south of the subject development).

The most critical/ governing storm flow that this pipe is to convey is the 100-year storm flow.

The existing 100-year flow from the development to the south is **0.933m³/s** (referenced from the Village at Bay Moorings Development Phase 4 FSR prepared by WMI & Associates Ltd., September 2012).

The existing 100-year flow from the external lands to the east and west of the site is $1.071m^3/s$ (combined flows from EXT 1, 2, 3 as detailed in this report). Therefore, the maximum allotted release rate for the subject site into the 975mm diameter Fox Street outlet pipe is $0.334m^3/s$ (2.338 - 0.933 - 1.071).

From comparing the uncontrolled post development peak flows noted in Tables 2 & 3 for catchment 101, it can be seen that the uncontrolled post-development peak flows exceed the allowable release rate levels for the 2-year through to 100-year storm events, therefore some peak flow attenuation is required.

6.2 Preliminary SWM facility Design

In comparing the model run outputs from 24-hour SCS Type-II and 4-hour Chicago storm distributions, the 24-hour SCS Type-II Distribution consistently produced more conservative storage volumes, and therefore were used in establishing the size and preliminary design of the proposed Stormwater management facility.

The proposed stormwater management facility will be designed to incorporate quantity controls for the runoff generated on-site. **Table 4** below provides an overall release rate and stage-storage-discharge summary for the controlled discharge from a SWM facility that would be required to attenuate all storm events up to including the 100-year storm event to the allowable release rate levels.

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Storm Event (Year)	4-hr Chicago Storm Pre- Development Peak Flows (m3/s) (per Table 1)	Catchment 101 Post- Development Peak Flows- Uncontrolled (m3/s) (per Table 3)	Pond Outflow- Post Development <u>Controlled</u> Peak Flow - Catchment 101 (m3/s)	Estimated SWM Facility Active Storage Volume (m3)	Estimated SWM Facility Water Levels (MASL)
2	0.064	0.382	0.063	888	185.74
5	0.138	0.577	0.131	1183	185.91
25	0.292	0.953	0.251	1708	186.19
100	0.458	1.310	0.299	2258	186.47

From comparing the Total Post-development Peak Flows from table 3 to the allowable release flows noted previously, it can be seen that the SWM facility storage volumes and storage water levels are sufficient to attenuate peak flows to below allowable levels, for 5-year through to 100-year storm events. Also, it can be seen from table 4 that the post development peak flow can be reduced to pre-development levels for the 2-year design storm event.

The proposed SWM facility illustrated in Figure 3 (Contained in Appendix A) is sized to provide adequate storage to attenuate flows to the permitted release rates noted previously, based on a permanent pool elevation of 185.10masl. The preliminary design is also in accordance with the summary of design guidance for Wet Pond facilities noted in the Ministry of the Environment's 2003 Stormwater Management Planning and Design Manual, table 4.6.

To meet the release rate requirements at various design storm events, multiple orifice and/or weir controls will be required to restrict flows are various stages within the pond. For the 2-year pre-development release rate target, a small diameter orifice control will likely be sufficient, however to accommodate larger release flows from larger storm events, a manhole cut-out weir will likely be required.

An earthen weir and associated overland flow channel will be incorporated into the SWM facility design to permit regional storm flows to pass without overtopping the facility or flooding adjacent properties.

A detailed analysis of the SWM facility, including the stage, storage and discharge, and inlet / outlet configuration will be provided during the detailed design phase.

Other Preliminary SWM facility Calculations are contained in Appendix B for reference.

7.0 Quality Control

The stormwater management requirements for this site were determined in consultation with the Town of Penetanguishene. The appropriate level of quality control was determined to be at an 'enhanced' level as defined by the MOE's Stormwater Management Planning & Design Manual (2003), which equates to the provision of 80% total suspended solids (TSS) removal.

An integrated treatment train approach will also be implemented to design the storm drainage system, which will help minimize any negative impacts the proposed development may have on the existing quality of stormwater runoff. The integrated treatment train approach is premised on providing quality control at the following three separate locations within the development:

- i) <u>Lot Level Control:</u> Reduced lot grading and roof leaders discharging to pervious surfaces on the residential lots will encourage infiltration and ultimately groundwater recharge at the source within the development.
- ii) <u>Conveyance Control:</u> Grassed swales will be utilized where necessary to convey stormwater runoff to either the storm sewer system or wet pond facility directly. The grassed swales within the development will not only provide stormwater conveyance but also aid in quality control enhancement of the stormwater before it enters the proposed wet pond facility and ultimately exits the subject lands. Also, due to the nature of the development which requires the use of an urban road cross-section, all proposed catchbasins will be equipped with sumps to help promote the removal of suspended solids travelling within the storm sewer system before being released into the end-of-pipe wet pond facility.
- iii) <u>End-of-pipe Control:</u> The final element to the treatment train approach to stormwater quality control is the use of a wet pond facility consisting of a permanent pool and extended detention storage.

The preliminary calculations contained in this report provide end of pipe quality control calculations pertaining to storage volumes and release rates within the SWM facility in accordance with MOE criteria for the subject site area only (catchment 101). Some quality attenuation will inherently be provided for external areas draining into block 90, however, since this area acts as a natural attenuation buffer.

Preliminary SWM facility Calculations pertaining to quality control storage volumes are contained in Appendix B for reference.

8.0 Post-Development Hydrology

In an effort to minimize the loss in on-site infiltration expected due to development, soak-away pits are proposed for the lots and the medium density block 88.

To approximate the total rainfall volume that soak away pits could retain, a desktop analysis of rainfall events and native soils conditions were completed.

As identified in the PML Geotechnical report, the native soils are predominantly sand, which is ideal for infiltration, however soak-away pits should be constructed with shallow depths to avoid conflict with the high groundwater table in some locations. The native soils are considered to have percolation rates of at least 60mm/hr (for Loamy sand, as per MOE Stormwater Management Planning & Design Manual table 4.4).

From Rainfall Event Analysis Reports for the Orillia rainfall station (sourced from the PCSWMM program development by Imbrium Systems Corp.), it is estimated that the cumulative percentage of annual rainfall volume attributed from rainfall events with depths less than or equal to 19.05mm is 71.2%. Furthermore, the typical maximum rainfall depth used in the sizing of soak-away pits which accept rooftop runoff is 20mm.

For the subdivision lots the average rooftop area is assumed to be 1500ft² (140m²). For a 20mm rainfall event, the required storage volume is 2.8m3 for each lot. Using a 1.2m soak-away pit depth, a clearstone medium with a 0.40 voids ratio, the dimensions of a soak away pit required to retain and infiltrate 20mm of rainfall over a rooftop area is approximately 2m (L) x 3m (W) x 1.2m (D) ($2.0^*3.0^*1.2^*0.4 = 2.88$ m³ storage volume).

The total rooftop area proposed for the block 88 multi-residential buildings is $3464m^2$, which would require a storage volume of 69.3m3 for all of the rooftops. Using the same parameters as above, twelve 3.5m (L) x 3.5m (W) x 1.2m (D) soak away pits could be employed ($12^*3.5^*3.5^*1.2^*0.4 = 70.6m^3$ storage volume).

Since the cumulative percentage of annual rainfall volume attributed from rainfall events with depths less than or equal to 19.05mm is 71.2%, the total annual volume of rainfall retained can be expressed by the following equation:

466mm/yr rainfall x 71.2% x (87 lots x 140m2 lot rooftop area + 3464m2 blk 88 rooftop area) = 5.19×10^{6} L/yr

Therefore, the increase in on-site infiltration as a result of the soak-away pits on each of the subdivision lots and within the medium density residential block is $(0.519 + 2.7) \times 10^7 \text{ L/yr} = 3.22 \times 10^7 \text{ L/yr}.$

To provide surface water recharge, it is proposed to direct the existing flows from external lands located to the east of the site into the block 90 woodlot. This will be

achieved by utilizing a shallow rear-lot storm sewer or overland flow channel to convey runoff through the rear of lots 25-27 and 33-36 and across Beck boulevard into the woodlot. This will be beneficial since it will provide significant surface water retention for block 90, and also because it can be drained by an overland conveyance route or shallow storm sewer that will be above the existing groundwater table and have minimal crossing conflicts with other sewers.

9.0 Sediment and Erosion Controls

In accordance with Town policy, effective erosion and sediment control must be established prior to construction commencement and maintained until the site has been stabilized. Exposure of the soil during construction should be minimized to avoid erosion and sedimentation. The sites erosion potential may be mitigated through the use of sound erosion and sedimentation control measures. The following measures must shall be carried out prior to construction and maintained until disturbed areas have regained a significant grass cover:

<u>Topsoil Stripping:</u> Topsoil stripping will be reduced as much as possible on-site. Where grading is necessary, the exposed soil will be stabilized by seeding immediately upon being set to grade. Should topsoil stockpiling be required, the stockpiles will be kept at manageable levels for grass/weed cutting purposes.

<u>Silt Fence:</u> Silt fence will be placed along the down slope of all excavated material and along the perimeter of the site to prevent sediment transport. Periodic inspections and repairs to the silt fence should be performed regularly, as well as after every rainfall event.

<u>Mud Mat:</u> Mud tracking from construction traffic must be controlled through the use of a mud-mat consisting of clear stone located at the site's construction entrances/ exits.

<u>Vegetated Buffers:</u> Existing grassland vegetation/wooded and lawn areas along the development limits are to be maintained wherever possible. These areas will provide a natural barrier to filter potentially sediment-laden overland flow before it is released from the site.

Finally, the Site Engineer will be responsible for completing routine inspections of the sediment and erosion control structures throughout the construction phase of the development, particularly after rainfall events. All damaged or clogged control devices or fencing must be repaired immediately.

10.0 Summary and Conclusions

This Functional Servicing and Stormwater Management Report demonstrates how the proposed development drainage can be serviced and how drainage can be accommodated. Specifically, we note the following:

- A storm sewer system will provide minor system drainage, and new municipal roadways will provide major storm conveyance to a new SWM facility located centrally within the site.
- A network of sanitary sewers will service the subject development and connect into the existing municipal sanitary drainage system to the south of the site. new watermains will also connect to existing mains to the south of the subject site, and will provide adequate potable water and fire flow service. A Permit to Take Water will likely be required to facilitate dewatering the sanitary sewer trench during construction.
- The preliminary grading design takes into consideration the high groundwater table by keeping proposed elevations as high as possible, drainage permitting. Engineered fill or pier/ piling equipped house foundations will need to be implemented to overcome low bearing pressures afforded by the native soils.
- The proposed SWM facility will provide quantity controls for the subject development to pre-development levels for up to the 2-year design storm event. Storm events greater in intensity than this, for up to and including the 100-year storm event, will be attenuated to less than or equal to the available capacity of the existing 975mm diameter outlet sewer on Fox Street.
- External areas upstream of the site will be conveyed directly to the block 90 woodlot via overland flow channels and storm sewers. Runoff from large, infrequent storm events not retained by the woodlot will be drained by an interceptor swale and connect to the SWM facility outlet sewer, and outlet to the existing 975mm diameter Fox Street outlet sewer.
- An integrated treatment train approach will be implemented into the design of the internal storm drainage system which will help minimize any negative impacts the proposed development may have on the existing quality of stormwater runoff. An 'enhanced' level of quality control, as defined in the MOE's Stormwater Management Planning & Design Manual will be provided through extended detention storage provided within the SWM facility.
- Soak away pits will be provided on each lot in an effort to increase infiltration and lessen the effects of a reduction in post-development water balance for the area. Further groundwater recharge will be provided for the environmentally sensitive Block 90 woodlot by routing an external drainage by-pass sewer directly to these lands, to mimic existing conditions.
- The use of silt fencing, existing vegetated buffers, and a construction mud mat will ensure downstream stormwater quality is maintained during construction.

The functional servicing and stormwater management strategy described in this report demonstrates that the site can be accommodated within the framework of existing / adjacent infrastructure, with minimal impacts on the surrounding environment.

Based on the above, we request that this report be received by the Municipality in support of draft plan approval of the proposed plan of subdivision and ultimately the construction of the proposed development.

Respectfully submitted,

WMI & Associates Limited

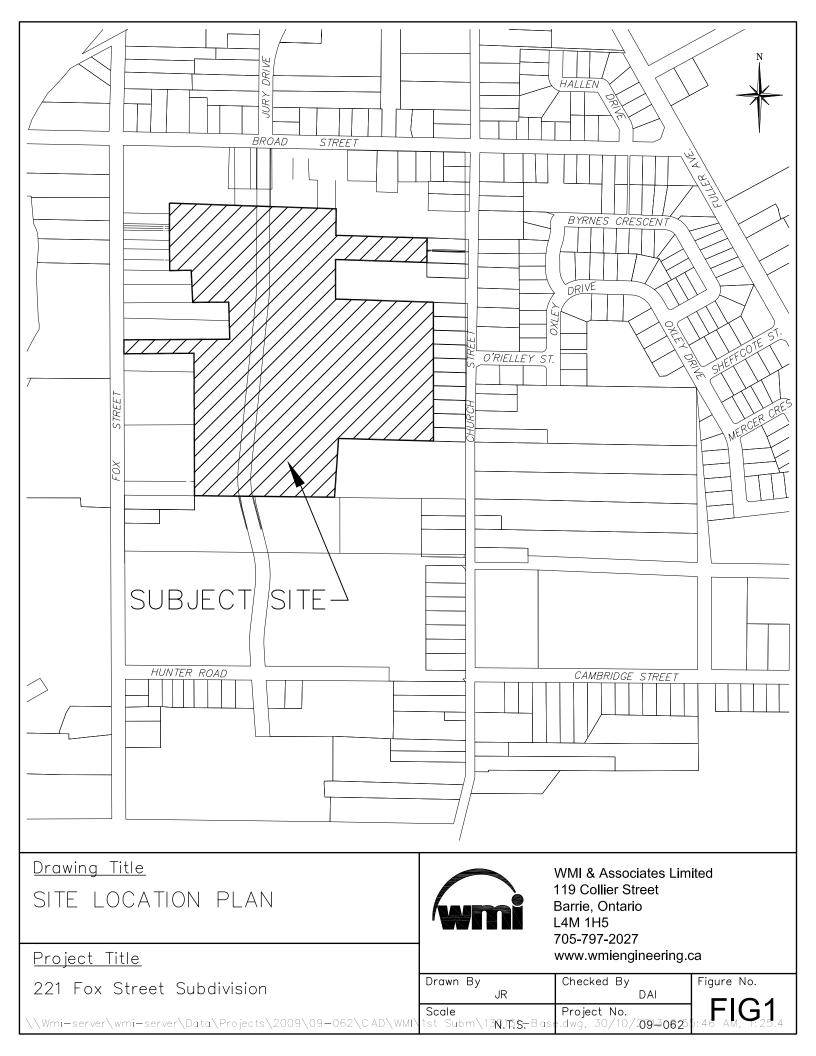
John

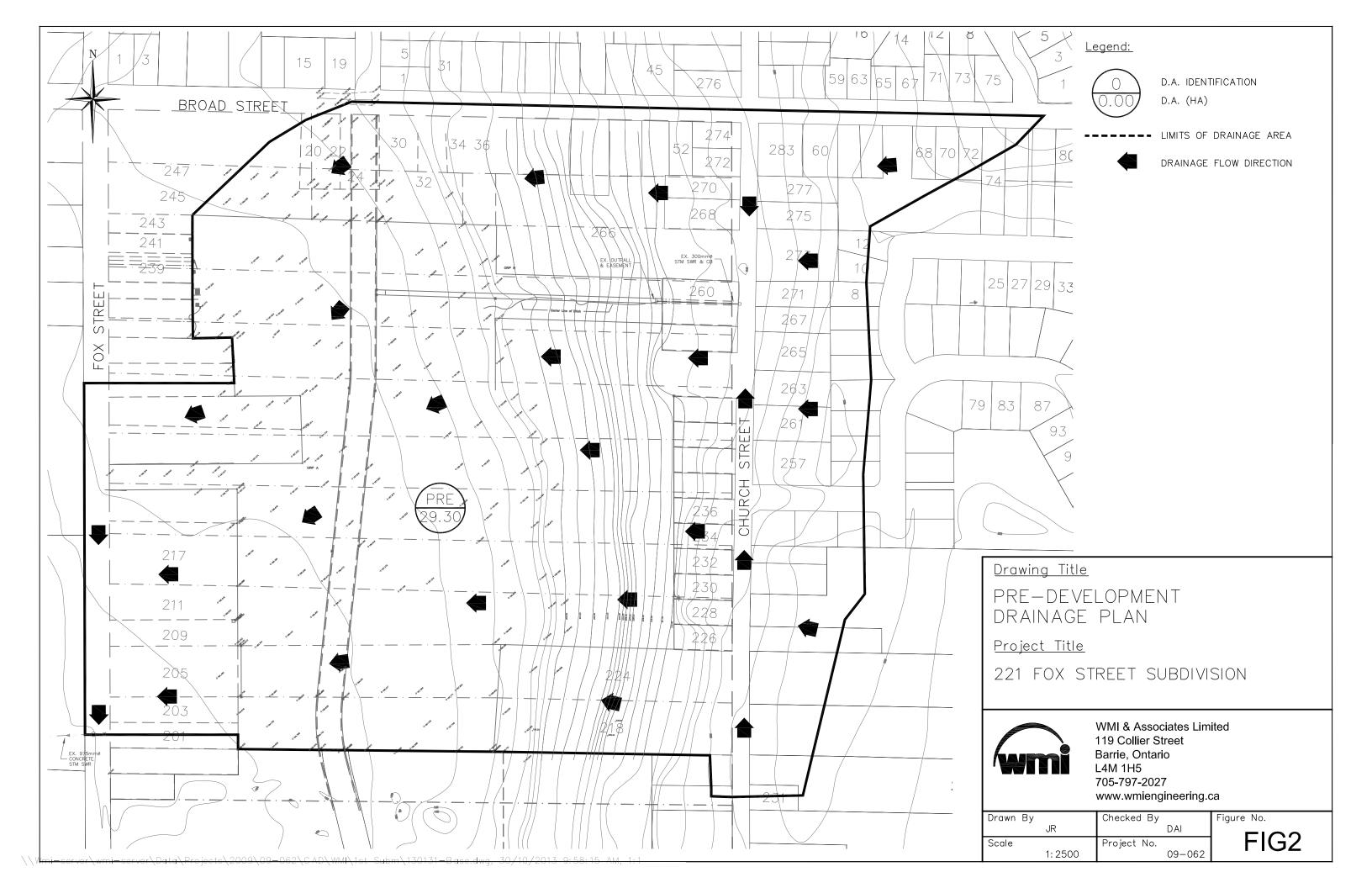
Jonathan Reimer, P. Eng.

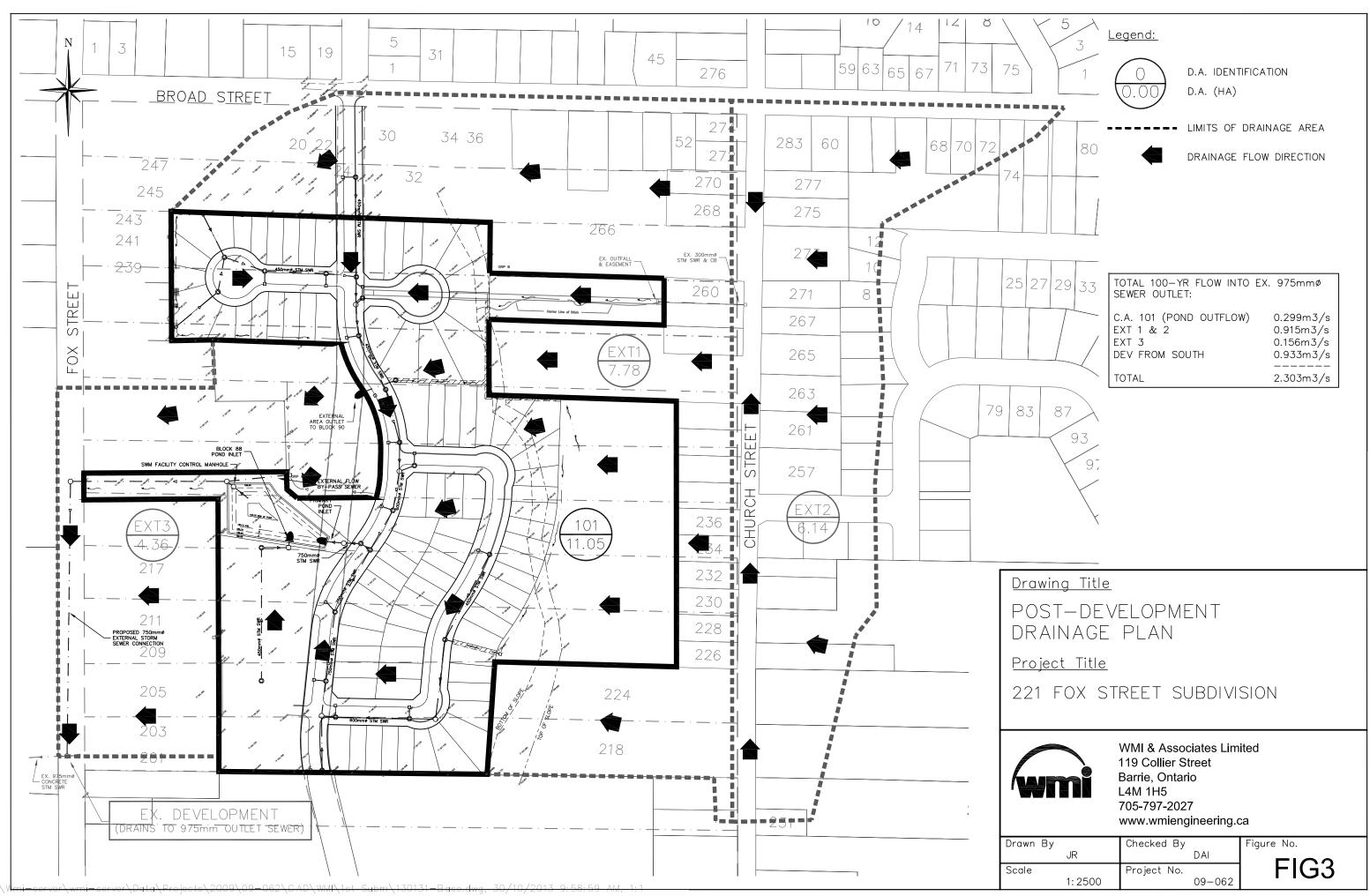
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Figures

Appendix A









SUBJECT SITE-	HALLEN HA
221 FOX TOWN OF PENE COUNTY OF SCALE 25 20 15 10 5 0 25 WNERS' CERTIFICATE	1 : 1000 50 75metres
EREBY AUTHORIZE LUCAS AND ASSOCIA JBDIVISION AND TO SUBMIT SAME TO TH	
URVEYOR'S CERTIFICATE	
CERTIFY THAT THE BOUNDARIES OF THE	
	PETER RAIKES, OLS
DDITIONAL INFORMATION RE ECTION 51(17) OF THE PLA	
SHOWN ON PLAN h) MUNI SEE KEY PLAN i) SILTY RESIDENTIAL, OPEN SPACE j) SHOW SHOWN ON PLAN k) PRIV.	
IETRIC	
STANCES SHOWN ON THIS PLAN ARE IN AN BE CONVERTED BY DIVIDING BY 0.30	
<u>STATISTICS</u> SINGLE FAMILY RESIDENTIAL (12m)	AREA % RESIDENTIAL UNITS 4.64 ha. 38.63% 87
LOTS 1-87) MEDIUM DENSITY TOWNHOUSE	
block 88) DPEN SPACE (PARKLAND)	0.48 ha. 4.00%
BLOCKS 91 & 92) DPEN SPACE (SWM POND)	0.58 ha. 4.83%
BLOCKS 89)	3.07 ha. 25.56%
ROADS	2.04 ha. 1699%
TOTAL	12.01 ha. 100.00%. 115
Lucas & A Consultants in Planning	
24 Debra Crescent, Ba (705) 721-9635 F	arrie, Ontario L4N 3T1
ATE : January 30, 2013 D	RAWN BY : G.J.L.

DWG NAME : DRAFT PLAN OF SUBDIVISION FIRST SUBMISSION.DWG

Design Calculations

Appendix B

<th <th="" c<="" colspan="6" th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>Prelii</th><th>minary Sa 221 Fo</th><th>nitary Sev x St. Deve</th><th></th><th></th><th>et</th><th></th><th></th><th></th><th></th><th></th></th>	<th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Prelii</th> <th>minary Sa 221 Fo</th> <th>nitary Sev x St. Deve</th> <th></th> <th></th> <th>et</th> <th></th> <th></th> <th></th> <th></th> <th></th>														Prelii	minary Sa 221 Fo	nitary Sev x St. Deve			et					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $											~~~	Elements	Requiring	Input In	formation										
Location Location Location Location Downstream No. of Units People per Unit Individual Cumulative Street Street Upstream NODE No. of Units People per lon Individual Cumulative Street Street Street A & B 5 3 30 2.5 75 75 4.28 1.67 2.28 2.28 0.43 2.10 200 0.50 234.0 24.19 0.75 Street C 4 1 34 2.5 75 75 4.28 1.67 2.28 2.28 0.43 2.10 200 0.50 234.0 24.19 0.75 Street C 4 3 11 2.5 28 28 4.36 0.64 1.14 1.14 0.22 0.43 2.10 200 0.50 234.0 24.19 0.75 Street C 4 1 34 2.5 85 85 4.26 1.89 1.14 1.14 0.22		i = peak extraneous (i.e. infiltration) flow rateResidential (L/cap./day), q:450(Harmon) $M=1+(14/(4+P^{0.5}))$ $Q_p = (P^*q^*M)/86.4$ (L/s)M = Ultimate Flow Factor (peaking factor)(for Industrial/Commercial/Institutional sewage flow calculations, see Notes below)(Harmon) $M=1+(14/(4+P^{0.5}))$ $Q_p = (P^*q^*M)/86.4$ (L/s) $Q_p = peak extraneous (i.e. infiltration) flow (L/s)(for Industrial/Commercial/Institutional sewage flowcalculations, see Notes below)where, P is population in 1000'sQ_d = Q_p + Q_i (L/s)Q_d = peak extraneous (i.e. infiltration) flow (L/s)Peak Infiltration Flow Rate:Population Density:2.5Mannings Coefficient, 'n':Infiltration (L/s/ha), i:0.19Population Density:2.5Mannings Coefficient, 'n':0.013$																							
Street Upstream NODE Downstream NODE No. of Units NODE People per Unit OR Area (ha) Individual Number of People Cumulative of People Sewage Flow (L/s) Individual Area (ha) Cumulative (L/s) Flow (L/s) Total Number (L/s) Dia. Slope Length Capacity Velocity Streets A & B Street E & D 5 3 30 2.5 75 75 4.28 1.67 2.28 2.28 0.43 2.10 200 6.50 234.0 24.19 0.75 Street E & D 4 1 34 2.5 85 85 4.26 1.89 1.14 1.14 0.22 2.10 200 6.50 234.0 24.19 0.75																									
Streets A & B 5 3 30 2.5 75 75 4.28 1.67 2.28 2.28 0.43 2.10 200 0.50 234.0 24.19 0.75 Street C 4 3 11 2.5 28 28 4.36 0.64 1.14 1.14 0.22 0.43 2.10 200 6.50 81.0 87.24 2.69 Street E & D 4 1 34 2.5 85 85 4.26 1.89 1.14 1.14 0.22 2.10 200 2.00 28.0 24.19 0.75 2.69 Street E & D 4 1 1.14 1.14 1.14 0.22 2.10 200 200 234.0 24.19 0.75 2.69 Mathematical Street E & D 4 1 1.46 1.14 1.14 0.22 2.10 200 200 200 286.0 48.39 1.49	Street	Upstream		OR	OR	Number	Cumulative Number	Ultimate Flow Factor	Sewage Flow		Cumulative		Flow		Slope	Length	Capacity		Fall in Sewer (m)						
Biock 79 Beck Bivd. 2 1 28 5 2.5 5 70 2.5 70 13 70 204 4.28 4.14 1.56 4.40 1.14 1.14 1.14 0.22 1.30 1.78 5.70 200 200 102.0 24.19 0.75 Beck Bivd. 1 MH GG 0 2.5 0 289 4.09 6.15 0.00 7.98 1.52 7.67 200 0.50 48.0 24.19 0.75	Street C Street E & D Beck Blvd. Block 79 Beck Blvd.	4 4 3 Block 79 2	3 1 2 2 1	11 34 7 28 5	2.5 2.5 2.5 2.5 2.5 2.5 2.5	28 85 18 70 13	28 85 121 70 204	4.36 4.26 4.22 4.28 4.14	1.67 0.64 1.89 2.66 1.56 4.40	2.28 1.14 1.14 1.14 1.14 1.14 1.14	2.28 1.14 1.14 4.56 1.14 6.84	0.43 0.22 0.22 0.87 0.22 1.30	2.10 0.85 2.10 3.53 1.78 5.70	200 200 200 200 200 200 200	0.50 6.50 2.00 0.50 0.50 0.50	81.0 286.0 129.0 102.0 74.0	87.24 48.39 24.19 24.19 24.19	2.69 1.49 0.75 0.75 0.75	1.17 5.27 5.72 0.65 0.51 0.37 0.24						

//Wmi-server/wmi-server/Data\Projects\2009\09-062\Spreadsheets\Sanitary\[130201-sandesignsheet.xls]SAN SHEET

WMI & Associates Limited 119 Collier Street, Barrie, Ontario L4M 1H5 p (705) 797-2027 f (705) 797-2028

	Date: Project No: Prepared by:	JR									
		Sewer Pro	ofile Data								
1	Drop in MH (m)	Top of Grate	Elevation (m)	Invert Ele	vation (m)						
r	DS	US	DS	US	DS						
tior	on Density provided above).										

wmi																			
											-	Storm S evelopm		-					
												_ ~~~	Elements	Requiring	ı Input Info	ormation			
	Rational Meth	od Calculation:							Manning's Form		ation:		Rainfall In	tensity C	alculation:				
	$Q = 2.78^{*}(C_{F}^{*}C)$	C*I*A)							$V = (k^* R^{2/3} S^{1/2})$	'n	Q = V*A		$I = A^*T_C^B$			Rainfall IDF D	ata:	Orill	ia, ON.
									MOE Velocity Re	quirements:	0.8m/s - 6.0	0m/s						5-year	100-year
	where,								where,				where,				A =	29.7	49.9
	Q = peak flow	rate (L/s)							V = mean velocit	y (m/s)			$T_{\rm C}$ = Time	of Concer	tration (hr)		B =	-0.728	-0.726
	C _F = runoff coe	efficient factor for	storms >	<u>10-yr</u>				m events and	k = 1.0 for SI unit	ts			A = Rainfa	II IDF Coe	fficient				
	C = runoff coef	ficient					5 for the 25, 5	0 & 100-yr	R = hydraulic rad	lius (m)			B = Rainfa	II IDF Coe	fficient	Runoff Coeff.	Factors, $C_F =$	1.00	1.25
	I = rainfall inte	nsity (mm/hr)			storm eve	ents respe	ectively)		S = friction slope										
	A = area (ha)								n = Mannings Co		0.013								
	n – urou (nu)								n – Mannigo Od		0.010								
L	Location Runoff Calcula					unoff Calculation	n Data				Sewer Calculation Data								
Street	Upstream NODE	Downstream NODE	C =	C =	Areas (ha) C =	C =	Individual 2.78CA	Accumulated 2.78CA	Time of Concentration	Storm Event	Rainfall Intensity	Peak Runof Flow	f Diameter	Slope	Length	Capacity	Velocity	Pipe Flow Time	Pipe Storage Volume
			0.20	0.40	0.60	0.75			(mins)		(mm/hr)	(L/s)	(mm)	(%)	(m)	(L/s)	(m/s)	(mins)	(m ³)
EXT FLOW*	EXT 1 & 2	blk 90								5-year		405.00	450	2.00	30.00	420.63	2.56	0.20	4.9
ST. A, B & BECK BLVD	3	2			1.84		3.07	3.07	20.00	5-year	66.08	203.04	450	0.50	100.00	210.32	1.28	1.30	16.4
BECK BLVD - POND	2	1			1.84		3.07	6.14	21.30	5-year	63.12	387.87	600	0.50	100.00	452.94	1.55	1.07	29.2
										_									
ST. E - ST. D ST.D - BECK BLVD.	6 5	5 4			1.84 1.84		3.07 3.07	3.07 6.14	15.00 15.92	5-year 5-year	81.48 78.03	250.35 479.46	450 600	1.00	100.00 100.00	297.43 640.56	1.81 2.19	0.92 0.76	16.4 29.2
BECK BLVD - POND.	4	1			1.84		3.07	9.22	16.68	5-year	75.42	695.20	750	0.50	100.00	821.24	1.80	0.93	45.6
PRIMARY POND INLET**	1	POND1			0.00		0.00	15.36	22.37	5-year	60.90	935.58	750	0.75	100.00	1005.81	2.21	0.76	45.6
BLOCK 79 POND INLET	7	POND2			1.84		3.07	3.07	15.00	5-year	81.48	250.35	450	0.75	100.00	257.58	1.57	1.06	16.4
		nage Areas (ha):		0.00	11.05	0.00													
	Total Dra	inage Area (ha):	11.05																
NOTES:		approximate pipe or catchment EXT							nternal drainage a	rea (11.05 /	6 = 1.84 ha)	1							

\\Wmi-server\wmi-server\Data\Projects\2009\09-062\Spreadsheets\SWM\[130201 stmdesignsheet.xls]STM SHEET

WMI & Associates Limited 119 Collier Street, Barrie, Ontario L4M 1H5 p (705) 797-2027 f (705) 797-2028

		Date: Project No:	01-Feb-13 09-062			
		Prepared by:	JR			
			Sewe	r Profile Data		
ge	Fall in	Drop in MH (m)	Top of Grate	Elevation (m)	Invert Ele	vation (m)
	Sewer (m)	DS	US	DS	US	DS
	0.60 0.50 1.00 1.00 0.50 0.75 0.75					INPUT VALUE



RUNOFF COEFFICIENT CALCULATIONS "C" SPREADSHEET

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

RUNOFF COEFFICIENT NUMBERS

	Land Cover	Hydro	Hydrologic Soil Groups					
		A-AB	B-BC	C-D				
	0 - 5% grade	0.22	0.35	0.55				
Cultivated Land	5 - 10% grade	0.3	0.45	0.6				
	10 - 30% grade	0.4	0.65	0.7				
	0 - 5% grade	0.1	0.28	0.4				
Pasture Land	5 - 10% grade	0.15	0.35	0.45				
	10 - 30% grade	0.22	0.4	0.55				
	0 - 5% grade	0.08	0.25	0.35				
Woodlot or Cutover	5 - 10% grade	0.12	0.3	0.42				
	10 - 30% grade	0.18	0.35	0.52				
Lakes and Wetlands		0.05	0.05	0.05				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.95	0.95	0.95				
Gravel	(not used for proposed parking or storage areas)	0.4	0.5	0.6				
Residential	Single Family	0.3	0.4	0.5				
Residential	Multiple (i.e. semi, townhouse, apartment, etc.)	0.5	0.6	0.7				
Industrial	Light	0.55	0.65	0.75				
industrial	Heavy	0.65	0.75	0.85				
Commercial		0.6	0.7	0.8				
Unimproved Areas		0.1	0.2	0.3				
	< 2% grade	0.05	0.11	0.17				
Lawn	2 - 7% grade	0.1	0.16	0.22				
	> 7% grade	0.15	0.25	0.35				

Ref: Runoff Coefficient Numbers - Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO. (1997)

<<< Elements Requiring Input Information</p>

PRE-DEVELOPMENT CONDITION - PRE (existing)

	Land Cover	Hydrologic Soil Groups				
		A-AB	B-BC	C-D		
	0 - 5% grade					
Cultivated Land	5 - 10% grade					
	10 - 30% grade					
	0 - 5% grade					
Pasture Land	5 - 10% grade					
	10 - 30% grade					
Woodlot or Cutover	0 - 5% grade	13.30				
	5 - 10% grade	13.30				
	10 - 30% grade					
Lakes and Wetlands						
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	2.71				
Gravel	(not used for proposed parking or storage areas)					
Residential	Single Family					
Residential	Multiple (i.e. semi, townhouse, apartment, etc.)					
Industrial	Light					
industrial	Heavy					
Commercial						
Unimproved Areas						
	< 2% grade					
Lawn	2 - 7% grade					
	> 7% grade					

Total Area (ha) = 29.30

Runoff Coefficient, C = 0.18



RUNOFF COEFFICIENT CALCULATIONS "C" SPREADSHEET

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

RUNOFF COEFFICIENT NUMBERS

	Land Cover	Hydrologic Soil Groups				
		A-AB	B-BC	C-D		
	0 - 5% grade	0.22	0.35	0.55		
Cultivated Land	5 - 10% grade	0.3	0.45	0.6		
	10 - 30% grade	0.4	0.65	0.7		
	0 - 5% grade	0.1	0.28	0.4		
Pasture Land	5 - 10% grade	0.15	0.35	0.45		
	10 - 30% grade	0.22	0.4	0.55		
	0 - 5% grade	0.08	0.25	0.35		
Woodlot or Cutover	5 - 10% grade	0.12	0.3	0.42		
	10 - 30% grade	0.18	0.35	0.52		
Lakes and Wetlands		0.05	0.05	0.05		
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.95	0.95	0.95		
Gravel	(not used for proposed parking or storage areas)	0.4	0.5	0.6		
Residential	Single Family	0.3	0.4	0.5		
Residential	Multiple (i.e. semi, townhouse, apartment, etc.)	0.5	0.6	0.7		
Industrial	Light	0.55	0.65	0.75		
industrial	Heavy	0.65	0.75	0.85		
Commercial		0.6	0.7	0.8		
Unimproved Areas		0.1	0.2	0.3		
	< 2% grade	0.05	0.11	0.17		
Lawn	2 - 7% grade	0.1	0.16	0.22		
	> 7% grade	0.15	0.25	0.35		

Ref: Runoff Coefficient Numbers - Adapted from Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO. (1997)

<<< Elements Requiring Input Information</p>

EXTERNAL AREA - EXT1

	Land Cover	Hydro	logic Soil G	iroups
		A-AB	B-BC	C-D
	0 - 5% grade			
Cultivated Land	5 - 10% grade			
	10 - 30% grade			
	0 - 5% grade			
Pasture Land	5 - 10% grade			
	10 - 30% grade			
	0 - 5% grade			
Woodlot or Cutover	5 - 10% grade	3.90		
	10 - 30% grade			
Lakes and Wetlands				
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.73		
Gravel	(not used for proposed parking or storage areas)			
Residential	Single Family			
Residentia	Multiple (i.e. semi, townhouse, apartment, etc.)			
Industrial	Light			
industrial	Heavy			
Commercial				
Unimproved Areas				
	< 2% grade			
Lawn	2 - 7% grade			
	> 7% grade	3.15		

Total Area (ha) = 7.78

Runoff Coefficient, C = 0.21

EXTERNAL AREA - EXT3

	Land Cover	Hydrologic Soil Groups					
		A-AB	B-BC	C-D			
	0 - 5% grade						
Cultivated Land	5 - 10% grade						
	10 - 30% grade						
	0 - 5% grade						
Pasture Land	5 - 10% grade						
	10 - 30% grade						
	0 - 5% grade	1.96					
Woodlot or Cutover	5 - 10% grade						
	10 - 30% grade						
Lakes and Wetlands							
Impervious Area	(i.e. buildings, roads, parking lot, etc.)	0.45					
Gravel	(not used for proposed parking or storage areas)						
Residential	Single Family						
Residential	Multiple (i.e. semi, townhouse, apartment, etc.)						
Industrial	Light						
industriai	Heavy						
Commercial							
Unimproved Areas							
	< 2% grade	1.96					
Lawn	2 - 7% grade						
	> 7% grade						

Total Area (ha) = 4.36

Runoff Coefficient, C = 0.16

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CURVE NUMBER & INITIAL ABSTRACTION CALCULATIONS CN & IA SPREADSHEET

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

SCS CURVE NUMBERS (AMC II (NORMAL) CONDITION)

INITIAL RAINFALL

								ABSTRACTION
_				IA				
Land Cover	Α	AB	(mm)					
Wetlands/Lakes/SWMF's	50	50	50	50	50	50	50	
Woods	32	46	60	67	73	76	79	10
Meadows	38	51	65	71	76	79	81	8
Pasture/Lawn	49	59	69	74	79	82	84	5
Cultivated	62	68	74	78	82	84	86	7
Impervious Areas	100	100	100	100	100	100	100	2

Ref: SCS Curve Numbers - Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO.(1997) Ref: Initial Rainfall Abstraction Values - UNESCO, Manual on Drainage in Urbanized Areas, (1987) Ref: AMC I & III Condition SCS Curve Number Values - Modern Sewer Design, Third Edition (Canadian), pg. 69, Table 3.6, (1996)

NOTES: - AMC II Condition SCS Curve Number values are not applicable to frozen soils or to the period where snowmelt

- contributes to stormwater runoff.

- STANDHYD COMMANDS (Swmhymo) - CN values are based solely on the pervious surfaces within the catchment. - NASHYD COMMANDS (Swmhymo) - CN values are based on both the pervious and impervious surfaces within the catchment (composite CN value).



Elements Requiring Input Information <<<

PRE-DEVELOPMENT CONDITION - PRE (existing)

Area per Land Cover Type and Hydrologic Soil Group

Hydrologic Soil Groups (for Nashyd Command)													
			(for Nashyd (Command)									
Land Cover	Α	AB	В	BC	С	CD	D	Total Area (ha) =	29.31				
Wetlands/Lakes/SWMF's													
Woods		26.6						CN(I) =	31				
Meadows								CN(II) =	51				
Pasture/Lawn								CN(III) =	70				
Cultivated													
Impervious Areas		2.71						IA (mm) =	9.3				



CURVE NUMBER & INITIAL ABSTRACTION CALCULATIONS **CN & IA SPREADSHEET**

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

INITIAL RAINFALL

								ABSTRACTION
			IA					
Land Cover	Α	AB	(mm)					
Wetlands/Lakes/SWMF's	50	50	50	50	50	50	50	
Woods	32	46	60	67	73	76	79	10
Meadows	38	51	65	71	76	79	81	8
Pasture/Lawn	49	59	69	74	79	82	84	5
Cultivated	62	68	74	78	82	84	86	7
Impervious Areas	100	100	100	100	100	100	100	2

SCS CURVE NUMBERS (AMC II (NORMAL) CONDITION)

Ref: SCS Curve Numbers - Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual", MTO.(1997) Ref: Initial Rainfall Abstraction Values - UNESCO, Manual on Drainage in Urbanized Areas, (1987) Ref: AMC I & III Condition SCS Curve Number Values - Modern Sewer Design, Third Edition (Canadian), pg. 69, Table 3.6, (1996)

NOTES: - AMC II Condition SCS Curve Number values are not applicable to frozen soils or to the period where snowmelt contributes to stormwater runoff. - STANDHYD COMMANDS (Swmhymo) - CN values are based solely on the pervious surfaces within the catchment.

- NASHYD COMMANDS (Swmhymo) - CN values are based on both the pervious and impervious surfaces within the catchment (composite CN value).

~~~	<b>Elements Requiring Input Information</b>
-----	---------------------------------------------

#### EXTERNAL AREA - EXT1

	Area per Land Cover Type and Hydrologic Soil Group												
			Hydro	logic Soil C		(for Nashyd C	Command)						
Land Cover	Α	AB	В	BC	С	CD	D	Total Area (ha) =	7.78				
Wetlands/Lakes/SWMF's													
Woods		3.904						CN(I) =	36				
Meadows								CN(II) =	56				
Pasture/Lawn		3.148						CN(III) =	75				
Cultivated													
Impervious Areas		0.726						IA (mm) =	7.2				

EXTERNAL AREA - EXT2

Area per Land Cover Type and Hydrologic Soil Group

			Hydro	(for Standhyd C	command)				
Land Cover	A	AB	В	BC	С	CD	D	Pervious Area (ha) =	4.60
Wetlands/Lakes/SWMF's									
Woods								CN(I) =	39
Meadows								CN(II) =	59
Pasture/Lawn		4.596						CN(III) =	77
Cultivated									
Impervious Areas								IA (mm) =	5.0

EXTERNAL AREA - EXT 3

#### Area per Land Cover Type and Hydrologic Soil Group

			Hydro		(for Nashyd C	command)			
Land Cover	Α	AB	В	BC	С	CD	D	Total Area (ha) =	4.37
Wetlands/Lakes/SWMF's									
Woods		1.96						CN(I) =	37
Meadows								CN(II) =	57
Pasture/Lawn		1.96						CN(III) =	75
Cultivated									
Impervious Areas		0.45						IA (mm) =	6.9

### **POST-DEVELOPMENT CONDITION - C.A. 101**

#### Area per Land Cover Type and Hydrologic Soil Group

			Hydro	ologic Soil (	Groups			(for Standhyd C	command)
Land Cover	Α	AB	В	BC	С	CD	D	Pervious Area (ha) =	7.19
Wetlands/Lakes/SWMF's									
Woods		2.5						CN(I) =	34
Meadows								CN(II) =	54
Pasture/Lawn		4.69						CN(III) =	73
Cultivated									
Impervious Areas								IA (mm) =	6.7

\\Wmi-server\wmi-server\Data\Projects\2009\09-062\Spreadsheets\SWM[130107 CN and IA CALCS_POST.xls]CN & IA CALCS

# TIME OF CONCENTRATION & TIME TO PEAK CALCULATIONS $T_{\rm c}$ & $T_{\rm p}$ SPREADSHEET

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

OVERLAND SHEET FLOW TIME OF CONCENTRATION (T_c) CALCULATION, T_c OVER

OVERLAND SP			CONCENT	KATION (1	) CALCULATIC	C, OVER				
The Runoff Coe	efficient 'C'	governs wh	hich Time of	Concentratio	on Formula is us	ed:	C >= 0.40	Bransby W	illiams Formu	ıla
		-					C < 0.40	Airport For	mula (FAA Ed	quation)
						Ref: MTO	Drainage	Managemen	t Manual, po:	, 28, Ch. 8, 1997
		~~~	Elements	Reauirina I	nput Informatio		,		, , , , , , , , , , , , , , , , , , ,	
				5				_	T _c ,	_{over} (min.)
Catchment	Area	h₁	h ₂	Length	Runoff	h _{DELTA}	Slope		Airport	Bransby Williams
I.D.	(ha)	(m)	(m)	(m)	Coefficient	(m)	(%)		Formula	Formula
**PRE (a)	14.65	188	182	330	0.18	6.0	1.8		44.7	
**PRE (b)	14.65	226	188	380	0.18	38.0	10.0		27.3	
Airport		(FAA Equat					Bransby W	illiams Form	ula	
T _{C, OVER}	=	3.26 (1.	1-C) (L) ^{0.5}	(min.)		T _{C, OVER}	=	0.0	57 (L)	(min.)
		(5	5) ^{0.33}	-				(S) ⁰	^{.2} (A) ^{0.1}	-
where,	C =	Runoff Co	efficient			where,	L =	Length of C	Overland Flow	Path, (m)
	L =	Length of	Overland Flo	ow Path, (m)			S =			Flow Path, (%)
	S =	0		d Flow Path,			A =	Catchment		. (/

CHANNELIZED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, T_{C, CHAN}

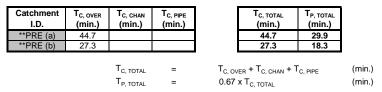
Refer to separate sheet attached for the calculation of the Velocity values (i.e. Flow Master Output, Manning's Channel Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)		T _{C. CHAN} (min.)				
		$T_{C,CHAN}$	=	 V	(min.)	where,	L = V =	Length of Channel, (m) Flow Velocity in Channel, (m/s)

PIPED FLOW TIME OF CONCENTRATION (T_c) CALCULATION, T_{c, PIPE} Refer to separate sheet attached for the calculation of the Velocity values (i.e. Culvert Master Output, Manning's Pipe Spreadsheet, etc.).

Catchment I.D.	Length (m)	Velocity (m/s)		Т _{с, PIPE} (min.)				
		T _{C, PIPE}	=	L V	(min.)	where,	L = V =	Length of Pipe, (m) Flow Velocity in Pipe, (m/s)

TOTAL TIME OF CONCENTRATION (T_c) AND TIME TO PEAK (T_P) CALCULATION, $T_{C, \text{ TOTAL}}$, $T_{P, \text{ TOTAL}}$ The Total Time of Concentration and Time to Peak values consist of a combination of the Overland, Channel and/or Pipe travel times.



**Note: The flow paths for the pre-development catchments have been broken up into 2 segments - (a) representing the flat section, and (b) representing the steep section, to give a more realistic Tc Value.

*Note: the "PRE undv" case refers to the condition which assumes that all areas surrounding the subject site are undeveloped (less impervious area)

\\Wmi-server\wmi-server\Data\Projects\2009\09-062\Spreadsheets\SWM\[130104 Tc & Tp Spreadsheet.xls]Tc & Tp Calcs



TIME OF CONCENTRATION & TIME TO PEAK CALCULATIONS T_C & T_P SPREADSHEET

Date:	07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

Prepared By: JR

A =

Catchment Area, (ha)

					c) CALCULATI			BropshyW	illiana Formi	
The Runon Co		governs wi	lich time o	Concentrat	ion Formula is u				illiams Formu	
									mula (FAA Eo	
						,	Drainage	wanagemen	t Manual, pg	28, Ch. 8, 1997
		~~~	Elements	Requiring I	nput Informatio	on			_	
								_	T _{C,}	_{over} (min.)
Catchment	Area	h1	h ₂	Length	Runoff	h _{DELTA}	Slope		Airport	Bransby Williams
I.D.	(ha)	(m)	(m)	(m)	Coefficient	(m)	(%)		Formula	Formula
EXT1	7.78	214	189	267	0.21	25.0	9.4		22.7	
EXT3	4.36	187.5	186.5	160	0.16	1.0	0.6		45.3	
								_		
Airpor		(FAA Equati				E	Bransby W	illiams Form	ula	
T _{C, OVER}	=	3.26 (1.1	-C) (L) ^{0.5}	(min.)		T _{C, OVER}	=	0.0	57 (L)	(min.)
		(S)	0.33	-				(S) ^{0.1}	² (A) ^{0.1}	-
where,	C =	Runoff Coe	fficient			where,	L =	( )	overland Flow	/ Path. (m)
	L =			ow Path, (m)		,	S =			Flow Path, (%)
		5		, , ,						/

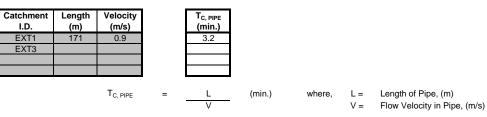
Length of Overland Flow Path, (m) L = Avg. Slope of Overland Flow Path, (%) S =

CHANNELIZED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, T_{C, CHAN} Refer to separate sheet attached for the calculation of the Velocity values (i.e. Flow Master Output, Manning's Channel Spreadsheet, etc.).

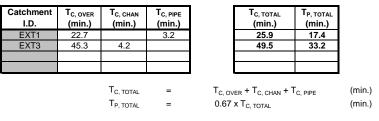
Catchment I.D.	Length (m)	Velocity (m/s)		T _{C. CHAN} (min.)				
EXT1								
EXT3	200	0.8		4.2				
		T _{C, CHAN}	=	 V	(min.)	where,	L = V =	Length of Channel, (m) Flow Velocity in Channel, (m/s)

PIPED FLOW TIME OF CONCENTRATION (T_C) CALCULATION, T_{C, PIPE}

Refer to separate sheet attached for the calculation of the Velocity values (i.e. Culvert Master Output, Manning's Pipe Spreadsheet, etc.).



TOTAL TIME OF CONCENTRATION (T_c) AND TIME TO PEAK (T_P) CALCULATION, T_{C, TOTAL}, T_{P, TOTAL} The Total Time of Concentration and Time to Peak values consist of a combination of the Overland, Channel and/or Pipe travel times.



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# STAGE-STORAGE-DISCHARGE (S-S-D) CALCULATIONS SWM FACILITY

	Date: 06-Jan-13 Project: 221 Fox St. FSR	Project No.: 09-062 Prepared By: JR	
	~~~	Elements Requiring Input Information	
Unsubmerged Orifice (Weir Flow)	Submerged Orifice (Orifice Flow)	Unsubmerged Weir (Weir Flow) Rectangular Broad- & Sharp-Crested Weirs	Submerged Weir (Orifice Flow) Submerged Sharp-Crested Weirs
$Q = C_W L H^{3/2} (m^3/s)$	$Q = C_0 A_0 (2gH)^{1/2} (m^3/s)$	$Q = C_W LH^{3/2}$ (m ³ /s) Triangular Broad-Crested Weirs	$Q = C_0 A_0 (2gH)^{1/2}$ (m ³ /s)
where, Q = Flow through unsubmerged orifice (m ³ /s)	where, $Q =$ Flow through submerged orifice (m ³ /s) $C_0 =$ Orifice Discharge Coefficient	$Q = 1.225H^{5/2}$ tan(Theta/2) (m ³ /s) Triangular Sharp-Crested Weirs	where, Q = Flow through submerged weir opening (m ³ /s)
C_W = Weir Coefficient H = Head/Depth of water acting on	$A_{O} = Cross-sectional area of orifice (m2) g = Gravitational acceleration (9.81m2/s)$	$Q = 0.581(8/15)(2g)^{3/2} tan(Theta/2)H^{3/2} (m^3/s)$ Trapezoidal Broad- & Sharp-Crested Weirs	C_0 = Orifice Discharge Coefficient A ₀ = Cross-sectional area of opening (m ²)
weir measured from above the	For circular vertical orifice,	$Q_{\text{TRAPEZOIDAL}} = Q_{\text{RECTANGULAR}} + Q_{\text{TRIANGULAR}} (m^3/s)$	g = Gravitational acceleration (9.81m2/s)
crest/invert of orifice (m) L = Length of weir (m) D = Diameter of Pipe/Orifice (m)	 H = Head/Depth of water acting on orifice measured from centroid of the opening (m) For circular horizontal orifice, 	where, Q = Flow through unsubmerged weir (m^3/s) C _W = Weir Coefficient	H = Head/Depth of water acting on orifice measured from centroid of the opening (m)
For circular vertical weir, L = Wetted Perimeter $L = D \times \cos^{-1}((D/2 - H)/(D/2))$	H = Head/Depth of water acting on orifice measured from above the invert (m)	(1.65 for Broad-Crested) (1.80 for Sharp-Crested) H = Head/Depth of water acting on weir	
For circular horizontal weir, L = Circumference L = 3.14 x D		measured from above the crest (m) L = Length of weir measured perpendicular to flow direction (m) Theta/2 = Angle of side slope measured from vertical axis (degrees)	

NOTES: Orifice Flow Notes

 Orifice Flow Notes

 • Vertical Orifice Flow calculations assume weir flow up to the centroid/center of orifice and then orifice flow above the crown/top of the orifice. Between the centroid and crown of the orifice is a flow transition stage from weir to orifice flow and is calculated based on a linear interpolation between the known weir flow at the centroid of the orifice flow above three-quarters of the orifices diameter (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and then orifice flow above three-quarters of the orifices diameter (0.75xD). Between (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and the norifice flow above three-quarters of the orifices diameter (0.75xD). Between (0.25xD) and (0.75xD) exists a flow transition stage which is calculated based on a linear interpolation between the known weir flow at (0.25xD) and the known orifice flow at (0.75xD).

 Weir Flow Notes

 • Orifice control is only applicable if the weir opening is submerged and not exposed to atmospheric pressure for all ranges of water elevations.

 • For all Weir Types, orifice control occurs when the water surface elevation is equal to or greater than the crown/top of the opening.

\\Wmi-server\wmi-server\Data\Projects\2009\09-062\Spreadsheets\SWM[130106 Detailed S-S-D Table .xls]S-S-D Table

	Orifice 1	Orifice 2	Orifice 3	Weir 1	Weir 2	Weir 3]	Elevation	Surface Area	Storage Volume
				Rectangular	Rectangular	Trapezoidal	= Weir Type	(m)	(m²)	(m³)
Orifice Type =	Vertical	Horizontal	Horizontal	Sharp-Crested	Sharp-Crested	Broad-Crested		185.100	1120	0.0
Orifice Invert Elev., m =	185.100	185.600		186.600			= Weir Crest Elev., m	185.70	1645	829.5
Incremental Depth, m =	0.100	0.100	0.100	0.100	0.100	0.100	= Incremental Depth, m	186.60	2175	2548.5
Water Elev. @ Inflow, m =	185.100	185.100		187.000			= Weir Openings Crown Elev., m (if appl.)	186.90	2365	3229.5
Orifice Diameter, m =	0.075	0.375		8.00			= Weir Length, m			
Centroid of Orifice, m =	185.138	185.600		1.80	1.80	1.65	= Weir Coefficient			
Orifice Area, m ² =	0.0044	0.1104	0.0000				= Side Slope (H:1)			
Orifice Coefficient =	0.63	0.63		0	0	0	= Theta/2, Degrees			
Weir Coefficient =	1.80	1.80		186.800			= Centroid of Orifice, m (if appl.)			
				3.20			= Orifice Area, m ² (if appl.)			
							= Orifice Coefficient (if appl.)			

Description	Elevation	Orifice 1	Orifice 2	Orifice 3	Weir 1	Weir 2	Weir 3	Total	Total	Notes
		Flow	Flow	Flow	Flow	Flow	Flow	Flow	Storage Volume	
	(m)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m ³)	
NWL	185.100	0.000		0.000		0.000	0.000	0.000	0	
	185.200	0.003		0.000		0.000	0.000	0.003	116	
	185.300	0.005		0.000		0.000	0.000	0.005	228	
	185.400	0.006		0.000		0.000	0.000	0.006	360	
	185.500	0.007		0.000		0.000	0.000	0.007	501	
	185.600	0.008	0.000	0.000		0.000	0.000	0.008	652	Extended Detention (Q=X.XXXm3/s, V=671m3 at 185.60m)
	185.700	0.009	0.056	0.000		0.000	0.000	0.066	813	2-year storm (Q=0.382m3/s, V=888m3 at 185.74m)
	185.800	0.010	0.113	0.000		0.000	0.000	0.123	980	
	185.900	0.011	0.169	0.000		0.000	0.000	0.180	1152	5-year storm (Q=0.577m3/s, V=1183m3 at 185.91m)
	186.000	0.011	0.195	0.000		0.000	0.000	0.206	1330	
	186.100	0.012	0.218	0.000		0.000	0.000	0.230	1514	
	186.200	0.013	0.239	0.000		0.000	0.000	0.251	1704	25-year storm (Q=0.953m3/s, V=1708m3 at 186.19m)
	186.300	0.013	0.258	0.000		0.000	0.000	0.271	1900	
	186.400	0.014	0.276	0.000		0.000	0.000	0.290	2102	
	186.500	0.014	0.292	0.000		0.000	0.000	0.307	2311	100-year storm (Q=1.310m3/s, V=2258m3 at 186.47m)
Freeboard	186.600	0.015	0.308	0.000	0.000	0.000	0.000	0.323	2527	
	186.700	0.015	0.323	0.000	0.455	0.000	0.000	0.794	2747	Regional storm (Q=0.874m3/s, V=2701m3 at 186.67m)
	186.800	0.016	0.338	0.000	1.288	0.000	0.000	1.641	2973	
Top of Pond	186.900	0.016	0.351	0.000	2.366	0.000	0.000	2.734	3206	
	187.000	0.017	0.365	0.000	0.000	0.000	0.000	0.382	3230	
	187.100	0.017	0.377	0.000	0.000	0.000	0.000	0.395	3230	
	187.200	0.018	0.390	0.000	0.000	0.000	0.000	0.408	3230	



	Date: 07-Jan-13		Project No.: 09-062						
	Project: 221 Fox St. FSR			Prepared By: JR					
		~~~	Elements Requirin	g Input Information					
Catchment I.D.'s		Drainage Area (ha)	Imperviousness (%)						
101		11.05	35	Total Drainage Area (ha) =	11.05				
				Total Imperviousness (%) =	35				
NOTE:	For catchment areas consisting c corresponding Water Quality Sto been extrapolated from the value	rage Volume Requirer	ment based on Table	35% and greater than 85%, the a.2 of the 2003 MOE SWMP mar	uual has				
SWM Facility Charac	cteristics (based on 2003 MOE G	uidelines, Table 3.2)	:						
	ection Level = Enhance WMP Type = Wet Por	d (Options are In		Basic) ybrid, Wet Pond or Dry Pond <b>BUT</b> a <b>Basic</b> Level of Protection)	the Dry Pond				

### 2003 MOE Table 3.2 Water Quality Storage Requirements based on Receiving Waters:

Total Storage Volume	= =	140 m ³ /ha <b>1547 m</b> ³
Permanent Pool Volume	= =	100 $m^3/\!ha$ (for wet facilities only, i.e. Wetland, Hybrid <u>OR</u> Wet Pond) 1105 $m^3$
Extended Detention Volume	= = <u>OR</u> =	<ul> <li>40 m³/ha (Water Quality Control Volume (40m³/ha), MOE Guidelines)</li> <li>442 m³</li> <li>671 m³ (Erosion Control Volume (25mm 4-hr Chicago Storm runoff volume), MOE Guidelines)</li> </ul>
Extended Detention Volume	=	671 m ³ (greater of the Water Quality & Erosion Control Volume)

NOTE: - The Extended Detention Volume is to be the greater of the Water Quality Control Volume and the Erosion Control Volume.

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#### STAGE-STORAGE CALCULATIONS SWM FACILITY DESIGN SPREADSHEET

Date: 07-Jan-13		Project No.: 09-062	
Project: 221 Fox St. FSR	Prepared By: JR		
	<<<	Elements Requiring Input Information	
Required Permanent Pool Volume Provided Permanent Pool Volume	= =	1105.0 m ³ 1111.3 m ³	
Bottom Elevation, Base Normal Water Level Elevation, NWL Top Elevation, Top	= = =	183.35m185.10m (for dry facilities, NWL is assumed at Base)186.90m	

#### Stage-Storage Information:

	Elevation (m)	Stage (m)	Surface Area 1 (m²)	Surface Area 2 (m²)	Total Surface Area (m²)	Avg. Surface Area (m ² )	Incremental Storage Volume (m ³ )	Total Storage Volume (m³)	Total Storage Volume Above NWL (m ³ )
Base	183.35	0.00	150.0		150.0	-	-	0.0	0.0
NWL	185.10	1.75	1120.0		1120.0	635.0	1111.3	1111.3	0.0
	185.70	2.35	1645.0		1645.0	1382.5	829.5	1940.7	829.5
Freeboard	186.60	3.25	2175.0		2175.0	1910.0	1719.0	3659.8	2548.5
Тор	186.90	3.55	2365.0		2365.0	2270.0	681.0	4340.8	3229.5

Description

Determining the <u>Water Surface Elevation</u> of a <u>known Storage Volume</u>:

		Total Storage Incl. P.P.	Active Storage Only
Extended	Storage Volume =		671
Detention	W.S. Elevation =		185.60
0	Storage Volume =		888
2-year	W.S. Elevation =		185.74
<b>F</b>	Storage Volume =		1183
5-year	W.S. Elevation =		185.91
10	Storage Volume =		
10-year	W.S. Elevation =		
	Storage Volume =		1708
25-year	W.S. Elevation =		186.19
=0	Storage Volume =		
50-year	W S Elevation =		
	Storage Volume =		2258
100-year	W.S. Elevation =		186.46
	Storage Volume =		2701
Regional	W.S. Elevation =		186.67

Determining the Storage Volume at a known Water Surface Elevation:

	Total Storage	Active Storage
	Incl. P.P.	Only
W.S. Elevation =		
Storage Volume =		

 $\label{eq:limit} we have the limit of the$ 

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# EXTENDED DETENTION VOLUME DRAWDOWN TIME & PEAK FLOW CALCULATIONS SWM FACILITY DESIGN SPREADSHEET

**Elements Requiring Input Information** 

Date: 07-Jan-13

Project No.: 09-062

Project: 221 Fox St. FSR

<<<

Prepared By: JR

Active Storage Stage-Area Relationship (from Table above):

	Elevation (m)	Stage (m)	Total Surface Area (m ² )
NWL	185.10	0.00	1120.0
	185.70	0.60	1645.0
	186.60	1.50	2175.0
Тор	186.90	1.80	2365.0

Extended Detention Drawdown Time:

t	=	0.66C ₂ h ^{1.5} +2C	₃ h ^{0.5} /2.75Ao	(MOE Equation 4.11)
where, t C ₂ C ₃ h _{CL} Extended Detention Elev Orifice Invert Elev A ₀	= = = = =	intercept from maximum hea extended dete control orifice	om area-depth I area-depth line Id (extended de	tention volume) acting on centroid of orifice (m) face elevation (m) (m)
$\begin{array}{c} \mbox{Orifice Coefficient, C} \\ \mbox{Orifice Plate Diameter, } D_{O} \\ \mbox{A}_{O} \\ \mbox{Extended Detention Elev} \\ \mbox{Orifice Invert Elev} \\ \mbox{h}_{CL} \end{array}$	= = = =	0.63 75 0.00442 185.60 185 0.563		.63 for orifice plate design) n recommended orifice size is a <b>75mm</b> diameter)
C ₂ C ₃	= = =	875.00 1120.00 158335	<<< <<< sec	within each of these two (2) formulas the arrays must be changed to match the range of values listed in the table above (i.e. Stage & Total Surface Area columns)
t	=	44.0	hr	

NOTE: The recommended drawdown time is 24hr but if an orifice size smaller than the required minimum (75mm dia.) is necessary to achieve the 24hr drawdown time than a minimum 12hr drawdown time is considered to be acceptable).

Quality Storm Peak Release Rate from Facility:

	$Q_P$	=	$CA_O(2gh_{CL})^{0.5}$	(Orifice Flow Equation)
where,	g h _{CL}	= =		lue to gravity (m/s ² ) ad (extended detention volume) acting on centroid of orifice (m)
	g	=	9.81	m/s ²
	Q _P	=	0.0092	m³/s

 $\label{eq:limit} we have the limit of the$ 



Hydrologic Modelling (SWMHYMO)

Appendix C

Metric units 2 *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013 : [JR] *# Modeller *# Company : WMI & Associates Ltd. *# License # : 2880720 *응 *% PRE-DEVELOPMENT CONDITION *2 *% 2-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1] START *% ["2SCS24.stm"] <--storm filename, one per line for NSTORM time -----READ STORM STORM_FILENAME=["STORM.001"] *8-----* PRE-DEVELOPMENT (EXISTING) CALIB NASHYD ID=[1], NHYD=["PRE"], DT=[1]min, AREA=[29.3](ha), DWF=[0](cms), CN/C=[51], IA=[9.3](mm), N=[3], TP=[0.803]hrs, RAINFALL=[ , , , ] (mm/hr), END=-1 *8_____ -----*% 5-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA START T2ERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2] *8 ["5SCS24.stm"] <--storm filename *8----------! *% 25-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] * % ["25SCS24.stm"] <--storm filename *% 100-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[6] *8 ["100SCS24.stm"] <--storm filename *% TIMMINS REGIONAL STORM (12-HR) START TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[7] *음 ["12REGTIM.089"] <---storm filename *8-----------FINISH

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Input					SWMHYI						****	***	****	****	*****	
	files	ame: C	:\09-	-062	SWMHYI	10\PR	E\S	CS\E	RE.	dat						*
Summer	filen 1. filen	ame: C	: \09	-062	SWMHYI	10\PR	E/S	CS/E	RE.	out						*
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†#	Project Name	: [221	FOX STR	EET	SUBDIVISION]	Project	Number:	109-0621
'#	Date	; 01-04	4-2013		-			

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*# Modeller ; [JR] *# Company : WMI & Associates Ltd. *# License # : 2880720 -----START ! Project dir.: C:\09-062\SWMHYMO\PRE\SCS\ Rainfall dir.: C:\09-062\SWMHYMO\PRE\SCS\ T2ERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 0.01NSTORM= 1 # 1=2SCS24.stm 001:0002------------| READ STORM | Filename: 2-Year SCS Type-II Storm Distribution (2 Ptotal= 46.70 mm] Comments: 2-Year SCS Type-II Storm Distribution (2 -----TIME RAIN TIME RAIN | TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr | hrs mm/hr i hrs mm/hr .20 .467 6.20 .934 1 12.20 9.340 18.20 .701 .467 . 40 6.40 .934 | 12.40 5.838 18.40 .700 .60 .467 6.60 .934 | 12.60 4.203 18.60 .934 .80 .467 6.80 .934 / 12.80 3.970 18,80 .701 1.00 .467 7.00 .934 | 13.00 2.802 .701 19.00 1.20 .467 7.20 .934 i 13.20 2,335 | 19.20 .934 1.40 .467 7.40 .934 1 13.40 2.335 | 19.40 .701 1.60 .467 7.60 .934 13.60 2.335 19.60 .934 1.80 .467 7.80 .934 13.80 2.335 1 19.80 .701 2.00 .467 8.00 .934 14.00 2.335 / 20.00 .934 2.20 .467 8.20 1.401 14.20 1.401 20.20 .701 2.40 .467 8.40 1.401 14.40 1.401 20.40 .701 2.60 .467 8.60 1.401 | 14.60 1.401 20.60 .467 2.80 .467 8.80 1.401 1.401 14.80 20.80 .701 3.00 .467 15.00 9.00 1.401 | 1.401 | 21.00 .700 3.20 .467 9.20 1.401 15.20 1.167 21.20 .467 3.40 .467 9.40 1.401 15.40 1.167 / 21.40 .701 3.60 .467 9.60 1.401 15.60 1.167 / 21.60 .467 3,80 .467 9.80 1.401 15.80 1.167 | 21.80 .701 .467 i 4.00 10.00 1.401 16.00 1.167 22.00 .467 4.20 .934 10,20 2.568 16.20 1.168 | 22.20 .467 4.40 .934 10.40 2.569 16.40 1.167 22.40 . 701 4.60 .934 10.60 2.568 1 16.60 1.167 22.60 .467 4.80 .934 2.569 10.80 16.80 1.167 22,80 .700 5.00 .934 11.00 2.568 17.00 .700 | 23.00 .467 5.20 934 11.20 3.503 17.20 .701 23.20 .467 5.40 .934 11.40 5.137 17.40 .934 23.40 .467 5.60 .934 11.60 12.375 .701 i 17.60 23.60 .701

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	TIME RAIN ( TIME RAIN   TIME RAIN   TIME RAIN
001:0003	hrs mm/hr   hrs mm/hr   hrs mm/hr   hrs mm/hr
* PRE-DEVELOPMENT (EXISTING)	.20 .606 6.20 1.212 12.20 12.120 18.20 .909
	.40 .606 6.40 1.212 12.40 7.575 18.40 .909
CALIB NASHYD / Area (ha)= 29.30 Curve Number (CN)=51.00	-60 $-606$ $-6.00$ $1.212$ $+12.40$ $-5.54$ $+18.60$ $-5.25$
01:PRE $DT = 1.00$   Ia (mm) = 9.300 # of Linear Res. (N) = 3.00	.80 .606   6.80 1.212   12.80 5.151   18.80 .909
U.H. Tp(hrs)= .803	1.00 .606   7.00 1.212   13.00 3.636   19.00 .909
	1.20 .606   7.20 $1.212$   $13.20$ $3.030$   $19.20$ $1.212$
Unit Hyd Qpeak (cms)= 1.394	1.40 .606   7.40 1.212   13.40 3.030   19.40 .909
	1.60 .606   7.60 1.212   13.60 3.030   19.60 1.212
PEAK FLOW $(cms) = .121$ (1)	1.80 .606 7.80 1.212 13.80 3.030 19.80 .909
TIME TO PEAK $(hrs) = 12.867$	2.00 .606 8.00 1.212 14.00 3.030 20.00 1.212
RUNOFF VOLUME $(mm) = 4.970$	
TOTAL RAINFALL (mm) = 46.701	
RUNOFF COEFFICIENT = .106	2.60 .606 ! 8.60 1.818 ! <b>14</b> .60 1.818   20.60 .606
	2.80 .606   8.80 1.818   14.80 1.818   20.80 .909
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	3.00 .606 ! 9.00 1.818 ! 15.00 1.818   21.00 .909
	<b>3.20</b> .606 <b>j 9.20 1.818 j 15.20 1.515 j 21.20</b> .606
	3.40 .606   9.40 1.818   15.40 1.515   21.40 .909
001:0004	3.60 .606 9.60 1.818 1 15.60 1.515 21.60 .606
** END OF RUN : 1	3.80 .606 9.80 1.818 15.80 1.515 21.80 .909
****	
	4.20 1.212   10.20 3.333   16.20 1.515   22.20 .606
	4.40 1.212   10.40 3.333   16.40 1.515   22.40 .909
	$4.60  1.212 \mid 10.60  3.333 \mid 16.60  1.515 \mid 22.60  .606$
	4.80 1.212   10.80 3.333   16.80 1.515   22.80 .909
	5.00 1.212   11.00 3.333   17.00 .909   23.00 .606
	5.20 1.212 / 11.20 4.545 / 17.20 .909 / 23.20 .606
	5.40 1.212   11.40 6.666   17.40 1.212   23.40 .606
START   Project dir.: C:\09-062\SWMHYMO\PRE\SCS\	5.60 1.212   11.60 16.059   17.60 .909   23.60 .909
	5.80 1.212   11.80 33.330   17.80 1.212   23.80 .606
Rainfall dir.: C:\09-062\SWMHYMO\PRE\SCS\	
	6.00 1.212   12.00 68.175   18.00 .909   24.00 .606
TZERO = .00 hrs on 0	
METOUT= 2 (output = METRIC)	002:0003
NRUN = 002	* PRE-DEVELOPMENT (EXISTING)
NSTORM= 1	
# 1=5SCS24.stm	CALIB NASHYD   Area (ha)= 29.30 Curve Number (CN)=51.00
	01:PRE DT= 1.00   Ia (mm)= 9.300 # of Linear Res.(N)= 3.00
002:0002	U.H. Tp(hrs) = .803
*#*************************************	
*# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062]	Unit Hyd Opeak (cms)= 1.394
# Date : 01-04-2013	arre what Sheary (cura) = 11024
# Modeller : [JR]	
	PEAK FLOW $(cms) = .226$ (1)
# Company : WMI & Associates Ltd.	TIME TO PEAK $(hrs) = 12.833$
# License # : 2880720	RUNOFF VOLUME (mm) = 8.911
#**************************************	TOTAL RAINFALL (mm) = 60.601
	RUNOFF COEFFICIENT = .147
002:0002	
	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
READ STORM   Filename: 5-Year SCS Type-II Storm Distribution (2	··· · ····
Ptotal= 60.60 mm! Comments: 5-Year SCS Type-II Storm Distribution (2	
	002:0004
	002:0004
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#### C:\09-062\SWMHYMO\PRE\SCS\PRE.out5 C:\09-062\SWMHYMO\PRE\SCS\PRE.out6 3.40 .814 | 9.40 2.442 | 15.40 2.035 | 21.40 1.221 002:0002------3.60 .814 9.60 2.442 | 15.60 2.035 21.60 .814 ** END OF RUN : 3 3 80 .814 | 9.80 2.442 | 15.80 2.035 21,80 1.221 4.00 .814 | 10.00 2,442 16.00 2.035 22.00 .814 4.20 1.628 10.20 4.477 16.20 2.035 22.20 .814 4.40 1.628 | 10.40 4.477 | 16.40 2.035 i 22.40 1.221 4.60 1.628 4.477 10.60 16.60 2.035 22.60 .814 4.80 1.628 / 10.80 4.477 1 16,80 2.035 22.80 1.221 5.00 1.628 | 11.00 4.477 17,00 1.221 | 23.00 .814 5.20 1,628 11.20 6.105 17.20 1.221 23.20 .814 1.628 | 11.40 5.40 8.954 | 17.40 1.628 | 23.40 .814 ! START | Project dir.: C:\09-062\SWMHYMO\PRE\SCS\ 1.628 | 11.60 21.571 | 17.60 5.60 1.221 | 23.60 1.221 5.80 1.628 | 11.80 44.770 | 17.80 1.628 | 23.80 .814 ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\SCS\ 6.00 1.628 | 12.00 91.575 | 18.00 1.221 | 24.00 .814 TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) 004:0003------NRUN = 004* PRE-DEVELOPMENT (EXISTING) NSTORM= 1 # 1=25SCS24.stm L CALTE NASHYD (ha) = 29.30 Curve Number (CN) = 51.00 Area ! 01:PRE DT= 1.00 | Ia (mm)= 9.300 # of Linear Res.(N)= 3.00 004:0002----------- U.H. Tp(hrs)= .803 *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] Unit Hyd Qpeak (cms)= 1.394 *# Date : 01-04-2013 *# Modeller : [JR] PEAK FLOW (cms) = .429 (i) *# Company : WMI & Associates Ltd. TIME TO PEAK (hrs) = 12.800*# License # : 2880720 RUNOFF VOLUME (mm) = 16.443 TOTAL RAINFALL (mm) = 81,400 RUNOFF COEFFICIENT = .202 -----(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. READ STORM | Filename: 25-Year SCS Type-II Storm Distribution ( | Ptotal= 81.40 mm | Comments: 25-Year SCS Type-II Storm Distribution ( ------004:0004-----TIME RAIN | TIME RAIN | TIME RAIN TIME RAIN _____ hrs mm/hr | hrs mm/hr hrs mm/hr | hrs mm/br 004:0002------.20 .814 6.20 1.628 | 12.20 16.280 | 18.20 1,221 _____ .40 .814 6.40 1.628 | 12.40 10.175 | 18.40 1.221 004:0002-----.60 .814 / 6,60 1.628 | 12.60 7.326 18,60 1.628 ** END OF RUN : 5 . 80 .814 | 6.80 1.628 | 12.80 6.919 | 18.80 1,221 1.00 .814 | 7.00 1.628 13.00 4.884 19.00 1,221 1.20 .814 1 7.20 1.628 1 13.20 4.070 19.20 1.628 1.40 .814 7.40 1.628 / 13.404.070 19.40 1.221 1.60 .814 / 7.60 1.628 / 13,60 4.070 19.60 1.628 1.80 .814 7.80 1.628 13.80 4.070 19.80 1,221 2.00 .814 8.00 1.628 14.00 4.070 i 20.00 1.628 2.20 .814 | 8.20 2.442 | 14.20 2,442 20.20 1.221 ------2,40.814 j 8.40 2.442 14.40 2,442 20.40 1.221 | START | Project dir.: C:\09-062\SWMHYMO\PRE\SCS\ 2.60 .814 | 8.60 2.442 | 14.60 2,442 20.60 .814 2.80 .814 | 8.80 2.442 | 14.80 2.442 20.80 1.221 ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\SCS\ 3.00 .814 9.00 2.442 | 15.00 2.442 21.00 1.221 3.20 .814 9.20 2.442 15.20 2.035 1 21.20 .814 TZERO = .00 hrs on n 01/02/2013 11:27:26 AM 5/901/02/2013 11:27:26 AM 6/9

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#### C:\09-062\SWMHYMO\PRE\SCS\PRE.out7 C:\09-062\SWMHYMO\PRE\SCS\PRE.out8 METOUT= 2 (output = METRIC) 006:0003------NRUN = 006 * PRE-DEVELOPMENT (EXISTING) NSTORM= 1 _____ # 1=100SCS24.stm CALIB NASHYD Area (ha) = 29.30 Curve Number (CN)=51.00 _____ 01:PRE DT= 1.00 | 1a (mm)≈ 9.300 # of Linear Res.(N)= 3.00 006:0002----------- U.H. Tp(hrs)= .803 *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] Unit Hyd Qpeak (cms)= 1.394 *# Date : 01-04-2013 *# Modeller : [JR] PEAK FLOW .634 (i) (cms) =*# Company : WMI & Associates Ltd. *# License # : 2880720 TIME TO PEAK (hrs)= 12,800 RUNOFF VOLUME 23.970 (mm) = *#*********** TOTAL RAINFALL (mm.) = 98.701 RUNOFF COEFFICIENT = .243 006:0002-----(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. | READ STORM 1 Filename: 100-Year SCS Type-II Storm Distribution | Ptotal= 98.70 mm! Comments: 100-Year SCS Type-II Storm Distribution ------006:0004-----TIME RAIN TIME BAIN ! TIME BAIN I TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr hrs mm/hr 006:0002-----.20 .987 6.20 1.974 12.20 19.740 | 18.20 1.481.40 .987 6.40 1.974 12.40 12.338 / 18.40 1,480 .60 .987 I 1.974 6.60 12.60 8,883 1 18.60 1.974 .80 .987 1 6.80 1.974 12.80 8.390 1 18.80 1.481 006:0002-----1.00 .987 | 7.00 1,974 13.00 5.922 19.00 1.481 ** END OF RUN : 6 1.20 .987 1.974 7.20 13.20 4.935 ! 19.20 1.974 **** 1.40 .987 7.40 1.974 13.40 4.935 ( 19.40 1.481 987 1.60 7.60 1.974 13.60 4.935 19,60 1.974 1.80 .987 | 7.80 1,974 | 13.80 4.935 19.80 1.481 2.00 .987 8.00 1,974 14.00 4.935 20.00 1.974 2.20 .987 | 8.20 2,961 14.20 2.961 20.20 1.481 2.40 .987 | 8.40 2,961 | 14.40 2,961 20.40 1 481 2.60 .987 1 8.60 2.961 14.60 2.961 20.60 .987 2.80 .987 | 8.80 2.961 14.80 2.961 20.80 1.481 I START | Project dir.: C:\09-062\SWMHYMO\PRE\SCS\ .987 3.00 9.00 2.961 15.00 2.961 21.00 1.480 3.20 .987 9,20 ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\SCS\ 2.961 15.20 2.467 1 21.20 987 .987 i 3.40 9.40 2.961 15.40 2.467 21.40 1.481 3.60 .987 | 9.60 2.961 15.60 2.467 21.60 .987 TZERO = .00 hrs on n METOUT= 2 (output = METRIC) 3.80 .987 | 9.80 2.961 15.80 2.467 21.80 1.481 4.00 .987 | 10.00 2.961 16.00 2.467 NRUN = 00722.00 .987 4.20 1.974 10.20 5.428 16.20 2.468 22.20 .987 NSTORM= 1 4.40 1.974 | 10.40 5.429 16.40 2,467 22.40 # 1=12REGT1M.089 1.481 22.60 4.60 1.974 | 10.60 5.428 16.60 2.467 .987 -----1.974 4.80 10.80 5.429 [ 16.80 2.467 007:0002------22.80 1.480 5.00 1.974 | 11.00 5.428 17.00 1.480 23.00 .987 5.20 1.974 1 11.20 7.403 17.20 1.481 23.20 .987 *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] 5.40 1.974 | 11.40 10.857 17.40 1.974 .987 23.40 *# Date : 01-04-2013 5.60 1.974 | 11.60 26.155 17.60 1,481 23.60 1.481 *# Modeller : [JR] 5.80 1.974 11.80 54.285 17.80 1.974 .987 23.80 *# Company : WMI & Associates Ltd. 6.00 1.974 | 12.00 111.038 | 18.00 *# License # : 2880720 1.481 | 24.00 .987 ****** -----01/02/2013 11:27:26 AM 7/9 01/02/2013 11:27:26 AM 8/9

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READ STORM   Ptotal= 193.00 mm	Conner	ame: TIMM) hts: TIMM)	INS REGIO	NAL STO NAL STO	RM (12-ho RM (12-ho	ur) ur)	
TIME hrs 1.00 2.00 3.00	RAIN   mm/hr   15.000   20.000   10.000	hrs n 4.00 3 5.00 3 6.00 20	0.000	8.00 9.00	RAIN   mm/hr   43.000   20.000   23.000	$10.00 \\ 11.00$	RAIN mm/hr 13.000 13.000 8.000
007:0003 * PRE-DEVELOPMENT (F	XISTING)						
CALIB NASHYD   01:PRE DT= 1.00	Area	(mm) =	29.30 9.300 .803		Number Linear Re		
Unit Hyd Qpeak	(cms)=	1.394					
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (1) PEAK FLOW D	(mm) = 1 (mm) = 1 ENT =	.93.000 .409		ANY.			
007:0004							
007:0002							
007:0002							
007:0002							
007:0002 FINISH			·				
**************************************	RS / NOTES	*****	******	******	*****	*****	*****
Simulation ended	on 2013-01	-04 a	t 19:34:	10			
			: <b></b>			<b></b>	

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2 Metric units *#***********************************	********
*# Date : 0: *# Modeller : [d *# Company : W *# License # : 2	221 FOX STREET SUBDIVISION] Project Number: [09-062] 1-04-2013 TR] 4I & Associates Ltd. 2880720
*8	CONDITION (4-HOUR CHICAGO STORM)
*% 25mm CHICAGO STO START *%	RM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1] ["25mm4hr.stm"] <storm filename,<="" td=""></storm>
READ STORM	STORM_FILENAME=["STORM.001"]
	ID=[1], NHYD=[*PRE*], DT=[1]min, AREA=[29.3](ha), DWF=[0](cms), CN/C=[51], IA=[9.3](mm), N=[3], TP=[0.803]hrs, RAINFALL=[, , , , , ](mm/hr), END=-1
*% 2-YEAR CHICAGO ST START	FORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
*%	["2CHI4.stm"] <storm filename<="" td=""></storm>
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*% 25-YEAR CHICAGO : START *%	STORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) T2ERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] ["25CH14.stm"] <storm filename<="" td=""></storm>
*% 100-YEAR CHICAGO START *%	STORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) TZERO=(0.0), METOUT=[2], NSTORM=[1], NRUN=[5] ["100CH14.stm"] <storm filename<="" td=""></storm>
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*# Modeller : [JR] *# Company : WMI & Associates Ltd. *# License # : 2880720 -----START | Project dir.: C:\09-062\SWMHYMO\PRE\CHI\ ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\CHI\ TZERO = .00 hrs on Û METOUT= 2 (output = METRIC) NRUN = 001 NSTORM= 1 # 1=25mm4hr.stm 001:0002----------Filename: 25mm Chicago Storm Distribution (4-hour) READ STORM | Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr hrs mm/hr hrs mm/hr | hrs mm/hr .17 1.740 1.17 10.720 2.17 3.750 3.17 2.040 .33 1.970 1.33 62.850 2.33 3.250 3.33 1.910 .50 2.290 1.50 13.740 2.50 2.890 3,50 1.790 .67 2.740 1,67 7.730 2.67 2.610 | 3.67 1.700 .83 3,500 1.83 5.590 | 2.83 2.380 | 3.83 1.610 1.00 5.020 2.00 4.460 3.00 2.190 4.00 1.530 001:0003------* PRE-DEVELOPMENT (EXISTING) _____ | CALIB NASHYD Area (ha) = 29.30 Curve Number (CN)=51.00 01:PRE DT= 1.00 | Ia (mm)= 9.300 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .803 Unit Hyd Qpeak (cms)= 1.394 PEAK FLOW .028 (i) (cms) =TIME TO PEAK (hrs) =2.717 RUNOFF VOLUME (mm) == .949 TOTAL RAINFALL (mm) = 25.000 RUNOFF COEFFICIENT = .038 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 001:0004-----** END OF RUN : 1 ****** 01/02/2013 11:27:26 AM 2/8

C:\09-062\SWMHYMO\PRE\CHI\PRE.out3 C:\09-062\SWMHYMO\PRE\CHI\PRE.out4 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. ____ ------002:0004-----START Project dir.: C:\09-062\SWMHYMO\PRE\CHI\ 002:0002----------- Rainfall dir.: C:\09-062\SWMHYMO\PRE\CHI\ ** END OF RUN : 2 TZERO = .00 hrs on 0 ****** METOUT= 2 (output = METRIC) NRUN = 0.02NSTORM= 1 # 1=2CHI4.stm ----START | Project dir.: C:\09-062\SWMHYMO\PRE\CHI\ *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013 ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\CHI\ *# Modeller : [JR] *# Company : WMI & Associates Ltd. *# License # : 2880720 TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 003 _____ NSTORM= 1 002:0002-----# 1=5CHI4.stm -----| READ STORM | Filename: 2-Year Chicago Storm Distribution (4-hou 003:0002------| Ptotal= 32.77 mm! Comments: 2-Year Chicago Storm Distribution (4-hou ------*# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] TIME RAIN | TIME RAIN | TIME RAIN | TIME RATN *# Date : 01-04-2013 *# Modeller : [JR]
*# Company : WMI & Associates Ltd.
*# License # : 2880720 hrs mm/hr | hrs mm/hr [ hrs mm/hr [ hrs mm/hr .17 2.285 | 1.17 14.057 / 2.17 4.915 3.17 2.674 .33 2.585 1.33 82.380 / 3.33 2.33 4.266 2.501 2.995 | 1.50 18.005 | .50 2.50 3.787 | 3.50 2.353 .67 3.598 | 1.67 10.127 | 2.67 3.416 | 3.67 2.223 . 83 4.586 1.83 7.331 2.83 3.120 3.83 2,109 1.00 6.583 2.00 5.849 3.00 2.877 -----4.00 2 007 | READ STORM | Filename: 5-Year Chicago Storm Distribution (4-hou | Ptotal= 43.79 mm | Comments: 5-Year Chicago Storm Distribution (4-hou 002:0003-----------* PRE-DEVELOPMENT (EXISTING) TIME RAIN | TIME TIME RAIN | RAIN | TIME RAIN ----hrs mm/hr hrs mm/hr | hrs mm/hr | hrs mm/hr | CALIB NASHYD | Area (ha) = 29.30 Curve Number (CN)=51.00 .17 3.077 1.17 18.812 | 2.17 6.603 | 3.17 3.599 | 01:PRE DT= 1.00 | Ia (mm)= 9.300 # of Linear Res. (N)= 3.00 .33 3.479 | 1.33 109.412 | 2.33 5.734 1 3.33 3.367 ----- U.H. Tp(hrs)= .803 .50 4.030 | 1.50 24.075 | 2.50 5.091 / 3.50 3.168 1.67 13.572 2.67 .67 4.838 4.594 | 3.67 2.993 Unit Hyd Opeak (cms)= 1.394 .83 6.162 | 1.83 9.837 | 2.83 4.197 | 3.83 2.840 1.00 8.836 | 2.00 7.853 | 3.00 3.872 | 4.00 2.703 PEAK FLOW (cms)= .064 (i) TIME TO PEAK (hrs)= 2.567 RUNOFF VOLUME (mm) = 2 059 003:0003-----TOTAL RAINFALL (mm)= 32.772 * PRE-DEVELOPMENT (EXISTING) RUNOFF COEFFICIENT = .063 -----01/02/2013 11:27:26 AM 3/8 01/02/2013 11:27:26 AM 4/8

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#### C:\09-062\SWMHYMO\PRE\CHI\PRE.out5 C:\09-062\SWMHYMO\PRE\CHI\PRE.out6 CALIB NASHYD Area (ha) = 29.30 Curve Number (CN)=51.00 TIME RAIN TIME RAIN TIME RAIN TIME RAIN 01:PRE DT= 1.00 | Ia (mm) = 9.300 # of Linear Res.(N)= 3.00 brs mm/hr hrs mm/hr ! hrs mm/hr | hrs mm/hr U.H. Tp(hrs)= ,803 .17 4.238 1.17 25.827 | 2.17 9.082 3.17 4.956 .33 4.791 1.33 149.649 | 2.33 7.889 3.33 4.637 Unit Hyd Qpeak (cms)= 1.394 .50 5.548 1.50 33.039 | 7.007 2.50 3.50 4.362 .67 6.658 1 1.67 18.646 2.67 6.324 3.67 4.123 PEAK FLOW .138 (i) (cms) =.83 8.477 I 1.83 13.522 2.83 5.778 3.83 3,911 TIME TO PEAK (hrs) =2.483 1.00 12.149 2.00 10.799 | 3.00 5.330 4.00 3.724 RUNOFF VOLUME (mm) = 4.271 TOTAL RAINFALL (mm) = 43.791 ------RUNOFF COEFFICIENT = .098 004:0003-----* PRE-DEVELOPMENT (EXISTING) (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. -------(ha)= 29.30 Curve Number (CN)=51.00 CALIB NASHYD Area _____ 01:PRE DT= 1.00 | Ia (mm)= 9.300 # of Linear Res.(N)= 3.00 003:0004-----U.H. Tp(hrs)= -803 003:0002------Unit Hyd Qpeak (cms)= 1.394 _____ 003:0002-----PEAK FLOW .292 (i) (cms) =** END OF RUN : 3 TIME TO PEAK (hrs) =2.433 RUNOFF VOLUME (mm) = 8.746 (mm) = TOTAL RAINFALL 60.078 RUNOFF COEFFICIENT = .146 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. -----004:0004-----START | Project dir.: C:\09-062\SWMHYMO\PRE\CHI\ 004:0002-----Rainfall dir.: C:\09-062\SWMHYMO\PRE\CHI\ 004:0002-----TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) 004:0002-----NRUN = 004** END OF RUN : 4 NSTORM= 1 # 1=25CHI4.stm ************************* 004:0002-----*# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013 *# Modeller : [JR] *# Company : WMI & Associates Ltd. START | Project dir.: C:\09-062\SWMHYMO\PRE\CHI\ *# License # : 2880720 ----- Rainfall dir.: C:\09-062\SWMHYMO\PRE\CHI\ 004:0002-----TZERO = .00 hrs on n METOUT= 2 (output = METRIC) READ STORM Filename: 25-Year Chicago Storm Distribution (4-ho NRUN = 005Ptotal= 60.08 mm; Comments: 25-Year Chicago Storm Distribution (4-ho NSTORM= 1 ------# 1=100CHI4.stm 01/02/2013 11:27:26 AM 5/8 01/02/2013 11:27:26 AM 6/8

C:\09-062\SWMHYMO\PRE\CHI\PRE.out7 C:\09-062\SWMHYMO\PRE\CHI\PRE.out8 005:0002-----*********** WARNINGS / ERRORS / NOTES *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] -----*# Date : 01-04-2013 Simulation ended on 2013-01-04 at 19:32:56 *# Modeller : [JR] *# Company : [JR] & Associates Ltd. *# License # : 2880720 ______ *#******* 005:0002----------| READ STORM | Filename: 100-Year Chicago Storm Distribution (4-h | Ptotal= 73.84 mm | Comments: 100-Year Chicago Storm Distribution (4-h ------TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr .17 5.248 | 1.17 31.788 | 2.17 11.222 3,17 6.134 .33 5.931 1.33 182.809 2.33 9.752 3.33 5.741 .50 6.865 | 1.50 40.631 | 2.50 8.664 | 3.50 5.402 .67 8.234 | 1.67 22.982 | 2.67 7.822 | 3.67 5.106 .83 10.476 | 1.83 16.686 | 2.83 7.149 | 3.83 4.845 1.00 14.996 | 2.00 13.336 | 3.00 6.596 | 4.00 4.613 005:0003-----* PRE-DEVELOPMENT (EXISTING) ------| CALIB NASHYD | Area (ha) = 29.30 Curve Number (CN)=51.00 01:PRE DT= 1.00 | Ia (mm) = 9.300 # of Linear Res.(N) = 3.00 ----- U.H. Tp(hrs)= .803 Unit Hyd Qpeak (cms)= 1.394 PEAK FLOW .458 (i) (cms) = TIME TO PEAK (hrs)= 2.400 RUNOFF VOLUME (mm)= 13.498 TOTAL RAINFALL (mm) = 73.838 RUNOFF COEFFICIENT = .183 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 005:0004-----------005:0002-----____ 005:0002----_____ 005:0002------_____ 005:0002-------FINISH 01/02/2013 11:27:26 AM 7/8 01/02/2013 11:27:26 AM 8/8

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2 Metric units *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013 *# Modeller : [JR] *# Company : WMI & Associates Ltd. *# License # : 2880720 *2 *% POST-DEVELOPMENT CONDITION *8 *% 2-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA START T2ERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1] *응 ["2SCS24.stm"] <--storm filename, *8-----READ STORM STORM_FILENAME=["STORM.001"] * CATCHMENT 101 CALIB STANDHYD ID=[1], NHYD=["101"], DT=[1](min), AREA=[11.05](ha), XIMP=[0.195], TIMP=[0.35], DWF=[0](cms), LOSS=[2], SCS curve number CN=[54], Pervious surfaces: IAper=[6.7] (mm), SLPP=[5.0] (%), LGP=[40](m), MNP=[0.25], SCP=[0](min), Impervious surfaces: IAimp=[2.0](nm), SLPI=[2.0](%), LGI=[200](m), MNI=[0.013], SCI=[0](min), RAINFALL=[ , , , , ] (mm/hr) , END=-1 * EXTERNAL AREA #1 CALIB NASHYD ID=[2], NHYD=["EXT1"], DT=[1]min, AREA=[7.78](ha), DWF=[0](cms), CN/C=[56], IA=[7.2](mm), N=[3], TP=[0.290]hrs, RAINFALL=[, , , ] (mm/hr), END=-1 *8-----* EXTERNAL AREA #2 CALIE STANDHYD ID=[3], NHYD=["EXT2"], DT=[1](min), AREA=[6.14](ha), XIMP=[0.14], TIMP=[0.25], DWF=[0](cms), LOSS=[2], SCS curve number CN=[59], Pervious surfaces: IAper=[5](mm), SLPP=[8.0](%), LGP=[90](m), MNP=[0.25], SCP=[0](min), Impervious surfaces: IAimp=[2.0](mm), SLPI=[3.0](%), LGI=[150](m), MNI=[0.013], SCI=[0](min), RAINFALL=[ , , , , ] (mm/hr) , END=-1 -----____ SHIFT HYD IDout=[4], NHYD=["S-EXI2"], IDin=[3], TLAG=[10](min) *%-----_____ ADD HYD IDsum=[5], NHYD=["S-EXT1+2"], IDs to add=[2+3] *8____ ----------IDout=[6], NHYD=["POND OUT"], IDin=[1], ROUTE RESERVOIR RDT = [1] (min), TABLE of ( OUTFLOW-STORAGE ) values (cms) - (ha-m) [ 0.0000 , 0.0000] [ 0.0080 , 0.0652]

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[ 0.2510 , 0.1704] [ 0.3230 , 0.2527] [ 1.6410 , 0.2973] [ 2.7340 , 0.3206] [ -1 , -1 ] (max twenty pts) IDovf=[ ], NHYDovf=[ ] **-----------* EXTERNAL AREA #3 CALIB NASHYD ID=[8], NHYD=["EXT3"], DT=[1]min, AREA=[4.36](ha). DWF=[0](cms), CN/C=[57], IA=[6.9](mm), N=[3], TP=[0.553]hrs, RAINFALL=[ , , , ] (mm/hr), END=-1 *\$-----------------*% 5-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2] START ["5SCS24.stm"] <--storm filename *8------*% 25-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA IDF DATA TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[3] START ["25SCS24.stm"] <---storm filename *% 100-YEAR 24hr SCS TYPE-II STORM DISTRIBUTION ORILLIA 1DF DATA TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4] START ["100SCS24.stm"] <---storm filename

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["12REGTIM.089"] <--storm filename

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*# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013

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	Rainfa	ll dir.	: C:\09-06	2\SWMHYN	IO\POST\SC	s\	
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01:0002							
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.20	.467	6.20	.934	12.20	9.340	hrs 18.20 18.40 18.60 19.00 19.20 19.40 19.60 19.80 20.00 20.00	.701
.40	.467	6.40	.934	12.40	5.838	18.40	.700
.60	.467	6.60	.934	12.60	4.203	18.60	.934
.80	<b>.</b> 467	6.80	.934	12.80	3.970	18.80	.701
1.00	.467	7.00	.934	13.00	2.802	19.00	.701
1.20	.467	7.20	.934	13.20	2.335	19.20	.934
1.40	.467	7.40	.934	13.40	2.335	19.40	.701
1.60	.467	7.60	.934	13.60	2.335	19.60	.934
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3.20		9.20		15.00		21.00	.467
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3.60			1,401			21.60	.467
3.80			1.401			21.80	.701
4.00			1.401			22.00	.467
4.20	.934	10.20	2.568			22.20	467
4.40	.934	10.40	2.569	16.40		22.40	.701
4.40	.934 !		2.568		1.167	22.60	.467
4.60		10.80	2.569		1.167		.700
4.60 4.80						23.00	.467
4.60			2.568	17.00	.,00 1		
4.60 4.80			2.568   3.503	17.00	.701	23.20	.467
4.60 4.80			2.568   3.503   5.137	17.00 17.20 17.40	.701	23.20 23.40	
4.60 4.80			2.568   3.503   5.137   12.375	17.00 17.20 17.40 17.60	.701   .934   .701	23.20 23.40 23.60	.467 .467 .701
4.60 4.80			2.568   3.503   5.137   12.375   25.685   52.538	17.00 17.20 17.40 17.60 17.80	.700   .701   .934   .701   .934	23.20 23.40 23.60 23.80	.467 .467

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*TOTALS*

12.000

15.071

46.701

.323

.382 (iii)

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CALIB STANDHYD	Area	(ha)=	6.14		
! 03:EXT2 DT= 1.00	Total	. Imp(%)=	25.00 Dir	. Conn.(%)=	14.00
		IMPERVIOUS	PERVIOUS	(i)	
Surface Area	(ha)=	1.53	4.61		
Dep. Storage	(mm) =	2.00	5.00		
Average Slope	(%)=	3.00	8.00		
Length	(m) =	150,00	90.00		
Mannings n	-	.013	.250		
Max.eff.Inten.(	mm/hr)=	52.54	9.57		
over	(min)	3.00	22.00		
Storage Coeff.	(min) =	3.03 (	ii) 22.40	(ii)	
Unit Hyd. Tpeak	(min) =	3.00	22.00		

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Unit Hyd. peak	(cms) =	.37	.05	
				*TOTALS*
PEAK FLOW	(cms) =	.12	.08	.165 (iii)
TIME TO PEAK	(hrs)=	12.00	12.28	12.000
RUNOFF VOLUME	(mm) =	44.70	9.13	14.113
TOTAL RAINFALL	(mm) =	46.70	46.70	46.701
RUNOFF COEFFICI	ENT =	.96	, 20	.302

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 59.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

	(111)	PLAK	L POM	DOES	NOT	INCLODE	BASEFLOW	TT.	ANI.
-									
0	01:0006								

SHIFT HYD(S-EXT2 )				
IN= 3> OUT= 4				
SHIFT= 10.0 min	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID= 3:EXT2	6.14	.165	12.000	14.113
SHIFT ID= 4:S-EXT2	6.14	.165	12.150	14.113

ADD HYD	(S-EXT1+2		ID: NHYD	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
		ID1	02:EXT1	7.78	. ,	12.22	6.53	.000
		+ID2	03:EXT2	6.14	.165	12.00	14.11	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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# 001:0005------* EXTERNAL AREA #2

RUNOFF COEFFICIENT =

* CATCHMENT 101

Length

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Surface Area

Average Slope

Mannings n

PEAK FLOW

* EXTERNAL AREA #1 _____

PEAK FLOW

TIME TO PEAK

RUNOFF VOLUME

TOTAL RAINFALL

RUNOFF VOLUME

TOTAL RAINFALL

Dep. Storage (mm)=

Max.eff.Inten.(mm/hr)≈

Storage Coeff. (min)=

Unit Hyd. Tpeak (min)= Unit Hyd. peak (cms)=

TIME TO PEAK (hrs)=

RUNOFF COEFFICIENT =

over (min)

(ha)=

(%)=

(m) =

(cms)=

(mm) = (mm) =

U.H. Tp(hrs)= .290 Unit Hyd Qpeak (cms)= 1.025

(cms)=

(hrs) = 12.217

(mm) = 6.527

(mm) = 46.701

(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 

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| CALIB STANDHYD | Area (ha)= 11.05 | 01:101 DT= 1.00 | Total Imp(%)= 35.00 Dir, Conn.(%)= 19.50

3.87

2 00

2.00

200.00

.013

52.54

4.00

4.00

.28

.30

12.00

44.70

46.70

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

.96

| CALIE NASHYD | Area (ha)= 7.78 Curve Number (CN)=56.00 | 02:EXT1 DT= 1.00 | Ia (mm)= 7.200 # of Linear Res.(N)= 3.00

.090 (i)

.140

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IMPERVIOUS PERVIOUS (i)

7.18

6.70

5.00

.250

40.00

10.31

17.00

17,00

.07

.13

12,20

7.89

46.70

.17

4.07 (ii) 17.37 (ii)

001:0004-----

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#### C:\09-062\SWMHYMO\POST\SCS\POST2.out5 C:\09-062\SWMHYMO\POST\SCS\POST2.out6 ------ Rainfall dir.: C:\09-062\SWMHYMO\POST\SCS\ 001:0008-----TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) _____ | ROUTE RESERVOIR | Requested routing time step = 1.0 min. NRUN = 002IN>01:(101 ) | NSTORM= 1 OUT<06: (POND O) ------ OUTLFOW STORAGE TABLE ------# 1=5SCS24.stm OUTFLOW STORAGE -----OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) 002:0002-----.000 .0000E+00 .323 .2527E+00 *#***** .008 .6520E-01 1.641 .2973E+00 *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] .251 .1704E+00 *# Date : 01-04-2013 *# Modeller : [JR] *# Company : WMI & Associates Ltd. 2.734 .3206E+00 BOUTING RESULTS AREA OPEAK TPEAK B.V. (ha) (cms) (hrs) (mm) *# License # : 2880720 INFLOW >01: (101 ) .382 11.05 12,000 15.071 OUTFLOW<06: (POND O) 11.05 .063 12.867 15.070 002:0002------PEAK FLOW REDUCTION [Qout/Qin] (%)= 16.379 TIME SHIFT OF PEAK FLOW (min)= 52.00 READ STORM Filename: 5-Year SCS Type-II Storm Distribution (2 MAXIMUM STORAGE USED (ha.m.)=.8882E-01 | Ptotal= 60.60 mm | Comments: 5-Year SCS Type-II Storm Distribution (2 TIME RAIN | TIME RAIN TIME RAIN | TIME RAIN 001:0009----hrs mm/hr | hrs mm/hr | brs mm/br 4 hrs mm/hr * EXTERNAL AREA #3 .20 .606 6,20 1.212 12.20 12.120 | 18,20 .909 .40 .606 6.40 1.212 12.40 7.575 18.40 .909 ! CALIB NASHYD | Area (ha)= 4.36 Curve Number (CN)=57.00 ! 08:EXT3 DT= 1.00 | Ia (mm)= 6.900 # of Linear Res.(N)= 3.00 .60 .606 6.60 1.212 12.60 5.454 18.60 1,212 .80 .605 6.80 1.212 12,80 5.151 18.80 .909 ----- U.H. Tp(hrs)= .553 1.00 .606 7.00 1.212 13.00 3.636 | 19.00 909 1.20 .606 i 7.20 1.212 13.20 3.030 | 19.20 1.212 Unit Hyd Qpeak (cms)= .301 1.40 .606 7.40 1,212 13.40 3.030 19.40 .909 1.60 .606 | 7.60 1.212 13.60 3.030 19.60 1.212 PEAK FLOW (Cms)= .034 (i) 1.80 .606 | 7.80 1.212 3.030 13.80 .909 19.80 TIME TO PEAK (hrs)= 12.517 2.00 .606 8.00 1.212 14.00 3.030 | 20.00 1.212 RUNOFF VOLUME (mm) =6.845 .606 i 2 20 8.20 1.818 14.20 1.818 20.20 .909 TOTAL RAINFALL (mm) = 46.701 2.40 .606 8.40 1.818 14.40 1.818 20.40 .909 RUNOFF COEFFICIENT = .147 2,60 .606 | 8,60 1.818 ( 14.60 1.818 20.60 .606 2.80 .606 | 8.80 1.818 14.80 1.818 20 80 .909 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 3.00 .606 | 9.00 1.818 15.00 1.818 / 21.00 .909 3.20 .606 1 9.20 1.818 | 15.20 1.515 21.20 .606 3.40 .606 | 9.40 1,818 15.40 1,515 21.40 .909 001:0010-----3.60 .606 1 9.60 1.818 15,60 1.515 21.60 .606 ** END OF RUN : 1 3.80 .606 1 9.80 1.818 15.80 1.515 21.80 .909 4.00 .606 1 ***** 10.00 1.818 16.00 1,515 | 22.00 .606 4.20 1.212 | 10.20 3.333 16.20 1.515 22.20 .606 4.40 1.212 | 10.40 3.333 16.40 1.515 1 22.40 .909 4.60 1.212 | 10.60 3.333 16.60 1,515 [ 22,60 .606 4.80 1.212 / 10.80 3.333 16.80 1.515 22.80 .909 5.00 1.212 11.00 3.333 17.00 .909 23.00 .606 5.20 1.212 11.20 4.545 17.20 .909 23.20 .606 5.40 1.212 11.40 6.666 17.40 1.212 23.40 .606 START Project dir.: C:\09-062\SWMHYMO\POST\SCS\ 5.60 1.212 11.60 16.059 17.60 .909 23.60 .909 5.80 1.212 | 11.80 33.330 | 17.80 1.212 | 23.80 .606 01/02/2013 11:27:27 AM 5/21 01/02/2013 11:27:27 AM 6/21

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and the second second

6.00 1.212 | 12.00 68.175 | 18.00 .909 | 24.00 .606

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<pre>1 01:101 DT= 1.00   Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm)= 2.00 6.70 Average Slope (%)= 2.00 5.00 Length (m)= 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr)= 68.17 19.60</pre>		CALIB STANDHYD						(0.)			
Surface Area (ha) 3.87 7.18 Dep. Storage (mm) 2.00 6.70 Average Slope (%) 2.00 5.00 Length (m) 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr) 68.17 19.60 over (min) 4.00 14.00 Storage Coeff. (min) 3.67 (ii) 13.96 (ii) Unit Hyd. Tpeak (min) 4.00 14.00 Unit Hyd. Tpeak (min) 4.00 14.00 Unit Hyd. Tpeak (min) 4.00 12.15 12.017 RUNOFF VOLUME (mm) 50.60 13.25 22.093 TOTAL RAINFALL (mm) 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFIOW IF ANY.				. Imp(%)=	35.00	Dir	. Conn	. (%)=	19.50		
Average Slope (%) = 2.00 5.00 Length (m) = 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr) = 68.17 19.60 over (min) 4.00 14.00 Storage Coeff. (min) = 3.67 (ii) 13.96 (ii) Unit Hyd. Tpeak (min) = 4.00 14.00 Unit Hyd. peak (cms) = .39 .25 .577 (iii) TIME TO PEAK (hrs) = 12.00 12.15 12.017 RUNOFF VOLUME (mm) = 50.60 13.25 22.093 TOTAL RAINFALL (mm) = 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.				IMPERVIOU	S PE	RVIOUS	(i)				
Average Slope (%) = 2.00 5.00 Length (m) = 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr) = 68.17 19.60 over (min) 4.00 14.00 Storage Coeff. (min) = 3.67 (ii) 13.96 (ii) Unit Hyd. Tpeak (min) = 4.00 14.00 Unit Hyd. peak (cms) = .39 .25 .577 (iii) TIME TO FEAK (hrs) = 12.00 12.15 12.017 RUNOFF VOLUME (mm) = 58.60 13.25 22.093 TOTAL RAINFALL (mm) = 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STORAGE COEFFICIENT. (iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.		Surface Area	(ha) =			7,18					
<pre>Max.eff.Inten.(mm/hr)= 68.17 19.60</pre>		Dep. Storage	(mm) =	2.00							
<pre>Max.eff.Inten.(mm/hr)= 68.17 19.60</pre>		Average Slope	(윤)=	2.00		5.00					
<pre>Max.eff.Inten.(mm/hr)= 68.17 19.60</pre>		Length Manual	(m) =	200.00		40.00					
over (min)         4.00         14.00           Storage Coeff. (min)=         3.67 (ii)         13.96 (ii)           Unit Hyd. Tpeak (min)=         4.00         14.00           Unit Hyd. peak (cms)=         .30         .08           *TOTALS*         *TOTALS*           PEAK FLOW (cms)=         .39         .25         .577 (iii)           TIME TO FEAK (hrs)=         12.00         12.15         12.017           RUNOFF VOLUME (mm)=         58.60         13.25         22.093           TOTAL RAINFALL (mm)=         60.60         60.60         60.601           RUNOFF VOLUME (mm)=         .97         .22         .365           (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:		Mannings n	=	.013		.250					
Storage Coeff. (min)= 3.67 (ii) 13.96 (ii) Unit Hyd. Tpeak (min)= 4.00 14.00 Unit Hyd. peak (cms)= .30 .08 *TOTALS* PEAK FLOW (cms)= .39 .25 .577 (iii) TIME TO PEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (mm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. D02:0004		Max.eff.Inten.	(mm/hr)=			19,60					
Unit Hyd. Tpeak (min)= 4.00 14.00 Unit Hyd. peak (cms)= .30 .08 *TOTALS* PEAK FLOW (cms)= .39 .25 .577 (iii) TIME TO PEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (mm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECIED FOR PERVIOUS LOSSES: CN* = 54.0 I a = Dep Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. D02:0004											
Unit Hyd. Tpeak (min)= 4.00 14.00 Unit Hyd. peak (cms)= .30 .08 *TOTALS* PEAK FLOW (cms)= .39 .25 .577 (iii) TIME TO PEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (mm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 IA = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. D02:0004		Storage Coeff,	(min)=	3.67	(ii)	13.96	(ii)				
<pre>PEAK FLOW (cms)= .39 .25 .577 (iii) TIME TO PEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (mm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>		Unit Hyd. Tpea	< (min)=	4.00		14.00					
<pre>PEAK FLOW (cms)= .39 .25 .577 (iii) TIME TO PEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (mm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>		Unit Hyd. peak	(cms)=	.30		. 08					
<pre>TIME TO FEAK (hrs)= 12.00 12.15 12.017 RUNOFF VOLUME (nm)= 58.60 13.25 22.093 TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>								*TOTAL	S*		
TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 IA = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. D02:0004		PEAK FLOW	(cms) =	.39		. 25					
TOTAL RAINFALL (mm)= 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .22 .365 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 IA = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) FEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. D02:0004		TIME TO PEAK	(hrs) =	12.00		12.15					
<pre>(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>		RUNOFF VOLUME	(mm) =	58.60		13.25			-		
<pre>(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:</pre>		TOTAL KAINFALL	(mm) =	60.60		60.60					
002:0004		CN* = 5 (ii) TIME STE THAN THE	4.0 Ia = P (DT) SHOU STORAGE CC	Dep. Sto LD BE SMA EFFICIENT	rage ( LLER OR	Above) EQUAL					
CALIE NASHYD   Area (ha)= 7.78 Curve Number (CN)=56.00 02:EXT1 DT=1.00   Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 Unit Hyd Qpeak (cms)= 1.025 PEAK FLOW (cms)= .159 (1) TIME TO PEAK (hrs)= 12.217 RUNOFF VOLUME (mm)= 11.272 TOTAL RAINFALL (mm)= 60.601 RUNOFF COEFFICIENT = .186		CN* = 5 (ii) TIME STE: THAN THE (iii) PEAK FLO	4.0 Ia = P (DT) SHOU STORAGE CC W DOES NOT	Dep. Sto ILD BE SMA DEFFICIENT INCLUDE B	rage ( LLER OR ASEFLOW	Above) EQUAL IFAN	¥.				
<pre>/ 02:EXT1 DT= 1.00 / Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .290 Unit Hyd Opeak (cms)= 1.025 PEAK FLOW (cms)= .159 (i) TIME TO PEAK (hrs)= 12.217 RUNOFF VOLUME (mm)= 11.272 TOTAL RAINFALL (mm)= 60.601 RUNOFF COEFFICIENT = .186</pre>		CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO	4.0 IA = P (DT) SHOU STORAGE CO V DOES NOT	Dep. Sto ILD BE SMA DEFFICIENT INCLUDE B	rage ( LLER OR ASEFLOW	Above) EQUAL IFAN	¥.				
Unit Hyd Qpeak (cms)= 1.025 PEAK FLOW (cms)= .159 (i) TIME TO PEAK (hrs)= 12.217 RUNOFF VOLUME (mm)= 11.272 TOTAL RAINFALL (mm)= 60.601 RUNOFF COEFFICIENT = .186	E	CN* = 5. (ii) TIME STEJ THAN THE (iii) PEAK FLO 2:0004	4.0 Ia = P (DT) SHOU STORAGE CC W DOES NOT	Dep. Sto ILD BE SMA DEFFICIENT INCLUDE B	rage ( LLER OR ASEFLOW	Above) EQUAL IF AN	Y.				
Unit Hyd Qpeak (cms)= $1.025$ PEAK FLOW (cms)= $.159$ (i) TIME TO PEAK (hrs)= $12.217$ RUNOFF VOLUME (mm)= $11.272$ TOTAL RAINFALL (mm)= $60.601$ RUNOFF COEFFICIENT = $.186$	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004	4.0 Ia = P (DT) SHOU STORAGE CC # DOES NOT	(ba) =	rage ( LLER OR ASEFLOW	Above) EQUAL	Y.  ve Num	oer (	CN) = 56.0		
PEAK FLOW       (cms)=       .159 (1)         TIME TO PEAK       (hrs)=       12.217         RUNOFF VOLUME       (mm)=       11.272         TOTAL RAINFALL       (mm)=       60.601         RUNOFF COEFFICIENT       =       .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004	4.0 Ia = P (DT) SHOU STORAGE CC # DOES NOT	(ba) =	rage ( LLER OR ASEFLOW	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0		
TOTAL RAINFALL (mm) = 60.601 RUNOFF COEFFICIENT = .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004	4.0 Ia = P (DT) SHOU STORAGE CC # DOES NOT	(ba) =	rage ( LLER OR ASEFLOW	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0		
TOTAL RAINFALL (mm) = 60.601 RUNOFF COEFFICIENT = .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLON 2:0004	4.0 Ia = 2 (DI) SHOU STORAGE CC 4 DOES NOT 	<pre>bep. Sto LLD BE SMA DEFFICIENT INCLUDE B (ha) = (mm) = Tp(hrs) =</pre>	rage ( LLER OR ASEFLOW	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0	0	
TOTAL RAINFALL (mm)= 60.601 RUNOFF COEFFICIENT = .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004- EXTERNAL AREA #1 CALIE NASHYD 02:EXT1 DT= 1.0 Unit Hyd Qpeak	4.0 IA = 2 (DT) SHOU STORAGE CC 4 DOES NOT 	<pre>bep. Sto LLD BE SMA DEFFICIENT INCLUDE B (ha) = (mm) = Tp(hrs) = 1.025</pre>	rage ( LLER OR ASEFLOW  7.78 7.200 .290	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0		
TOTAL RAINFALL (mm)= 60.601 RUNOFF COEFFICIENT = .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004- EXTERNAL AREA #1 CALIE NASHYD 02:EXT1 DT= 1.0 Unit Hyd Qpeak	4.0 IA = 2 (DT) SHOU STORAGE CC 4 DOES NOT 	<pre>bep. Sto LLD BE SMA DEFFICIENT INCLUDE B (ha) = (mm) = Tp(hrs) = 1.025</pre>	rage ( LLER OR ASEFLOW  7.78 7.200 .290	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0	0	
RUNOFF COEFFICIENT = .186	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004- EXTERNAL AREA #1 CALIE NASHYD 02:EXT1 DT= 1.0 Unit Hyd Qpeak	4.0 IA = 2 (DT) SHOU STORAGE CC 4 DOES NOT 	<pre>bep. Sto LLD BE SMA DEFFICIENT INCLUDE B (ha) = (mm) = Tp(hrs) = 1.025</pre>	rage ( LLER OR ASEFLOW  7.78 7.200 .290	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0	0	
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLOX 2:0004	4.0 IA = 2 (DT) SHOU STORAGE CC # DOES NOT 	<pre>bep. Sto plD BE SMA DEFFICIENT INCLUDE B (ha)= (mm)= Tp(hrs)= 1.025 .159 (i 12.217 11.272</pre>	rage ( LLER OR ASEFLOW  7.78 7.200 .290	Above) EQUAL	Y.  ve Num	oer (	CN)=56.0 (N)= 3.0		
(2) LEW LOW DOED NOT INCLUDE DESERIOW IT ANI.	* E	CN* = 5. (ii) TIME STE: THAN THE (iii) PEAK FLO 2:0004	4.0 IA = 2 (DT) SHOU STORAGE CC 4 DOES NOT 	<pre>bep. Sto plD BE SMA DEFFICIENT INCLUDE B (ha)= (mm)= Tp(hrs)= 1.025 .159 (i 12.217 11.272 60.601</pre>	rage ( LLER OR ASEFLOW  7.78 7.200 .290	Above) EQUAL	Y.  ve Num	oer (	CN) = 56.0 (N) = 3.0	000	
	* E	CN* = 5. (ii) TIME STEI THAN THE (iii) PEAK FLOU 2:0004	4.0 IA = 2 (DT) SHOU STORAGE CC # DOES NOT 	<pre>bep. Sto plD BE SMA DEFFICIENT INCLUDE B (nm) = Tp(hrs) = 1.025 .159 (i) 12.217 11.272 60.601 .186</pre>	rage ( LLER OR ASEFLOW 7.78 7.200 .290	Above) EQUAL I IF AN Cur # o	Y.  ve Num	oer (	CN) = 56.0 (N) = 3.0	 0 0	
	* E	CN* = 5. (ii) TIME STEI THAN THE (iii) PEAK FLOU 2:0004	4.0 IA = 2 (DT) SHOU STORAGE CC # DOES NOT 	<pre>bep. Sto plD BE SMA DEFFICIENT INCLUDE B (nm) = Tp(hrs) = 1.025 .159 (i) 12.217 11.272 60.601 .186</pre>	rage ( LLER OR ASEFLOW 7.78 7.200 .290	Above) EQUAL I IF AN Cur # o	Y.  ve Num	oer (	CN) = 56.0 (N) = 3.0	000	

002:0005-----* EXTERNAL AREA #2 CALIB STANDHYD | Area (ha)= 6.14 03:EXT2 DT= 1.00 | Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00 IMPERVIOUS PERVIOUS (1) 1.53 Surface Area (ha)= Dep. Storage (mm)= 4.61 2.00 5.00 Average Slope (%)= 3.00 8.00 (m) = Length 150.00 90.00 Mannings n .013 = .250 Max.eff.Inten.(mm/hr)= 68.17 17.89 over (min) 3.00 18.00 Storage Coeff. (min)= 2.73 (ii) 17.81 (ii) Unit Hyd. Tpeak (min) -3.00 18.00 Unit Hyd. peak (cms)= .40 .06 *TOTALS* PEAK FLOW .15 (cms) = .16 .254 (iii) TIME TO PEAK (hrs)= 12.00 12.22 12.000 RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = 58.60 15.04 21.146 60.60 60.60 60.601 RUNOFF COEFFICIENT = .97 .25 .349 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 59.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 002:0006-----------/ SHIFT HYD(S-EXT2 ) | SHIFT HID/S-EAL | IN= 3---> OUT= 4 | | SHIFT= 10.0 min | AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) ID= 3:EXT2 6.14 .254 12.000 21.146 SHIFT ID= 4:S-EXT2 6.14 12.150 21.146 002:0007-----ADD HYD (S-EXT1+2 ) | ID: NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) 7.78 .159 12.22 11.27 (ha) (cms) ID1 02:EXT1 .000

6.14 .254 12.00 21.15

SUM 05:S-EXT1+2 13.92 .358 12.02 15.63 .000

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+ID2 03:EXT2

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

002:0008-----------ROUTE RESERVOIR Requested routing time step = 1.0 min. IN>01:(101 ) ( | OUT<06:(POND 0) | ======== OUTLFOW STORAGE TABLE ======== OUTFLOW STORAGE | OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .323 .2527E+00 .008 .6520E-01 1 1.641 .2973E+00 251 1704E+00 2.734 .3206E+00 ROUTING RESULTS AREA OPEAK TPEAK R.V. -----(ha) (Cms) (hrs) (mm) INFLOW >01: (101 ) 11.05 .577 12.017 22.093 OUTFLOW<06: (POND O) 11,05 .131 12.583 22.092 PEAK FLOW REDUCTION [Qout/Qin] (%)= 22.643 TIME SHIFT OF PEAK FLOW (min) = 34.00MAXIMUM STORAGE USED (ha.m.)=.1183E+00 002:0009-----EXTERNAL AREA #3 | CALIB NASHYD | Area (ha)= 4.36 Curve Number (CN)=57.00 08:EXT3 DT= 1.00 | Ia (mm) = 6.900 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .553 Unit Hyd Qpeak (cms)= .301 PEAK FLOW .060 (i) (cms) =TIME TO PEAK (hrs)= 12.500 RUNOFF VOLUME (mm) = 11.755 TOTAL RAINFALL (mm) = 60.601 RUNOFF COEFFICIENT = .194 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 002:0010------002:0002-----** END OF RUN : 2 01/02/2013 11:27:27 AM 9/21

C:\09-062\SWMHYMO\POST\SCS\POST2.out10 | START | Project dir.: C:\09-062\SWMHYMO\POST\SCS\ ----- Rainfall dir.: C:\09-062\SWMHYMO\POST\SCS\ TZERO = .00 hrs on n METOUT= 2 (output = METRIC) NRUN = 003NSTORM= 1 # 1=25SCS24.stm 003:0002-----*#******************* *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-04-2013 *# Modeller : [JR] *# Company : WMI & Associates Ltd.
*# License # : 2880720 _____ 003:0002-----_____ READ STORM Filename: 25-Year SCS Type-II Storm Distribution ( | Ptotal= 81.40 mm | Comments: 25-Year SCS Type-II Storm Distribution ( _____ TIME RAIN TIME RATNI TIME RAIN TIME RAIN hrs mm/hr hrs mm/hr | hrs mm/hr | hrs mm/hr .20 .814 / 6.20 1.628 12.20 16.280 18.20 1.221 .40 .814 | 6.40 1.628 12.40 10.175 | 18.40 1.221 .60 .814 6.60 1.628 12.60 7.326 1 18.60 1.628 .80 .814 6.80 1.628 12.80 6.919 | 18.80 1.221 1.00 .814 / 7.00 1.628 13.00 4.884 19.00 1.221 1.20 .814 7.20 1.628 13.20 4.070 19.20 1.628 1.40 .814 7.40 1.628 13.40 4.070 H 19.40 1 221 1.60 .814 7.60 1.628 13.60 4.070 1 19.60 1.628 1.80 .814 7.80 1.628 / 13.80 4,070 | 19.80 1.221 2.00 .814 / 8.00 1.628 14.00 4.070 | 20.00 1.628 2.20 .814 8.20 2.442 14.20 2.442 20.20 1 221 2.40 .814 / 8.40 2.442 14.40 2.442 1 20.40 1.221 2.60 .814 1 8.60 2.442 2.442 14.60 20.60 .814 2.80 .814 / 8.80 2.442 14.80 2.442 20.80 1,221 3.00 .814 / 9.00 2.442 15.00 2.442 21.00 1.221 3.20 .814 | 9.20 2.442 15.20 2.035 1 21.20 .814 3.40 .814 9.40 2.442 15.40 2.035 | 21.40 1.221 3.60 .814 | 9.60 2.442 15.60 2.035 21.60 .814 3.80 .814 | 9.80 2.442 15.80 2.035 21.80 1.221 4.00 .814 | 10.00 2.442 16.002.035 22.00 .814 4.20 1.628 10.20 4.477 16.20 2.035 22.20 .814 4.40 1.628 | 10.40 4.477 16.40 2.035 22,40 1.221 4.60 1.628 10.60 4.477 16.60 2.035 | 22.60 .814 4.80 1.628 | 10.80 4.477 16.80 2.035 22.80 1.221 5.00 1.628 | 11.00 4.477 | 17.00 1.221 | 23.00 .814 01/02/2013 11:27:27 AM 10/21

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			6.105   8.954				
5.60	1.628 !	11.60	21.571	17.60	1.221	23.60	1.221
			91.575				

CATCHMENT 101							
CALIB STANDHYD	Area	(ha)=	11.05				
01:101 DT= 1.00	Total	1 Imp(%)=	35.00	Dir.	. Conn	(そ)=	19.50
	-	IMPERVIOU:	S PER	VIOUS	(i)		
Surface Area	(ha)=			7.18	,-,		
Dep. Storage				6.70			
Average Slope							
Length							
Mannings n	-	.013		.250			
Max.eff.Inten.(m	m/hr)=	91.58	3	8,15			
over	(min)	3.00	1	1.00			
Storage Coeff.	(min)-	3.26	(ii) 1	1.14	(ii)		
Unit Hyd. Tpeak	(min)=	3.00	1	1.00			
Unit Hyd. peak	(cms)=	.36		.10			
						*TOTALS	*
PEAK FLOW	(cms) =	.54		.50		.953	(iii)
TIME TO PEAK	(hrs)=	12.00	1	2.10		12.000	
RUNOFF VOLUME	(mm) =	79.39	2	3.03		34.025	
TOTAL RAINFALL	(mm) =	81.40	8	1.40		81.400	
RUNOFF COEFFICIE	ENT =	.98		.28		.418	

 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
 THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

# 003:0004------* EXTERNAL AREA #1

CALIB NASHYD   02:EXT1 DT= 1.00	Area   Ia U.H.	(ha)= (mm)= Tp(hrs)=	7.78 7.200 .290	Curve Number (CN)=56.00 # of Linear Res.(N)= 3.00
Unit Hyd Qpeak	( cms ) =	1.025		
PEAK FLOW TIME TO PEAK	(cms)= (hrs)=	.289 (i) 12.200		
RUNOFF VOLUME TOTAL RAINFALL	(mm) = (mm) =	20.110 81.400		
RUNOFF COEFFICIE	ENT =	.247		

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(1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD 03:EXT2 DT= 1.00	Area	(ha)=	6.14	Dir Con	- / <u>8</u> \-	14.00	
		-		BII, COM	1.(0)-	14.00	
S		IMPERVIOU		IOUS (i)			
Surface Area	(na)=	1.53 2.00		.61			
Dep. Storage Average Slope	$(mn) = (S_{1}) m$	2.00		.00			
Length	(m) =	150.00	00	.00 .00			
Mannings n	(111) =	.013	-2	250			
Max.eff.Inten.(	mm/hr)⊨	91.58	35.	. 51			
over	(min)	2.00	14.	.00			
over Storage Coeff.	(min) =	2.43	(ii) 13	.89 (ii)			
Unit Hyd. Tpeak Unit Hyd. peak	(min) =	2.00	14.	.00			
Unit Hyd. peak	( CRS ) =	. 49.		.08			
					*TOTAL	S*	
PEAK FLOW TIME TO PEAK	(cms) =	.22 12.00	12	.29		5 (iii)	
TIME TO PEAK	(hrs)=	12.00	12.		12.00		
RUNOFF VOLUME TOTAL RAINFALL	(mm) =	79.39 81.40	25.	.69	33.21		
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP	ENT = URE SELEC: .0 Ia = (DT) SHOU	.98 TED FOR PH Dep. Sto JLD BE SMA	ERVIOUS LOS prage (Abo ALLER OR EQ	.32 SSES: ove)	81.40 .40		
RUNOFF COEFFICE (i) CN PROCED CN* = 59	ENT = URE SELEC: .0 Ia = (DT) SHOU STORAGE CO	.98 TED FOR PE Dep. Sto JLD BE SMA DEFFICIENT	ERVIOUS LOS Drage (Abo ALLER OR EQ	.32 SSES: ove) QUAL			
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE	ENT = URE SELEC: .0 Ia = (DT) SHOU STORAGE CO DOES NOT	.98 TED FOR PE Dep. Sto JLD BE SMA DEFFICIENT	ERVIOUS LOS Drage (Abo ALLER OR EQ F. BASEFLOW IN	.32 SSES: ove) QUAL			
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELEC: (DT) SHOI STORAGE CC DOES NOT	.98 TED FOR PH Dep. Sto JLD BE SMA DEFFICIENT INCLUDE H	ERVIOUS LOS Drage (Abo ALLER OR EQ F. BASEFLOW IN	.32 SSES: ove) QUAL			
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELEC? .0 Ia = (DT) SHOU STORAGE CC DOES NOT	.98 TED FOR PH = Dep. Sto JLD BE SMA DEFFICIENT INCLUDE E	ERVIOUS LOS Drage (Abc ALLER OR EQ F. BASEFLOW IN	.32 SSES: ove) QUAL F ANY.	. 40	8	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELEC: (DT) SHOU STORAGE CC DOES NOT 	.98 TED FOR PH = Dep. Str JLD BE SMA DEFFICIENT INCLUDE E	ERVIOUS LOS Drage (Abd ALLER OR EQ P BASEFLOW IN QPEAK	.32 SSES: DVe) QUAL F ANY. TPEAK	.40 	8	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELEC: (DT) SHOU STORAGE CC DOES NOT 	.98 TED FOR PH = Dep. Str JLD BE SMA DEFFICIENT INCLUDE E	ERVIOUS LOS Drage (Abd ALLER OR EQ P BASEFLOW IN QPEAK	.32 SSES: DVe) QUAL F ANY. TPEAK	.40 	8	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (i) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELECT (DT) SHOU STORAGE NOT DOES NOT )   .   .   .	.98 TED FOR PF = Dep. Sto DEFFICIENT INCLUDE F AREA (ha) 6.14	2RVIOUS LOS prage (Abo ALLER OR EG F. BASEFLOW II QPEAK (cms) .435	.32 SSES: ove) QUAL F ANY.  TPEAK (hrs) 12.000	.40  R.V (run 33.21	8 	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW D3:0006	ENT = URE SELEC: (DT) SHOU STORAGE CC DOES NOT ) ) ) )	.98 TED FOR PE = Dep. Stc JLD BE SMA INCLUDE E AREA (ha) 6.14 6.14	CRVIOUS LOS Drage (Abd ALLER OR EG F. BASEFLOW IN QPEAK (cms) .435 .435	.32 SSES: ove) QUAL F ANY. TPEAK (hrs) 12.000 12.150	.40 R.V (mm 33.21 33.21	8 	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELECT (DT) SHOU STORAGE CC DOES NOT )   .   .   .	.98 TED FOR PF = Dep. Store JLD BE Store DEFFICIENT INCLUDE F AREA (ha) 6.14 6.14	CRVIOUS LOS prage (Abc NLLER OR EC SASEFLOW II QPEAK (cms) .435 .435	.32 SSES: ove) QUAL F ANY. TPEAK (hrs) 12.000 12.150	.40 R.V (mm 33.21 33.21	8 	
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME STEP THAN THE (iii) PEAK FLOW 03:0006	ENT = URE SELEC: (DT) SHOU STORAGE CC DOES NOT 	.98 TED FOR PE = Dep. Stc JLD BE SMA INCLUDE E AREA (ha) 6.14 6.14	CRVIOUS LOS Drage (Abc ALLER OR EG F. BASEFLOW IN QPEAK (cms) .435 .435	.32 SSES: ove) QUAL F ANY. TPEAK (hrs) 12.000 12.150	.40 R.V (mm 33.21 33.21	8  	DWF
RUNOFF COEFFICI (i) CN PROCED CN* = 59 (ii) TIME 559 THAN STEP THAN STEP 03:0006	ENT = URE SELEC: (DT) SHOU STORAGE CC DOES NOT 	.98 NED FOR PF = Dep. Stc JLD BE SMJ INCLUDE F INCLUDE F AREA (ha) 6.14 6.14 WHYD	CRVIOUS LOS Drage (Abc ALLER OR EC L. BASEFLOW IN QPEAK (cms) .435 .435 AREA (ha)	.32 SSES: ove) QUAL F ANY. TPEAK (hrs) 12.000 12.150	.40 R.V (mm 33.21 33.21 TPEAK (hrs)	8 	DWF (cms) .000

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C:\09-062\SWMHYMO\POST\SCS\POST2.out13 C:\09-062\SWMHYMO\POST\SCS\POST2.out14 _____ ***** SUM 05:S-EXT1+2 13.92 .627 12.02 25.89 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY. 003:0008-----| START | Project dir.: C:\09-062\SWMHYMO\POST\SCS\ -----ROUTE RESERVOIR Requested routing time step = 1.0 min. ----- Rainfall dir.: C:\09-062\SWMHYMO\POST\SCS\ IN>01:(101 ) OUT<06: (POND O) TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) ----- OUTLFOW STORAGE TABLE -----OUTFLOW STORAGE | OUTFLOW STORAGE ------(cms) (ha.m.) (cms) (ha.m.) NRUN = 004.000 .0000E+00 .323 .2527E+00 NSTORM= 1 .008 .6520E-01 1.641 .2973E+00 1 # 1=100SCS24.stm .251 .1704E+00 2.734 .3206E+00 004:0002-----ROUTING RESULTS AREA OPEAK TPEAK R.V. _____ (ha) (cms) (hrs) (mm) *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] INFLOW >01: (101 ) 11.05 .953 12.000 34.025 *# Date : 01-04-2013 *# Modeller : [JR] OUTFLOW<06: (POND O) 11.05 .251 12,450 34.023 *# Company : WMI & Associates Ltd. *# License # : 2880720 PEAK FLOW REDUCTION [Qout/Qin](%)= 26.372 TIME SHIFT OF PEAK FLOW (min)= 27.00 MAXIMUM STORAGE USED (ha.m.)=.1708E+00 004:0002----------003:0009-----READ STORM Filename: 100-Year SCS Type-II Storm Distribution * EXTERNAL AREA #3 | Ptotal= 98.70 mm! Comments: 100-Year SCS Type-II Storm Distribution ------_____ | Area | CALIB NASHYD (ha)= 4.36 Curve Number (CN)=57.00 TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | 08:EXT3 DT= 1.00 | Ia (mm) = 6.900 # of Linear Res.(N)= 3.00 hrs mm/hr | hrs mm/hr hrs mm/hr | hrs mm/hr ----- U.H. Tp(hrs)= .553 .20 1.974 | 12.20 19.740 | 18.20 .987 6.20 1.481 .40 .987 1 1.974 | 12.40 12.338 | 18.40 6.40 1,480 Unit Hyd Qpeak (cms)= .301 .60 .987 / 6.60 1.974 | 12.60 8.883 | 18.60 1.974 .80 .987 | 6.80 1.974 12.80 8.390 / 18.80 1.481 PEAK FLOW (cms) =.108 (i) 1.00 .987 7.00 1.974 | 13.00 5.922 1 19.00 1.481 TIME TO PEAK (hrs) = 12,5001.20 .987 7.20 1.974 4.935 13.20 19.20 1.974 RUNOFF VOLUME (mm) = 20.856 1.40 .987 7.40 1.974 13.40 4.935 19,40 1,481 TOTAL RAINFALL (mm)= 81.400 1.60 .987 | 7.60 1.974 | 13.60 4.935 | 19.60 1.974 RUNOFF COEFFICIENT = ,256 1.80 .987 7.80 1.974 13.80 4.935 19.80 1.481 2.00 .987 1.974 8.00 14.004.935 / 20.00 1.974 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 2 20 .987 2.961 | 8.20 14.20 2.961 / 20.20 1.481 2.40 .987 8.40 2.961 | 14,40 2.961 20.40 1.481 ------2.60 .987 8.60 2.961 | 14.60 2.961 20.60 . 987 003:0010-----2,80 .987 8.80 2.961 i 14.80 2.961 20.80 1.481 _____ 3.00 .987 9.00 2,961 | 15.00 2,961 / 21.00 1.480 003:0002------3.20 .987 9.20 2.961 | 15.20 2.467 21.20 .987 3,40 .987 9.40 2.961 | 15.40 2.467 21.40 1.481 003:0002-----3,60 .987 | 9,60 2.961 | 15.60 2.467 | 21.60 .987 ** END OF RUN : 3 3.80 .987 9.80 2.961 | 15.80 2.467 | 21.80 1.481 01/02/2013 11:27:27 AM 13/2101/02/2013 11:27:27 AM 14/21

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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	PEAK FLOW (cms)= .417 (i) TIME TO PEAK (hrs)= 12.200 RUNOFF VOLUME (mm)= 28.764 TOTAL RAINFALL (mm)= 98.701 RUNOFF COEFFICIENT = .291 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
004:0003 * CATCHMENT 101	CALIB STANDHYD   Area (ha)= 6.14   03:EXT2 DT= 1.00   Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00
<pre>CALIB STANDHYD   Area (ha)= 11.05   01:101 DT= 1.00   Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm)= 2.00 6.70 Average Slope (%)= 2.00 5.00 Length (m)= 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr)= 111.04 54.60 over (min) 3.00 10.00 Storage Coeff. (min)= 3.02 (ii) 9.85 (ii) Unit Hyd. Tpeak (min)= 3.00 10.00 Unit Hyd. Tpeak (min)= 3.00 10.00 Unit Hyd. peak (cms)= .37 .11 *TOTALS* PEAK FLOW (cms)= .65 .75 1.310 (iii) TIME TO PEAK (hrs)= 12.00 12.08 12.000 RUNOFF VOLUME (mm)= 96.70 32.47 44.999 TOTAL RAINFALL (mm)= 98.70 98.70 98.701 RUNOFF COEFFICIENT = .98 .33 .456 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.</pre>	IMPERVIOUS       PERVIOUS (i)         Surface Area       (ha)=       1.53       4.61         Dep. Storage (mm)=       2.00       5.00         Average Slope (%)=       3.00       8.00         Length       (m)=       150.00       90.00         Mannings n       =       .013       .250         Max.eff.Inten.(mm/hr)=       111.04       54.33         over (min)       2.00       12.00         Storage Coeff. (min)=       2.25 (ii)       11.92 (ii)         Unit Hyd. Tpeak (min)=       2.00       12.00         Unit Hyd. peak (cms)=       .52       .09         *TOTALS*       PEAK FLOW (cms)=       .26       .45         UNOFF VOLUME (mm)=       96.70       35.84       44.367         TOTAL RAINFALL (mm)=       98.70       98.701       82.00         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:       .450       .450         (ii) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:       .26       .450         (iii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL       THAN THE STORAGE COEFFICIENT.         (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	004:0006
004:0004 * EXTERNAL AREA #1   CALIB NASHYD   Area (ha)= 7.78 Curve Number (CN)=56.00   02:EXT1 DT= 1.00   Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .290	SHIFT HYD (S-EXT2 )     IN= 3> OUT= 4     SHIFT= 10.0 min   AREA QPEAK TPEAK R.V. 
Unit Hyd Qpeak (cms)= 1.025	004:0007
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ADD HYD (S-EXT1+2 )   ID: NHYD ID1 02:EXT1	AREA (ha) 7.78	QPEAK (cms) .417	TPEAK (hrs) 12.20	R.V. (mm) 28.76	DWF (cms) .000
+ID2 03:EXT2	6.14	.629	12.00	44.37	.000
SUM 05:S-EXT1+2	13.92	.915	12.02	35.65	.000

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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IN>01:(101 )						
OUT<06: (POND O)					=3 <b>=3==</b> ====	
		LOW STO	RAGE	OUTFLOW	STORAGE	
		ms) (ha	1.m.)	(cms)	(ha.m.) .2527E+00 .2973E+00 .3206E+00	
		000.0000	E+00	.323	.2527E+00	
		008 .6520	E-01	1.641	.2973E+00	
	•	251 .1704	E+00	2.734	.3206E+00	
ROUTING RESU	JLTS	AREA	OPEAK	TPEAK	R.V.	
		(ha)	(cms)	(hrs)	(10100)	
INFLOW >01:	(101 )	11.05	1.310	12.000	44.999	
OUTFLOW<06:	(POND O)	11.05	.299	12.467	44.997	
	PEAK FLO	W REDUCT	ION [Qout	/Qin](%)=	22.865	
	TIME SHIFT	OF PEAK B	LOW	(min)=	28.00	
	MAXIMUM S	TORAGE (	SED	(ha.m.)=	.2258E+00	
08:EXT3 DT= 1		(mm) = Tp(hrs) =		# of Line	ear Res.(N)= 3.00	
Unit Hyd Qpe	eak (cms)=	.301				
PEAK FLOW	(cms) =	.156 (i	1			
TIME TO PEAK		12.483				
	1E (mm)=					
	LL (mm)=					
RUNOFF COEFF	ICIENT =	.301				
(i) PEAK FLC	W DOES NOT I	NCLUDE BAS	EFLOW IF	ANY.		
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(output								
	IM.089							
: [221 : 01-04 : [JR] : WMI 4 : 2880 : 2880	FOX STRE 4-2013 & Associa 0720 ********* Filenam	ET SUBE	UNS R	ON]	Project N:	2mbe	r: [09-	062]
.00 15	.000 1	4.00	3.000	1 <u>n</u> 1 7	LS RUR/D1 00 43.00/	2 1	_nrs	nm/nr 13 000
.00 20.	1 000	5.00	5.000	8.	00 20.000		11.00	13,000
.00 10.	.000	6.00 2	0.000	1 9.	00 23.000	) į	12.00	8.000
	: [221 : 01-0: : [JR] : WMI : 289 : WMI : 00 : 00 : 00 : 00 : 00 : 00 : 00 : 0	<pre>: [221 FOX STRE : 01-04-2013 : [JR] : WMI &amp; Associa : 2880720</pre>	<pre>: [221 FOX STREET SUBE : 01-04-2013 : [JR] : WM &amp; Associates Ltd : 2880720</pre>	<pre>: [221 FOX STREET SUBDIVISIC : 01-04-2013 : [JR] : WMI &amp; Associates Ltd. : 2880720</pre>	<pre>: [221 FOX STREET SUBDIVISION] : 01-04-2013 : [JR] : WMI &amp; Associates Ltd. : 2880720</pre>	<pre>: [221 FOX STREET SUBDIVISION] Project N. : 01-04-2013 : [JR] : WMI &amp; Associates Ltd. : 2880720</pre>	<pre>: [221 FOX STREET SUBDIVISION] Project Numbe : 01-04-2013 : [JR] : WMI &amp; Associates Ltd. : 2880720 ( Filename: TIMMINS REGIONAL STORM (12-ho 0 mm/ Comments: TIMMINS REGIONAL STORM (12-ho 0 mm/hr   hrs mm/hr   hrs mm/hr   brs mm/hr   hrs mm/hr   hrs mm/hr   0.0 15.000   4.00 3.000   7.00 43.000   0.00 20.000   5.00 5.00 0 8.00 20.000  </pre>	: [JR] ; WMI & Associates Ltd.

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F= 1.

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		IMPERVIOUS	PERVIOUS	(i)	
Surface Area Dep. Storage Average Slope Length Mannings n	(ha)=	3.87	7.18		
Dep. Storage	(mm) -	2.00	6 20		
Average Slope	(%)=	2.00	5.00 40.00		
Length	(m)=	200 00	40.00		
Manninge n	(10)-	200.00	.250		
Max.eff.Inten.( over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	nm/hr)=	43.00	32.61		
over	(min)	4.00	13.00		
Storage Coeff.	(min)-	4.41 (ii	) 12.80	(ii)	
Unit Hyd. Tpeak	(min)=	4.00	13.00		
Unit Hyd. peak	( cms ) =	.26	.09		
				*TOTALS*	
PEAK FLOW	(cms) =	.26	.62	.874 (ii:	()
TIME TO PEAK	(hrs) =	7.00	7.02	.874 (ii: 7.000	-,
BUNCEE VOLUME	(mm)-	100 00	07 12	115 434	
TOTAL DATHEALT	(1000) -	102.00	102 00	102 000	
TOTAL RAINFALL	(nun)=	193.00	193.00	193.000	
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	SNT =	.99	.50	. 598	
(iii) PEAK FLOW	DOES NOT		FLOW IF AN	Y.	
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00	 ! Area ! Ia U.H.	h (ha)= (mm)= 7 . Tp(hrs)=		ve Number (CN)=5 f Linear Res.(N)= 3	
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak	! Area   Ia U.H. (cms)=	1 (ha) = (mm) = 7 Tp(hrs) = 1.025			
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI	 ! Area ! Ia U.H. (cms) = (cms) = (hrs) = (mm) = (mm) = ENT =	n (ha) = (mm) = 7 Tp(hrs) = 1.025 .488 (i) 7.067 89.580 193.000 .464	7.78 Cur .200 # o .290	ve Number (CN)=50 f Linear Res.(N)= :	
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D	<pre>/ Area / Ia / U.H. (cms)= (cms)= (cms)= (mm)= (mm)= ENT = DES NOT I</pre>	<pre>h (ha) = (mm) = 7 Tp(hrs) = 1.025 .488 (i) 7.067 89.580 193.000 .464 ENCLUDE BASEFL</pre>	7.78 Cur .200 # o .290	ve Number (CN)=50 f Linear Res.(N)= :	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I	<pre>h (ha) = (mm) = 7 Tp(hrs) = 1.025 .488 (i) 7.067 89.580 193.000 .464 ENCLUDE BASEFL</pre>	7.78 Cur .200 # o .290	ve Number (CN)=50 f Linear Res.(N)= :	5.00 3.00
5:0004	Arez   Ia U.H. (cms)= (cms)= (hrs)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 Tp(hrs) = 1.025 .488 (i) 7.067 89.580 193.000 .464 ENCLUDE BASEFL COLUDE BASEFL COLUDE BASEFL COLUDE BASEFL</pre>	7.78 Cur .200 # o .290	ve Number (CN)=50 f Linear Res.(N)= :	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005 EXTERNAL AREA #2 CALIE STANDHYD 03:EXT2 DT= 1.00	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005 EXTERNAL AREA #2 CALIE STANDHYD 03:EXT2 DT= 1.00	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005 EXTERNAL AREA #2 CALIE STANDHYD 03:EXT2 DT= 1.00	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00
5:0004	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005 EXTERNAL AREA #2 CALIB STANDHYD 03:EXT2 DT= 1.00	Arez   Ia U.H. (cms)= (hrs)= (hrs)= (nm)= (nm)= ENT = DES NOT I 	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00
5:0004 EXTERNAL AREA #1 CALIB NASHYD 02:EXT1 DT= 1.00 Unit Hyd Qpeak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFICI (i) PEAK FLOW D 5:0005 EXTERNAL AREA #2 CALIB STANDHYD 03:EXT2 DT= 1.00	Area   Ia U.H. (cms) = (cms) = (hrs) = (nm) = ENT = DES NOT I    Area   Tota  (ha) = (mm) =	<pre>h (ha) = (mm) = 7 (mm) = 7 1.025 .488 (i) 7.067 89.580 193.000 .464</pre>	7.78 Cur 200 # o 290 OW IF ANY. 6.14 5.00 Dir PERVIOUS	<pre>ve Number (CN)=50 f Linear Res.(N)= 0 . Conn.(%)= 14.00</pre>	5.00 3.00

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ROUTE RESERVOIR IN>01:(101 ) OUT<06:(POND O)	1							
05:0008	-							
NOTE: PEAK FLOWS	DO I	NOT INCLUDE	BASEFLO	WS IF AM	1Y.			
	SUM	05:S-EXT1+2	1	3.92	.968	7.00	101.27	.000
		U3:EX12						
		02:EXT1						
ADD HYD (S-EXT1+2	)	ID: NHYD	AI ()	REA ha) 7 70	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	DWF (cms)
05:0007								
ID= 3:EXT2 SHIFT ID= 4:S-EXT2		AREA (ha) 6.14 6.14	.48	36 36	7.000 7.150	116.07 116.07	13 13	
SHIFT= 10.0 min		AREA (ha)	QPEA (cms	-ur 5)	(hrs)	R.V (mn	1)	
IN= 3> OUT= 4	1	105-						
SHIFT HYD(S-EXT2								
)5:0006								
(iii) PEAK FLOW								
	STOR	AGE CCEFFICI	ENT.					
CN* = 59	.0	Ia = Dep. S	Storage	(Above	e)			
(i) CN PROCED						.00	-	
TOTAL RAINFALL RUNOFF COEFFICI			00 99	193.00	)	193.00	0	
TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL	(hrs (mn	a)= 6.9 a)= 191.0	98 00	7.03 103.86 193.00		7.00 116.07 193.00	10 73	
PEAK FLOW	(cms	a) = .1	10 98	.38 7.03		.48	6 (iii)	
Max.eff.Inten.( over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak PEAK FLOW	(cms	s)= .3	35	.07		*TOTAL	.s*	
Unit Hyd. Tpeak	(mir (mir	(1) = 3.2 (1) = 3.0	28 (11) 00	15.23	(11)			
over	(mir	1) 3.0	00	15.00				
Max.eff.Inten.(r	un/hr	c)= 43.0	00	32.04	L			
Average Slope Length Mannings n	(1)	= .03	13	.250				
Length	(n	ນໍ⊨ 150 (	no.	90.00	1			

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	OUTFLOW (cms) .000 .008 .251	(ha. .0000E .6520E	m.) +00   -01	(cms)	2527E+00 2973E+00	
ROUTING RESULTS		AREA	QPEAK	TPEAK	R.V.	
INFLOW >01: (101 OUTFLOW<06: (POND	) 1:		(cms) .874 .837	(hrs) 7.000 7.050	(mm) 115.434 115.431	
	K FLOW E SHIFT OF IMUM STORA	PEAK FL	DW	/Qin](%)= (min)= (ha.m.)=	3.00	
005:0009 * EXTERNAL AREA #3						
! CALIB NASHYD     08:EXT3 DT= 1.00	Area Ia U.H. Tp	(mm) 🗢	6.900	Curve Num # of Line	nber (CN)=5 ear Res.(N)=	
Unit Hyd Qpeak ()	cms)=	.301				
RUNOFF VOLUME	hrs)= 7. (mm)= 91. (mm)= 193.	.239 (1) .267 .692 .000 .475				
RUNOFF COEFFICIEN	r = .	. 475				
			FLOW IF .	ANY.		
RUNOFF COEFFICIEN: (i) FEAK FLOW DOE:			FLOW IF .	ANY.		
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RUNOFF COEFFICIEN: (i) PEAK FLOW DOE: 005:0010	S NOT INCLU	JDE BASEI				
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RUNOFF COEFFICIEN: (i) PEAK FLOW DOE: 005:0002	S NOT INCLU	JDE BASE				

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*# Date : 0 *# Modeller : [4 *# Company : W *# License # : .	221 FOX STREET SUBDIVISION] Project Number: [09-062] 1-06-2013 TR] MI & Associates Ltd. 2880720
* * * * \$	I CONDITION (4HR CHICAGO SIORM)
START	RM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[1] ["25mm4hr.stm"] <storm filename,<="" th=""></storm>
READ STORM	STORM_FILENAME=["STORM.001"]
* CATCHMENT 101 CALIB STANDHYD	<pre>ID=[1], NHYD=["101"], DT=[1](min), AREA=[11.05](ha), XIMD=[0.195], TIMD=[0.35], DWF=[0](cms), LOSS=[2], SCS curve number CN=[54], Pervious surfaces: IAper=[6.7](mm), SLPP=[5.0](%), LGP=[40](m), MND=[0.25], SCD=[0](min), Impervious surfaces: IAimp=[2.0](mm), SLPI=[2.0](%), LGI=[200](m), MNI=[0.013], SCI=[0](min) RAINFALL=[, , , ](mm/hr), END=-1</pre>
** * EXTERNAL AREA #1 CALIB NASHYD	<pre>ID=[2], NHYD=["EXT1"], DT=[1]min, AREA=[7.76](ha), DWF=[0](cms), CN/C=[56], IA=[7.2](mm), N=[3], TP=[0.290]hrs, RAINFALL=[, , , , ](mm/hr), END=-1</pre>
** * EXTERNAL AREA #2 CALIB STANDHYD	<pre>ID=[3], NHYD=["EXT2"], DT=[1](min), AREA=[6.14](ha), XIMP=[0.14], TIMP=[0.25], DWF=[0](cms), LOSS=[2], SCS curve number CN=[59], Pervious surfaces: lAper=[5](mm), SLPP=[6.0](%), LGP=[90](m), MNP=[0.25], SCP=[0](min), Impervious surfaces: lAimp=[2.0](mm), SLPI=[3.0](%), LGI=[150](m), MNI=[0.013], SCI=[0](min) RAINFALL=[, , , ](mm/hr), END=-1</pre>
SHIFT HYD	IDout=[4], NHYD=["S-EXT2"], IDin=[3], TLAG=[10](min)
ADD HYD	IDsum=[5], NHYD=["S-EXT1+2"], IDs to add=[2+3]
	IDout=[6], NHYD=["POND OUT"], IDin=[1], RDT=[1](min), TABLE of ( OUTFLOW-STORAGE ) values (cms) - (ha-m) [ 0.0000, 0.0000] [ 0.0080, 0.0652]

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*9	<pre>[ 0.2510 , 0.1704] [ 0.3230 , 0.2527] [ 1.6410 , 0.2973] [ 2.7340 , 0.3206] [ -1 , -1 ] (max twenty pts) IDovf=[ ], NHYDovf=[ ]</pre>
* EXTERNAL AREA #3 CALIB NASHYD	<pre>ID=[8], NHYD=["EXT3"], DT=[1]min, AREA=[4.36](ha), DWF=[0](cms), CN/C=[57], IA=[6.9](mm), N=[3], TP=[0.553]hrs, RAINFALL=[, , , , ](mm/hr), END=-1</pre>
*% 2-YEAR CHICAGO ST	ORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR)
START	TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[2]
*%	["2CHI4.stm"] <storm filename<="" td=""></storm>
*% 5-YEAR CHICAGO ST START *%	<pre>CORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR) TZERO=[0.0], METOUT=[2], NSIORM=[1], NRUN=[3] ["5CHI4.stm"] <storm filename<="" pre=""></storm></pre>
*% 25-YEAR CHICAGO S	TORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR)
START	TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[4]
*%	["25CH14.stm"] <storm filename<="" td=""></storm>
*% 100-YEAR CHICAGO	STORM DISTRIBUTION ORILLIA IDF DATA (4 HOUR)
START	TZERO=[0.0], METOUT=[2], NSTORM=[1], NRUN=[5]
*%	["100CHI4.stm"] <storm filename<="" td=""></storm>

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C:\09-062\SWMHYMO\POST\CHI\POST2.out2 *# Modeller : [JR]
*# Company : WMI & Associates Ltd. *# License # : 2880720 *#********************* ------I START Project dir.: C:\09-062\SWMHYMO\POST\CHI\ ----- Rainfall dir.: C:\09-062\SWMHYMO\POST\CHI\ TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 0.01NSTORM= 1 # 1=25mm4hr.stm 001:0002-----------| READ STORM | Filename: 25mm Chicago Storm Distribution (4-hour) | Ptotal= 25.00 mm | Comments: 25mm Chicago Storm Distribution (4-hour) -----TIME RAIN TIME RAIN | TIME RAIN | TIME RAIN hrs mm/hr | hrs mm/hr ! hrs mm/hr | hrs mm/hr .17 1.740 1.17 10.720 | 3.17 2.040 2.17 3,750 .33 1.970 2.33 3.250 1.33 62.850 | 3.33 1.910 .50 2.290 | 1.50 13.740 | 2.50 2.890 | 3.50 1.790 .67 2,740 | 1.67 7.730 2.67 2,610 3.67 1.700 .83 3.500 j 1,83 5.590 i 3.83 1.610 2.83 2.380 1.00 5.020 | 2.00 4.460 | 3.00 2.190 | 4.00 1.530 001:0003------* CATCHMENT 101 -----| CALIB STANDHYD | Area (ha)= 11.05 | 01:101 DT= 1.00 ! Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 -------IMPERVIOUS PERVIOUS (1) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm)= 2,00 6.70 Average Slope (%)= 2.00 5.00 Length (m) = 200.00 40.00 Mannings n .013 .250 Max.eff.Inten.(mm/hr)= 62.85 2,52 over (min) 4.00 27 00 3.79 (ii) Storage Coeff. (min)= 27.18 (ii) Unit Hyd. Tpeak (min)= 4.00 27.00 Unit Hyd. peak (cms)= .29 .04 *TOTALS* PEAK FLOW .03 (cms) = .34 .342 (iii) TIME TO PEAK (hrs)= 1.33 1.83 1.333 RUNOFF VOLUME (mm) = 23.00 1.97 6.075 TOTAL RAINFALL (mm) = 25.00 25.00 25.000 01/02/2013 11:22:22 AM 2/20

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RUNOFF COEFFICIENT = .92 .08 .243 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (i) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	CN* = 59.0 IA = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICTENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
	SHIFT HYD(S-EXT2 )
1:0004	IN= 3> OUT= 4 SHIFT= 10.0 min AREA OPEAK TPEAK R.V.
CALIB NASHYD / Area (ha)= 7.78 Curve Number (CN)=56.00 02:EXT1 DT= 1.00 / Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .290	ID= 3:EXT2 6.14 .146 1.333 5.319 SHIFT ID= 4:S-EXT2 6.14 .146 1.483 5.319
Unit Hyd Qpeak (cms)= 1.025	001:0007
PEAK FLOW       (cms)=       .021 (i)         TIME TO PEAK       (hrs)=       1.733         RUMOFF VOLUME       (mm)=       1.458         TOTAL RAINFALL       (mm)=       25.000	ADD HYD (S-EXT1+2)   ID: NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (num) (cms) ID1 02:EXT1 7.78 .021 1.73 1.46 .000
RUNOFF COEFFICIENT = .058 (1) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	+ID2 03:EXT2 6.14 .146 1.33 5.32 .000
1:0005	SUM 05:S-EXT1+2 13.92 .148 1.33 3.16 .000 NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
CALIB STANDHYD   Area (ha)= 6.14 03:EXT2 DT= 1.00   Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00	001:0008
IMPERVIOUS         PERVIOUS (i)           Surface Area (ha)=         1.53         4.61           Dep. Storage (mm)=         2.00         5.00           Average Slope (%)=         3.00         8.00           Length (m)=         150.00         90.00           Mannings n         =         .013         .250           Max.eff.Inten.(mm/hr)=         62.85         2.53           over (min)         3.00         36.00           Storage Coeff. (min)=         2.82 (ii)         35.81 (ii)           Unit Hyd. Tpeak (min)=         .39         .03	ROUTE RESERVOIR       Requested routing time step = 1.0 min.         IN>01:(101)       I         OUT<06:(POND 0)
PEAK FLOW       (cms)=       .14       .02       .146 (iii)         TIME TO PEAK       (hrs)=       1.33       1.98       1.333         RUNOFF VOLUME       (mm)=       23.00       2.44       5.319         TOTAL RAINFALL       (mm)=       25.00       25.00       25.00         RUNOFF COEFFICIENT       .92       .10       .213         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:	001:0009

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C:\09-062\SWMHYMO\POST\CHI\POST2.out5 C:\09-062\SWMHYMO\POST\CHI\POST2.out6 * EXTERNAL AREA #3 1.17 14.057 / 2.17 4.915 .17 2.285 1 3.17 2.674 ------.33 2.585 ( 1.33 82.380 | 2.33 4.266 | 3.33 2.501 CALTE NASHYD Area (ha) = 4.36 Curve Number (CN)=57.00 .50 2.995 1.50 18.005 2.50 3 787 3.50 2.353 08:EXT3 DT= 1.00 | Ia (mm) = 6,900 # of Linear Res.(N) = 3.00 .67 3,598 | 1.67 10.127 | 2.67 2.223 3.416 3.67 ----- U.H. Tp(hrs)= .553 .83 4.586 1 1.83 7.331 | 2,83 3,120 | 3,83 2,109 1.00 6.583 | 2.00 5.849 | 3.00 2 877 4.00 2.007 Unit Hyd Qpeak (cms)= .301 PEAK FLOW (cms) =.009 (i) 002:0003-----TIME TO PEAK (hrs)= 2.150 * CATCHMENT 101 RUNOFF VOLUME (mm) =1.562 ____ TOTAL RAINFALL (mm) = 25.000 | CALIB STANDHYD | Area (ha)= 11.05 01:101 DT= 1.00 | Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 RUNOFF COEFFICIENT = .062 -----(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm) = 2.00 6.70 001:0010------Average Slope (%)= 2.00 5.00 ** END OF RUN : 1 Length (m) = 200.00 40.00 Mannings n -.013 .250 Max.eff.Inten.(mm/hr)= 82.38 5.90 over (min) 3.00 20.00 3.40 (ii) Storage Coeff. (min)= 20.03 (ii) Unit Hyd. Tpeak (min)= 3.00 20.00 Unit Hyd. peak (cms)= .35 .06 *TOTALS* I START | Project dir.: C:\09-062\SWMHYMO\POST\CHI\ PEAK FLOW (cms) =.46 .07 .473 (iii) TIME TO PEAK (hrs) =1.33 1.65 1.333 ----- Rainfall dir.: C:\09-062\SWMHYMO\POST\CHI\ RUNOFF VOLUME (mm) = 30.77 3.70 8,983 TOTAL RAINFALL 32.77 (mm) = 32.77 32.772 TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) RUNOFF COEFFICIENT = .94 .11 .274 NRUN = 0.02(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: NSTORM= 1 CN* = 54.0 Ia = Dep. Storage (Above) # 1=2CH14.stm (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. 002:0002------(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-06-2013 *# Modeller : [JR] 002-0004------* EXTERNAL AREA #1 *# Company : WMI & Associates Ltd. ------*# License # : 2880720 ! CALIB NASHYD ! Area (ha)= 7.78 Curve Number (CN)=56.00 | 02:EXT1 DT= 1.00 | Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 ----- U.H. Tp(hrs)= .290 _____ Unit Hyd Opeak (cms)= 1.025 READ STORM Filename: 2-Year Chicago Storm Distribution (4-hou | Ptotal= 32.77 mm| Comments: 2-Year Chicago Storm Distribution (4-hou PEAK FLOW (cms)= .046 (i) _____ TIME TO PEAK (hrs) =1.700 TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN RUNOFF VOLUME (mm) = 2.904 hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr TOTAL RAINFALL (mm) = 32.772 01/02/2013 11:22;22 AM 5/20 01/02/2013 11:22:22 AM 6/20

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### RUNOFF COEFFICIENT = .089

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

03:	IB STAND EXT2 D	T= 1.00	T	rea Otal	(ha)= 1mp(%)=	6.14 25.00	Dir	. Conn	. (욱)=	14.00		
					IMPERVIO	US PER	vious	(i)				
	Surface	Area	(ha)	-	1.53		4.61					
	Dep. Sto Average	rage	(mm)	-	2.00	1	5.00					
	Average	Slope	(응)	-	3.00	1	3.00					
	Length	-	(m)	-	150.00		0.00					
	Mannings	11		-	.013		.250					
	Max.eff.	Inten.(r	mm/hr)	-	82.38	:	5.75					
			(min)		3.00	20	5.00					
	Storage				2.53	20 (ii) 20	5.28	(ii)				
	Unit Hyd	. Tpeak	(min)	=	3.00	26	5.00					
	Unit Hyd	, peak	(cms)	-	. 42		.04					
									*TOTAL			
	PEAK FLO		(cms)		.19		.04			7 <b>(iii)</b>		
	TIME TO RUNOFF V		(hrs)		1.33 30.77 32.77	-	L.75		1.33			
		O POLAR	(nun)	=	30.77	4	1.43		8.11	5		
	TOTAL PA	TNEATI	(mm)	_								
	TOTAL RA RUNOFF C (i) CN CN (ii) TI TH	INFALL OEFFICIN PROCEDU * = 59 ME STEP AN THE S	(mm) ENT JRE SE .0 (DT) STORAG	= LECT Ia = SHOU E CO	.94 ED FOR PI Dep. Sto LD BE SMI EFFICIEN	ERVIOUS LO Drage (Al ALLER OR H	oove) EQUAL	:	32.77 .24			
	TOTAL RA RUNOFF C (i) CN CN (ii) TI TH (iii) PE	INFALL OEFFICI * = 59 ME STEP AN THE S AK FLOW	(mm) ENT JRE SE .0 (DT) STORAG DOES	= LECT Ia = SHOU E CO NOT	.94 ED FOR PI Dep. Sto LD BE SMA EFFICIENT INCLUDE 1	ERVIOUS LO Drage (A) ALLER OR H I. BASEFLOW 1	.14 DSSES DOVE) EQUAL UF AN	: Y.	.24	8		
02:0	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TI (iii) PE	INFALL DEFFICI * = 59 ME STEP AN THE : AK FLOW	(mm) ENT JRE SE (DT) STORAG DOES	= LECT Ia = SHOU E CO NOT	.94 ED FOR PI Dep. Sto LD BE SM EFFICIEN INCLUDE I	ERVIOUS LO Drage (A) ALLER OR H I. BASEFLOW 1	.14 DSSES DOVE) EQUAL UF AN	: Y.	.24	8		
02:0 SHI	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TH (iii) PE 0006 FT HYD(S	INFALL OEFFICIN PROCEDU * = 59 ME STEP AN THE : AK FLOW -EXT2	(mm) ENT JRE SE .0 (DT) STORAG DOES 	= LECT Ia = SHOU E CO NOT	.94 ED FOR PI Dep. Sto LD BE SM EFFICIEN INCLUDE I	ERVIOUS LO Drage (A) ALLER OR H I. BASEFLOW 1	.14 DSSES DOVE) EQUAL UF AN	: Y.	.24	8		 
02:0 SHI IN=	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TE (iii) PE 0006 FT HYD (S 3> O	INFALL OEFFICI PROCEDU * = 59 ME STEP AN THE S AK FLOW 	(mm) ENT JRE SE (D) (DT) STORAG DOES ) 	= LECT Ia = SHOU E CO NOT	.94 ED FOR PI Dep. Std LD BE SM EFFICIENT INCLUDE 1	ERVIOUS LG Drage (A) ALLER OR H I. BASEFLOW 1	.14 DSSES DOVE) EQUAL UF AN	: Y.	.24	8		
02:0 SHI IN= SHI	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TI (iii) PE 0006 FT HYD(S 3> O FT = 10.1	INFALL OEFFICIN PROCEDU * = 59 ME STEP AN THE S AK FLOW 	(mm) ENT JRE SE 0 (DT) STORAG DOES )   	= LECT: Ia = SHOU: E CO: NOT	.94 ED FOR PI Dep. St. LD BE SMI EFFICIENT INCLUDE I	OPEAK	.14 DSSES DOVE) EQUAL UF AN	: Y. 	.24  R.V	8 		
02:0 SHI IN= SHI	TOTAL RA RUNOFF C (i) CN (ii) TII TH (iii) PE 0006 FT HYD(S 3> O FT= 10.	INFALL OEFFICIN * = 59 ME STEP AN THE 1 AK FLOW -EXT2 UT= 4 0 min	(mm) ENT JRE SE .0 (DT) STORAG DOES )       	= LECT: Ia = SHOU: E CO: NOT	.94 ED FOR PI Dep. St. LD BE SMI EFFICIENT INCLUDE I	OPEAK	.14 DSSES DOVE) EQUAL UF AN	: Y. 	.24  R.V (mm	8		 
02:0 SHI IN= SHI	TOTAL RA RUNOFF C (i) CN (ii) TI TH (iii) PE 0006 FT HYD(S 3> O FT= 10 ID= 3	INFALL DEFFICIN * = 59 ME STEP AN THE : AK FLOW -EXT2 UT= 4 0 min -EXT2	(mm) SNT JRE SE 0 (DT) STORAG DOES )       	= LECT: Ia = SHOU E CO: NOT	.94 ED FOR P Dep. St LD BE SM EFFICIENT INCLUDE I AREA (ha) 6.14	OPEAK (cms) .197	.14 DSSES DOVE) EQUAL UF AN TI (1)	:  PEAK hrs) .333	.24  R.V (mm 8.11	8  5		
D2:0 SHI IN= SHI	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TI (iii) PE 0006 FT HYD (S 3> O FT = 10.1 ID= 3 FT ID= 4	INFALL OEFFICI PROCEDU * = 59 ME STEP AN THE S AK FLOW EXT2 UT= 4 0 min :EXT2 :S-EXT2	(mm) ENT JRE SE .0 (DT) STORAG DOES :         	= LECT: Ia = SHOU E CO NOT	.94 ED FOR PJ Dep. St LD BE SM EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14	OPEAK (cms) .197	.14 DSSES DOVE) EQUAL UF AN TI (1)	:  PEAK hrs) .333	.24  R.V (mm	8  5		 
02:0 SHI IN= SHI SHI	TOTAL RA RUNOFF C (i) CN (ii) TI TH (iii) TE TH (iii) TE (iii) TE TH (iii) TE TH (III) TE TH (III) TE (III) TE	INFALL OEFFICIN PROCED9 ME STEP AN THE S AK FLOW 	(mm) ENT JRE SE 0 (DT) STORAG DOES )       	= LECT: Ia = SHOU E CO NOT	.94 ED FOR PJ Dep. St. LD BE SM EFFICTENT INCLUDE 1 AREA (ha) 6.14 6.14	CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK	.14 DSSES DOVE) EQUAL UF AN TI (1)	:  PEAK hrs) .333	.24  R.V (mm 8.11	8  5		
02:0 SHI IN= SHI SHI 02:0	TOTAL RA RUNOFF C (i) CN (ii) TI (iii) TI (iii) PE 0006 FT HYD(S: 3> O (FT= 10.) ID= 3 FT ID= 4	INFALL OEFFICI PROCEDO * = 59 ME STEP AN THE : AK FLOW -EXT2 UT= 4 0 min :EXT2 :S-EXT2	(mm) SNT JRE SE 0 (DT) STORAG DOES )         	= LLECT. Ia = SHOU E CO. NOT	.94 ED FOR PJ Dep. St. LD BE SM EFFICIEN' INCLUDE 1 AREA (ha) 6.14 6.14	QPEAK (cms) .197	.14 DSSES DOVE) EQUAL UF AN TI (1 1 1	: PEAK hrs) .333 .483	.24 R.V (mm 8.11 8.11	8  ) 5 5 5		
02:0 SHI SHI SHI 02:0 ADD	TOTAL RA RUNOFF C (i) CN (ii) TI TH (iii) TE TH (iii) TE (iii) TE TH (iii) TE TH (III) TE TH (III) TE (III) TE	INFALL DEFFICID PROCEDU * = 59 ME STEP AN THE S AK FLOW 	(mm) SNT JRE SE .0 (DT) STORAG DOES )  	= LLECT. Ia = SHOU E CO. NOT	.94 ED FOR PJ Dep. St. LD BE SM EFFICIEN' INCLUDE 1 AREA (ha) 6.14 6.14	CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK CPEAK	.14 DSSES DOVE) EQUAL (IF AN TI (I 1 1 1	: Y. PEAK hrs) .333 .483  PEAK	.24 R.V (mm 8.11 8.11 7PEAK	8 .) 5 5  R.V.	DWF	
02:0 SHI SHI SHI 02:0 ADD	TOTAL RA RUNOFF C (i) CN (ii) TI TH (iii) PE 0006	INFALL DEFFICID PROCEDU * = 59 ME STEP AN THE S AK FLOW 	(mm) SNT JRE SE .0 (DT) STORAG DOES )  	= = LECT Ia = SHOU E CO NOT 	.94 ED FOR PI Dep. St. LD BE SMM EFFICIEN. INCLUDE 1 AREA (ha) 6.14 6.14 6.14	CPEAK (CPEAK (CRS) (197) (197) (197) (197) (197) (197) (197) (197) (197) (197)	.14 DSSES DOVE) EQUAL UF AN TI () 1 1 1 ()	: PEAK hrs)  PEAK cms)	.24 R.V (mm 8.11 8.11	8 5 5	DWF (cms)	
02:0 SHI IN= SHI 02:0 ADD	TOTAL RA RUNOFF C (i) CN (ii) TI TH (iii) PE 0006	INFALL OEFFICIP PROCEDU * = 59 ME STEP AN THE STEP AN THE S AK FLOW 	(mm) SNT JRE SE (DT) STORAG DOES )             1 ] ] ] ] TD1 0.	= = LECT Ia = SHOU E CO NOT 	.94 ED FOR PI Dep. St. LD BE SMM EFFICIEN. INCLUDE 1 AREA (ha) 6.14 6.14 6.14	CPEAK (cms) AREA AREA (ha)	.14 DSSES DOVE) EQUAL UF AN TI () 1 1 1 ()	: PEAK hrs)  PEAK cms)	.24 R.V (rom 8.11 8.11 8.11 TPEAK (hrs)	8 5 5	DWF (cms)	

# C:\09-062\SWMHYMO\POST\CHI\POST2.out8

+ID2	03:EXT2	6.14	.197	1.33	8.12	.000
SUM	05:S-EXT1+2	13.92	.204	1.33	5.20	.000

# NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTING RESULTS INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	.000 .0000 .008 .6520 .251 .1704 AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	L.m.)     DE+00   DE+00   DE+00   QPEAK (cms) .473 .033 CION [Qout UOW ISED	(cms) .323 1.641 2.734 TPEAK (hrs) 1.333 3.367 c/Qin](%)=	(ha.m.) .2527E+00 .2973E+00 .3206E+00 R.V. (mm) 8.983 8.982 6.874 122.00	
ROUTING RESULTS INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	(cms) (ha .000 .0080 .008 .6520 .251 .1704 AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	L.m.)     DE+00   DE+00   DE+00   QPEAK (cms) .473 .033 CION [Qout UOW ISED	(cms) .323 1.641 2.734 TPEAK (hrs) 1.333 3.367 t/Qin](%)= (min)=	(ha.m.) .2527E+00 .2973E+00 .3206E+00 R.V. (mm) 8.983 8.982 6.874 122.00	
ROUTING RESULTS INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	.000 .0000 .008 .6520 .251 .1704 AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	E+00   E+00   QPEAK (cms) .033 :ION [Qout LOW SED	.323 1.641 2.734 TPEAK (hrs) 1.333 3.367 t/Qin](%)= (min)=	.2527E+00 .2973E+00 .3206E+00 R.V. (mm) 8.983 8.982 6.874 122.00	
INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM D2:0009	AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	QPEAK (cms) .473 .033 TION [Qout LOW SED	TPEAK (hrs) 1.333 3.367 :/Qin](%)= (min)=	R.V. (mm) 8.983 8.982 6.874 122.00	
INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM D2:0009	AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	QPEAK (cms) .473 .033 TION [Qout LOW SED	TPEAK (hrs) 1.333 3.367 :/Qin](%)= (min)=	R.V. (mm) 8.983 8.982 6.874 122.00	
INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	AREA (ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	QPEAK (cms) .473 .033 TION [Qout LOW SED	TPEAK (hrs) 1.333 3.367 :/Qin](%)= (min)=	R.V. (mm) 8.983 8.982 6.874 122.00	
INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	(ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	(cms) .473 .033 TION [Qout LOW SED	(hrs) 1.333 3.367 :/Qin](%)= (min)=	(mm) 8.983 8.982 6.874 122.00	
INFLOW >01: (101 ) OUTFLOW<06: (POND O) PEAK F TIME SHI MAXIMUM 02:0009	(ha) 11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	(cms) .473 .033 TION [Qout LOW SED	(hrs) 1.333 3.367 :/Qin](%)= (min)=	(mm) 8.983 8.982 6.874 122.00	
PEAK F TIME SHI MAXIMUM 02:0009- EXTERNAL AREA #3	11.05 11.05 LOW REDUCT FT OF PEAK F STORAGE U	.473 .033 TION [Qout LOW SED	1.333 3.367 :/Qin](%)= (min)=	8.983 8.982 6.874 122.00	
PEAK F TIME SHI MAXIMUM 02:0009 EXTERNAL AREA #3	LOW REDUCT FT OF PEAK F STORAGE U	ION [Qout LOW SED	=/Qin](%)= (min)=	6.874 122.00	
PEAK F TIME SHI MAXIMUM 02:0009- EXTERNAL AREA #3	LOW REDUCT FT OF PEAK F STORAGE U	ION [Qout LOW SED	=/Qin](%)= (min)=	6.874 122.00	
CALIE NASHYD   Ar 08:EXT3 DT= 1.00   Ia	ea (ha)= (mm)=	4.36	Curve Nur	nber (CN)=57.00	
	H. Tp(hrs)=	.553			
Unit Hyd Qpeak (cms)=	.301				
PEAK FLOW (cms)=	.019 (i	3			
PEAK FLOW (cms)= TIME TO PEAK (hrs)=	2.100	-			
RUNOFF VOLUME (mm) =	3.078				
TOTAL RAINFALL (mm) =	32.772				
RUNOFF COEFFICIENT =	.094				
TOTAL RAINFALL (mm) =	32.772				

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C:\09-062\SWMHYMO\POST\CHI\POST2.out9 C:\09-062\SWMHYMO\POST\CHI\POST2.out10 Max.eff.Inten.(mm/hr)= 109.41 13,15 over (min) 3.00 15.00 3.03 (ii) 15.11 (ii) Storage Coeff. (min)= Unit Hyd. Tpeak (min)= 3.00 15.00 Unit Hyd. peak (cms)= .37 .08 *TOTALS* | START | Project dir.: C:\09-062\SWMHYMO\POST\CHI\ PEAK FLOW .62 .669 (iii) (cms) =.16 TIME TO PEAK (hrs)= 1.33 1.55 1.333 ----- Rainfall dir.: C:\09-062\SWMHYMO\POST\CHI\ RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = 41.79 6.91 13.714 43.79 43.79 43.791 TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) RUNOFF COEFFICIENT = .95 .16 .313 NRUN = 003 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: NSTORM= 1 CN* = 54.0 Ia = Dep. Storage (Above) # 1=5CH14.stm (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. 003:0002-----(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. *# Project Name: [221 FOX STREET SUBDIVISION] Project Number: [09-062] *# Date : 01-06-2013 003:0004------*# Modeller : [JR] *# Company : WMI & Associates Ltd. *# License # : 2880720 * EXTERNAL AREA #1 -----CALIB NASHYD | Area (ha)= 7.78 Curve Number (CN)=56.00 (mm)= 7.200 # of Linear Res.(N)= 3.00 02:EXT1 DT= 1.00 | Ia U.H. Tp(hrs)= .290 003:0002-----Unit Hyd Qpeak (cms)= 1.025 READ STORM Filename: 5-Year Chicago Storm Distribution (4-hou | Ptotal= 43.79 mm! Comments: 5-Year Chicago Storm Distribution (4-hou PEAK FLOW .096 (i) (cms) =-----TIME TO PEAK (brs) =1.683 TIME RAIN | TIME RAIN | TIME RAIN TIME RATN BUNDEE VOLUME (mm) = 5.669 TOTAL RAINFALL (mm) = hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/br 43.791 .17 3.077 | 1.17 18.812 | 2.17 6.603 | 3.17 3.599 RUNOFF COEFFICIENT = .129 .33 3.479 | 1.33 109.412 | 2.33 5.734 3.33 3.367 .50 4.030 1.50 24.075 2.50 5.091 3.50 (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 3.168 .67 4.838 1.67 13.572 2.67 4.594 1 2,993 3.67 . 83 4.197 | 6.162 / 1.83 9.837 | 2.83 3.83 2.840 -----1.00 8.836 | 2.00 7.853 | 3.00 3.872 | 4.00 2.703 * EXTERNAL AREA #2 -----003:0003------CALIB STANDHYD | Area (ha)= 6.14 * CATCHMENT 101 | 03:EXT2 DT= 1.00 | Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00 ____ CALIB STANDHYD Area (ha)= 11.05 IMPERVIOUS PERVIOUS (1) 01:101 DT= 1.00 | Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 Surface Area (ha)= 1.53 4.61 _____ Dep. Storage (mm) = 2.00 5.00 IMPERVIOUS PERVIOUS (i) Average Slope (%)= 3.00 8.00 Surface Area (ha)= 3.87 7,18 Length (m) = 150.00 90.00 Dep. Storage 2.00 (mm) = 6.70 Mannings n .013 .250 -Average Slope (%)= 2 00 5.00 Length (m) = 200.00 40.00 Max.eff.Inten.(mm/hr)= 109.41 12.97 Mannings n .013 .250 over (min) 2.00 19.00 01/02/2013 11:22:22 AM 9/20 01/02/2013 11:22:22 AM 10/20

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(ha)	QPEAK (cms)	.00 .06 .10 .63 .04 .79 .18 SSES: ove) QUAL F ANY. 	1.33 12.76 43.79 .29	(111) 3 6 1 2 	
= .2( = 1.3) = 41.7; = 43.7; = .9] LECTED FOR 1 Ia = Dep. St SHOULD BE ST SHOULD SHOULD SH	2 5 3 1 9 8 9 43 5 Derage (Ab MALLER OR E NT. BASEFLOW I QPEAK (cms)	.06 .10 .63 .04 .79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	.27 1.33 12.76 43.79 .29	(111) 3 6 1 2 	
= .2( = 1.3) = 41.7; = 43.7; = .9] LECTED FOR 1 Ia = Dep. St SHOULD BE ST SHOULD SHOULD SH	4 3 1 9 8 9 43 5 PERVIOUS LO Corage (Ab MALLER OR E WALLER OR E WT. BASEFLOW I COPEAK (cms)	.10 .63 .04 .79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	.27 1.33 12.76 43.79 .29	(111) 3 6 1 2 	
= 1.3; = 41.7; = 43.7; = .9! LECTED FOR 1 Ia = Dep. S: SHOULD BE SI SHOULD BE SI COEFFICIE! NOT INCLUDE AREA (ha)	3 1 9 8 9 43 5 PERVIOUS LO. Corage (Ab. MALLER OR E. VT. BASEFLOW I.  QPEAK (cms)	.63 .04 .79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	.27 1.33 12.76 43.79 .29	(111) 3 6 1 2 	
= 1.3; = 41.7; = 43.7; = .9! LECTED FOR 1 Ia = Dep. S: SHOULD BE SI SHOULD BE SI COEFFICIE! NOT INCLUDE AREA (ha)	3 1 9 8 9 43 5 PERVIOUS LO. Corage (Ab. MALLER OR E. VT. BASEFLOW I.  QPEAK (cms)	.63 .04 .79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	1.33 12.76 43.79 .29	3 6 1 2 2	
= 41.7: = 43.7: = .9! LECTED FOR 1 Ia = Dep. S: SNOULD BE SI & COEFFICIEN NOT INCLUDE AREA (ha)	9 8 9 43 5 PERVIOUS LO torage (Ab 4ALLER OR E TT. BASEFLOW I QPEAK (cms)	.04 .79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	12.76 43.79 .29		
AREA (ha)	9 43 5 borage (Ab MALLER OR E NT. BASEFLOW I QPEAK (cms)	. 79 .18 SSES: ove) QUAL F ANY. TPEAK (hrs)	43.79 .29		
= .91 LECTED FOR 1 Ia = Dep. St SHOULD BE SI SHOULD BE SI SCOEFFICIEI NOT INCLUDE AREA (ha)	PERVIOUS LO torage (Ab MALLER OR E NT. BASEFLOW I QPEAK (cms)	.18 SSES: ove) QUAL F ANY. TPEAK (hrs)	.29 	 	
LECTED FOR 1 Ia = Dep. S: SHOULD BE SI S COEFFICIE: NOT INCLUDE AREA (ha)	PERVIOUS LO torage (Ab MALLER OR E NT. BASEFLOW I QPEAK (cms)	SSES: ove) QUAL F ANY. TPEAK (hrs)	 R. V		
Ia = Dep. St SHOULD BE ST E COEFFICIEN NOT INCLUDE AREA (ha)	ALLER OR EN VT. BASEFLOW I OPEAK (cms)	QUAL F ANY. TPEAK (hrs)	R.V	0	
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V	0	
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V	0	
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V	0	
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V	0	
(ha)	(cms)	(hrs)	R.V	0	
(ha)	(cms)	(hrs)	R.V	0	
(ha)	(cms)	(hrs)	R.V	0	
(ha)	(cms)	(hrs)	R.V	0	
(ha) 6.14	(cms)	(hrs)	(	0	
6.14			(111)	·	
	.279 .279	1.333	12,76	6	
6.14	.279	1.483	12.76	6	
		ODEAN	<b>TDDA</b> *	B 17	
J. MAID	AREA (ha)	QPEAK	IPEAK	R.V.	DWE
0. EVT1	(114)	(cms)	(nrs)	(mm)	(cms)
S.BAIL	1.18	.096	1,68	5.67	.000
B:EXT2	6.14	279	1 33	12 77	.000
		. 2.19	1.00		.000
5:S-EXT1+2	13.92	,298	1.33	8,80	.000
	: NHYD :EXT1 :EXT2 :S-EXT1+2 INCLUDE B/	: NHYD AREA (ha) :EXT1 7.78 :EXT2 6.14 :S-EXT1+2 13.92 INCLUDE BASEFLOWS IF	(ha)       (cms)         (:EXT1       7.78       .096         ::EXT2       6.14       .279         :S-EXT1+2       13.92       .298         'INCLUDE BASEFLOWS IF ANY.	P: NHYD         AREA         QPEAK         TPEAK           (ha)         (cms)         (hrs)           1:EXT1         7.78         .096         1.68           :EXT2         6.14         .279         1.33           :S-EXT1+2         13.92         .298         1.33	D: NHYD         AREA         QPEAK         TPEAK         R.V.           (ha)         (cms)         (hrs)         (mm)           :EXT1         7.78         .096         1.68         5.67           :EXT2         6.14         .279         1.33         12.77           :S-EXT1+2         13.92         .298         1.33         8.80

ROUTE RESERVOIR     IN>01:(101 )	Requested routing time step = 1.0 min.
OUT<06:(POND O)	OUTLFOW STORAGE TABLE
	OUTFLOW STORAGE   OUTFLOW STORAGE
	(cms) (ha.m.)   (cms) (ha.m.)
	.000 .0000E+00   .323 .2527E+00
	.008 .6520E-01   1.641 .2973E+00
	.251 .1704E+00   2.734 .3206E+00

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11/20

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ROUTING RESU	JLTS			QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW >01; OUTFLOW<06:		) 0)	11.05	.669	1.333 2.483	13.714 13.714
	PEAL TIM	-	FLOW REDUCTION		/Qin](%)= (min)=	11.950 69.00

TIME SHI	FT OF PEAK	FLOW	(min)=	69.00
MAXIMUM	STORAGE	USED	(ha.m.)=.	9634E-01

#### 003:0009-----* EXTERNAL AREA #3

CALIB NASHYD     08:EXT3 DT= 1.00		Curve Number (CN)=57.00 # of Linear Res.(N)= 3.00

Unit Hyd Qpeak (cms)= .301

PEAK FLOW	(cms)=	.038	(i)
TIME TO PEAK	(hrs)=	2.067	
RUNOFF VOLUME	(mm) —	5.956	
TOTAL RAINFALL	(mm) =	43.791	
RUNOFF COEFFICI	ENT =	.136	

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

003:0010
003:0002
003:0002
** END OF RUN : 3

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START	i.	Project	dir.:	C:\09-062\SWMHYMO\POST\CHI\
		Rainfall	dir.:	C:\09-062\SWMHYMO\POST\CHI\
TZERO = METOUT= NRUN = 004 NSTORM= #	2 (outpi 4	ut = METR	0 IC)	
004:0002				

01/02/2013 11:22:22 AM

C:\09-062\SWMHYMO\POST\CHI\POST2.out13	C:\09-062\SWMHYMO\POST\CHI\POST2.out
#*************************************	
<pre># Date : 01-06-2013 # Modeller : [JR] # Company : WMI &amp; Associates Ltd.</pre>	004:0004 * EXTERNAL AREA #1
# License # : 2880720 #************************************	! CALIB NASHYD ( Area (ha)= 7.78 Curve Number (CN)=56.00   02:EXT1 DT=1.00 ( Ia (mm)= 7.200 # of Linear Res.(N)= 3.00 
04:0002	-
READ STORM   Filename: 25-Year Chicago Storm Distribution (4-ho Ptotal= 60.08 mm   Comments: 25-Year Chicago Storm Distribution (4-ho	Unit Hyd Qpeak (cms)= 1.025 PEAK FLOW (cms)= .197 (i)
	TIME TO PEAK (hrs) = 1.667
TIME RAIN   TIME RAIN   TIME RAIN   TIME RAIN	RUNOFF VOLUME $(nm) = 11.076$
hrs mm/hr   hrs mm/hr   hrs mm/hr   hrs mm/hr	TOTAL RAINFALL (mm) = 60.078
.17 4.238   1.17 25.827   2.17 9.082   3.17 4.956 .33 4.791   1.33 149.649   2.33 7.889   3.33 4.637	RUNOFF COEFFICIENT = .184
.55  4.751  4.55  4.457  .50  5.548  1.55  33.039  2.50  7.007  3.50  4.362	(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
.67 6.658   1.67 18.646   2.67 6.324   3.67 4.123	
.83 8.477   1.83 13.522   2.83 5.778   3.83 3.911	
1.00 12.149   2.00 10.799   3.00 5.330   4.00 3.724	004:0005* EXTERNAL AREA #2
04:0003	CALIB STANDHYD   Area (ha)= 6.14
04:0003CATCHMENT 101	
04:0003 CATCHMENT 101 CALIE STANDHYD   Area (ha)= 11.05	<pre>/ CALIB STANDHYD / Area (ha)= 6.14 / 03:EXT2 DT= 1.00 / Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00 ///////////////////////////////////</pre>
04:0003	<pre>( CALIE STANDHYD   Area (ha)= 6.14 ( 03:EXT2 DT= 1.00   Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00</pre>
04:0003	$ \begin{array}{c c} \hline \begin{array}{c} ( \ CALIB \ STANDHYD &   \ Area & (ha) = & 6.14 \\   \ ( \ O3:EXT2 & DT = 1.00 &   \ Total \ Imp(\$) = & 25.00 \ Dir. \ Conn.(\$) = & 14.00 \\ \hline \\ Surface \ Area & (ha) = & 1.53 & 4.61 \\ \hline \\ Dep. \ Storage & (nm) = & 2.00 & 5.00 \\ \hline \end{array} $
04:0003	$ \begin{array}{c c} \text{CALIB STANDHYD} & \text{Area} & (ha) = & 6.14 \\ \hline 03:\text{EXT2} & \text{DT} = 1.00 & \text{Total Imp}(\$) = & 25.00 & \text{Dir. Conn.}(\$) = & 14.00 \\ \hline \\ & \text{IMPERVIOUS} & \text{PERVIOUS} & (i) \\ \hline \\ \text{Surface Area} & (ha) = & 1.53 & 4.61 \\ \hline \\ \text{Dep. Storage} & (mm) = & 2.00 & 5.00 \\ \hline \\ \text{Average Slope} & (\$) = & 3.00 & 8.00 \\ \end{array} $
04:0003	$ \begin{array}{c c} \hline \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
04:0003	$ \begin{array}{c c} \text{CALIB STANDHYD} & \text{Area} & (ha) = & 6.14 \\ \hline \text{(03:EXT2} & \text{DT} = 1.00 & \text{Total Imp}(\$) = & 25.00 & \text{Dir. Conn.}(\$) = & 14.00 \\ \hline \\ & \text{IMPERVIOUS} & \text{PERVIOUS}(i) \\ \text{Surface Area} & (ha) = & 1.53 & 4.61 \\ \text{Dep. Storage} & (mm) = & 2.00 & 5.00 \\ \text{Average Slope} & (\$) = & 3.00 & 8.00 \\ \text{Length} & (m) = & 150.00 & 90.00 \\ \text{Mannings n} & = & .013 & .250 \\ \end{array} $
04:0003	<pre>( CALIB STANDHYD</pre>
04:0003	<pre>( CALIB STANDHYD   Area (ha)= 6.14   03:EXT2 DT=1.00   Total Imp(%)= 25.00 Dir. Conn.(%)= 14.00 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 1.53 4.61 Dep. Storage (mm)= 2.00 5.00 Average Slope (%)= 3.00 8.00 Length (m)= 150.00 90.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr)= 149.65 27.78 over (min) 2.00 15.00</pre>
04:0003	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
D4:0003	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
D4:0003	$\label{eq:constraint} \begin{array}{ c c c c c c c c c c c c c c c c c c c$
04:0003	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
D4:0003	$\label{eq:constraint} \begin{array}{ c c c c c c c c c c c c c c c c c c c$
D4:0003	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
D4:0003	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
Od:0003	$ \begin{array}{c c} \mbox{(ALIE STANDHYD} &   & Area & (ha) = & 6.14 \\ \mbox{(031EXT2} & DT = 1.00 &   & Total Imp(%) = & 25.00 & Dir. Conn.(%) = & 14.00 \\ \hline & & IMPERVIOUS & PERVIOUS (i) \\ \mbox{Surface Area} & (ha) = & 1.53 & 4.61 \\ \mbox{Dep. Storage} & (mm) = & 2.00 & 5.00 \\ \mbox{Average Slope} & (%) = & 3.00 & 8.00 \\ \mbox{Length} & (m) = & 150.00 & 90.00 \\ \mbox{Mannings n} & = & .013 & .250 \\ \hline & Max.eff.Inten.(mm/hr) = & 149.65 & 27.78 \\ & & over (min) & 2.00 & 15.00 \\ \mbox{Storage Coeff. (min) = } & 1.99 (ii) & 14.64 (ii) \\ \mbox{Unit Hyd. Tpeak (min) = } & 2.00 & 15.00 \\ \mbox{Unit Hyd. peak (cms) = } & .56 & .08 \\ \hline & & & & & \\ \hline & & & & & \\ \hline & PEAK FLOW & (cms) = & .35 & .22 & .427 (iii) \\ \mbox{TIME TO PEAK (hrs) = } & 1.33 & 1.55 & 1.333 \\ \mbox{RUNOFF VOLUME (mm) = } & 60.08 & 60.08 & 60.078 \\ \mbox{RUNOFF COEFFICIENT = } & .97 & .25 & .347 \\ \hline \end{array} $
O4:0003	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
04:0003	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
01:101 DT= 1.00 Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 IMPERVICUS PERVICUS (i) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm)= 2.00 6.70 Average Slope (%)= 2.00 5.00 Length (m)= 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr)= 149.65 30.96 over (min) 3.00 11.00 Storage Coeff. (min)= 2.68 (ii) 11.25 (ii) Unit Hyd. Tpeak (min)= 3.00 11.00 Voit Hyd. Tpeak (min)= 3.00 11.00 Unit Hyd. peak (cms)= .40 .10 *TOTALS* PEAK FLOW (cms)= .87 .37 1.040 (iii) TIME TO PEAK (hrs)= 1.33 1.48 1.333 RUNOFF VOLUME (mm)= 58.06 13.03 21.814 TOTAL RAINFALL (mm)= 60.08 60.078 RUNOFF COEFFICIENT = .97 .22 .363 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:	$\begin{tabular}{ c c c c c c } \hline Area (ha) &= 6.14 \\ \hline (03:EXT2 DT = 1.00 & Total Imp(%) &= 25.00 Dir. Conn.(%) &= 14.00 \\ \hline & IMPERVIOUS PERVIOUS (i) \\ \hline Surface Area (ha) &= 1.53 4.61 \\ Dep. Storage (mm) &= 2.00 5.00 \\ Average Slope (%) &= 3.00 8.00 \\ Length (m) &= 150.00 90.00 \\ \hline Mannings n &= .013 .250 \\ \hline Max.eff.Inten.(mm/hr) &= 149.65 27.78 \\ & over (min) 2.00 15.00 \\ Storage Coeff. (min) &= 1.99 (ii) 14.64 (ii) \\ Unit Hyd. Tpeak (mn) &= 2.00 15.00 \\ \hline Unit Hyd. peak (cms) &= .56 .08 \\ & *TOTALS* \\ \hline PEAK FLOW (cms) &= .35 .22 .427 (iii) \\ TIME TO PEAK (hrs) &= 1.33 1.55 1.333 \\ RUNOFF VOLUME (mm) &= 58.08 14.81 20.865 \\ TOTAL RAINFALL (mm) &= 60.08 60.08 60.078 \\ RUNOFF COEFFICIENT &= .97 .25 .347 \\ \hline (i) CN FROCEDURE SELECTED FOR PERVIOUS LOSSES: \\ CN* &= 59.0 Ia = Dep. Storage (Above) \\ \hline (ii) TIME STEP (DT) SHOULD BE SMALER OR EQUAL THAN THE STORAGE COEFFICIENT. \\ \hline \end{tabular}$
Od:0003	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
CATCHMENT 101 CALTE STANDHYD   Area (ha)= 11.05 01:101 DT= 1.00   Total Imp(%)= 35.00 Dir. Conn.(%)= 19.50 IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 3.87 7.18 Dep. Storage (mm)= 2.00 6.70 Average Slope (%)= 2.00 5.00 Length (m)= 200.00 40.00 Mannings n = .013 .250 Max.eff.Inten.(mm/hr)= 149.65 30.96 over (min) 3.00 11.00 Storage Coeff. (min)= 2.68 (ii) 11.25 (ii) Unit Hyd. Tpeak (min)= 3.00 11.00 Storage Coeff. (min)= 40 .10 *TOTALS* PEAK FLOW (cms)= .40 .10 *TOTALS* PEAK FLOW (cms)= .87 .37 1.040 (iii) TIME TO PEAK (hrs)= 1.33 1.48 1.333 RUNOFF VOLUME (mm)= 58.08 13.03 21.814 TOTAL RAINFALL (mm)= 60.08 60.08 60.078 RUNOFF COEFFICIENT = .97 .22 .363 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 54.0 Ia = Dep. Storage (Above) (ii) TIME STORAGE COEFFICIENT.	I CALIB STANDHYD       Area $(ha) = 6.14$ (03:EXT2       DT=1.00       Total Imp(%) = 25.00       Dir. Conn.(%) = 14.00         IMPERVIOUS       PERVIOUS (i)         Surface Area $(ha) = 1.53$ 4.61         Dep. Storage $(mm) = 2.00$ 5.00         Average Slope       (%) = 3.00       8.00         Length $(m) = 150.00$ 90.00         Mannings n       = 0.013       .250         Max.eff.Inten.(mm/hr) =       149.65       27.78         over (min)       2.00       15.00         Storage Coeff.       (min) =       1.99 (ii)         Unit Hyd. Tpeak (min) =       2.00       15.00         Unit Hyd. peak (cons) =       .56       .08         PEAK FLOW       (cons) =       .56       .08         THE TO PEEX (hrs) =       1.33       1.55       1.333         RUMOFF VOLUME       (mm) =       58.08       14.61       20.865         TOTAL RAINFALL       (mm) =       60.08       60.078       .347         (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:       .347       .347         (ii) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:       .347       .347         (
04:0003	I CALIB STANDHYD       Area $(ha) = 6.14$ (03:EXT2       DT=1.00       Total Imp(%) = 25.00       Dir. Conn.(%) = 14.00         IMPERVIOUS       PERVIOUS (i)         Surface Area $(ha) = 1.53$ 4.61         Dep. Storage $(mm) = 2.00$ 5.00         Average Slope       (%) = 3.00       8.00         Length $(m) = 150.00$ 90.00         Mannings n       = .013       .250         Max.eff.Inten.(mm/hr) =       149.65       27.78         over (min)       2.00       15.00         Storage Coeff. (min) =       1.99 (ii)       14.64 (ii)         Unit Hyd. Tpeak (min) =       2.00       15.00         Storage Coeff. (min) =       1.99 (ii)       14.64 (ii)         Unit Hyd. Tpeak (min) =       2.00       15.00         Unit Hyd. peak (coms) =       .56       .08         *TOTALS*       *TOTALS*         PEAK FLOW       (coms) =       .35       .22       .427 (iii)         TIME TO PEAK (hrs) =       1.33       1.55       1.333         RUMOFF VOLUME       (mm) =       58.08       14.81       20.865         TOTAL RAINFALL       (mm) =       .97
04:0003	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $

SHIFT HYD(S-EXT2 )   IN= 3> OUT= 4   SHIFT= 10.0 min ID= 3:EXT2 SHIFT ID= 4:S-EXT2	1	QPEAK (cms) .427 .427	TPEAK (hrs) 1.333 1.483	R.V. (mm) 20.865 20.865	
004:0007					
ADD HYD (S-EXT1+2 )	- ID: NHYD	AREA	QPEAK	TPEAK R.V	. DWF
ADD HYD (S-EXT1+2 )	- 1 02:EXT1	(ha) 7,78	(cms) .197	(hrs) (mm 1.67 11.0	) (cms) 8 .000
				1.33 20.8	
SU	M 05:S-EXT1+2	13.92	.473	1.33 15.3	9.000
04:0008					
ROUTE RESERVOIR   IN>01:(101)	Requested rou	ting time	step = 1.	0 min.	
IN>01: (101 )   OUT<06: (POND O)	00	JTLFOW STOR	AGE TABLE		
	OUTFLOW SI	ORAGE	OUTFLOW	STORAGE	
	(Cms) (n .000 .001	)0E+00 )	(CmS)	(na.m.) 25275±00	
	.008 .652	20E-01	1.641	.2973E+00	
	OUTFLOW SI (cms) (h .000 .000 .008 .652 .251 .170	04E+00	2.734	.3206E+00	
ROUTING RESULTS					
	1.10.7	(cms)	(hrs)	(mm)	
INFLOW >01: (101 OUTFLOW<06: (POND	) 11.05	1.040	1.333	21.814	
OUTFLOW<06: (POND	0} 11.05	.171	2.117	21.813	
PEAK	FLOW REDUC	TION [Qout.	/Qin](%)=	16.426	
TIME	SHIFT OF PEAK	FLOW	(min) =	47,00	
MAXI	MUM STORAGE	UŞED	(ha.m.)=.	1357E+00	
04:0009					
EXTERNAL AREA #3					
CALIB NASHYD	Area (ba)-	4 36	Currie Nue		7 00
08:EXT3 DT= 1.00	T-> (	C 000	# of Line	ar Res.(N)=	3.00
	u.H. Tp(hrs)=	553			
Unit Hyd Qpeak (c	ms)= .301				
01/02/2013 11:22:22 AM					15/20
11/02/2013 11:22:22 AM					15/20

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PEAK FLOW	(cms) =	.075	(i)
TIME TO PEAK	(hrs) =	2.033	
RUNOFF VOLUME	(mm) =	11.552	
TOTAL RAINFALL	(mm) =	60.078	
RUNOFF COEFFICI	ENT =	.192	

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

004-0010
004:0010
004:0002
004:0002
** END OF RUN : 4

C:\09-062\SWMHYMO\POST\CHI\POST2.out16

START	1 1	Project	dir.:	C:\09-062	SWMHYM	O\POST\CHI		
	1	Rainfall	dir.:	C:\09-062	SWMHYM	O\POST\CHI\		
TZERO = .00 MEICUT= 2 ( NRUN = 005 NSTORM= 1 # 1=1	output 00CHI4	t = METRI 4.stm	IC)		·			
005:0002	[22] 01-08 [JR] WMI 8 2880	FOX STRE 5-2013 Associa 0720	ET SU	blivision]	******* Pro	*************		**************************************
005:0002								
	ատվ  E I s സյ	Comment RAIN   n/hr	tis: 100 TIME hrs	0-Year Chic RAIN   mm/hr	ago St TIME hrs	orm Distrik RAIN   mm/hr	oution TIME hrs	(4-h RAIN mm/hr
.1	75.	248	1.17	31,788	2.17	11.222	3.17	6.134

01/02/2013 11:22:22 AM

.33	5.931	1.33	182.809	2.33	9.752	3.33	5.741
.50	6.865	1.50	40.631	2.50	8.664	3.50	5.402
.67	8.234	1.67	22.982	2,67	7.822	3.67	5,106
.83	10.476	1.83	16.686	2.83	7.149	3.83	4.845
1.00	14.996	2.00	13.336	3.00	6.596	4.00	4.613

CALIB STANDHYD 01:101 DT= 1.00	Area   Total	(ha)= . 1mp(%)=	11.05 35.00 D	ir. Conn.	(%)= 19	.50
	-	IMPERVIOU	S PERVIO	US (i)		
Surface Area	(h=)-	3 87	7 1	Q		
Dep. Storage Average Slope Length	(mm) =	2.00	6.7	0		
Average Slope	(%)=	2.00	5.0	0		
Length	(m) =	200.00	40.0	0		
Mannings n	=	.013	.25	U		
Max.eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak	m/hr)=	182.81	52.7	9		
over	(min)	2.00	9.0	0		
Storage Coeff.	(min)=	2.47	(ii) 9.3	9 (ii)		
Unit Hyd. Tpeak	(min)=	2.00	9.0	0		
Unit Hyd. peak	(cms) =	.48	.1.	2		
DEAK FLOW	(	1 07	.6		*TOTALS*	4.4.2.5
PEAK FLOW TIME TO PEAK	(cms) =	1.07	.0	5	1.454 ( 1.333	111)
DINORE VOLUME	(mm) =	71 04	10.2	2 C	20 511	
RUNOFF VOLUME TOTAL RAINFALL	(mm) -	71.04	15.2	4	72 020	
RUNOFF COEFFICIE					.400	
(i) CN PROCEDU CN* = 54. (ii) TIME STEP THAN THE S (iii) PEAK FLOW	0 Ia = (DT) SHOU TORAGE CO	- Dep. Sto JLD BE SMA DEFFICIENT	rage (Abov LLER OR EQU	e) AL		
005:0004						
CALIB NASHYD 02:EXT1 DT= 1.00	Ia	(mm) =	7.200 #	urve Numb of Linea	er (CN) r Res.(N)	=56.00 = 3.00
Unit Hyd Opeak	(cms)=	1.025				
	(ama).	.304 (i	)			

01/02/2013 11:22:22 AM

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17/20

C:\09-062\SWMHYMO\POST\CHI\POST2.out18

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD	Area	(ha)=	£ 14				
03:EXT2 DT= 1.00				Dir. Cor	nn.(%)=	14.00	
		IMPERVIO	ועפיזס פו	OUS (i)			
Surface Area							
Dep. Storage	(mm) =	2.00	5.				
Dep. Storage Average Slope	(%)=	3.00	8.				
Length	(m) =	150.00	90.				
Length Mannings n	=	.013					
Max.eff.Inten.(mm	/hr)=	182.81	47.	07			
over (	min)	2.00	12.	.00			
Storage Coeff. (	min)=	1.84	(ii) 12.	08 (ii)			
Unit Hyd. Tpeak (	min)=	2.00	12.	00			
Max.eff.Inten.(mm over() Storage Coeff () Unit Hyd. Tpeak ( Unit Hyd. peak ( PEAK FLOW ()	cms) =	.59		.09			
					*TOTAL	S*	
						9 (iii)	
TIME TO PEAK (	hrs)=	1.33	1.	50	1.33		
RUNOFF VOLUME TOTAL RAINFALL	(mm) =	71.84	21.	.61	28.63		
		73 84		84	73.83		
TOTAL RAINFALL	(1017) -	,5104	13.				
(i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP (	T = E SELECT Ia =	.97 ED FOR PI Dep. Sto	ERVIOUS LOS brage (Abo	.29 SSES: ove)	.38		
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0	T = E SELECT Ia = DT) SHOU ORAGE CC	.97 ED FOR PP Dep. Sto LD BE SMA DEFFICIENT	ERVIOUS LOS Drage (Abo ALLER OR EQ I.	.29 SSES: Dve) DUAL			
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( TPAN THE ST (iii) PEAK FLOW D	T = E SELECT Ia = DT) SHOU ORAGE CO OES NOT	.97 ED FOR PH Dep. Sto LD BE SMU EFFICIENT INCLUDE H	ERVIOUS LOS Drage (Abo ALLER OR Εζ Γ. BASEFLOW IF	29 SSES: DVe) DUAL 7 ANY.			
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( TPAN THE ST (iii) PEAK FLOW D	T = E SELECT Ia = DT) SHOU ORAGE CO OES NOT	.97 ED FOR PH Dep. Sto LD BE SMU EFFICIENT INCLUDE H	ERVIOUS LOS Drage (Abo ALLER OR Εζ Γ. BASEFLOW IF	29 SSES: DVe) DUAL 7 ANY.			
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT	.97 ED FOR PH Dep. Sto LD BE SMU EFFICIENT INCLUDE H	ERVIOUS LOS Drage (Abo ALLER OR Εζ Γ. BASEFLOW IF	29 SSES: DVe) DUAL 7 ANY.			
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) THME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PF Dep. St LD BE SMU EFFICIENT INCLUDE 1	ERVIOUS LOS Drage (Abc ALLER OR EC I. BASEFLOW IE	29 SSES: DVe) QUAL F ANY.	.38	8	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( THAN THE ST (iii) PEAK FLOW D 	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PF Dep. St LD BE SMU EFFICIENT INCLUDE 1	ERVIOUS LOS Drage (Abc ALLER OR EC I. BASEFLOW IE	29 SSES: DVe) QUAL F ANY.	.38	8	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) THME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PF Dep. Sto LD BE SMA EFFICIENT INCLUDE I AREA (ha)	CPEAK (Cms)	29 SSES: DVe) DUAL F ANY. TPEAK (hrs)	.38  R.V (mm	8 	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PF Dep. Sto LD BE SMA EFFICIENT INCLUDE I AREA (ha)	CPEAK (Cms)	29 SSES: DVe) DUAL F ANY. TPEAK (hrs)	.38  R.V (mm	8 	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PF Dep. Sto LD BE SMA EFFICIENT INCLUDE I AREA (ha)	DERVIOUS LOS Drage (Abc ALLER OR EQ I. BASEFLOW IE	29 SSES: DVe) DUAL F ANY. TPEAK (hrs)	.38  R.V (mm	8 	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. Std LD BE SM EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14	ERVIOUS LOS Drage (Abc ALLER OR EQ I. BASEFLOW IN OPEAK (cms) .599 .599	29 SSES: DVe) JUAL 7 ANY. TPEAK (hrs) 1.333 1.483	.38 R.V (nm 28.63 28.63	8  7. 19 9 9	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT IA = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. Std LD BE SM EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14	ERVIOUS LOS Drage (Abc ALLER OR EQ I. BASEFLOW IN OPEAK (cms) .599 .599	29 SSES: DVe) JUAL 7 ANY. TPEAK (hrs) 1.333 1.483	.38 R.V (nm 28.63 28.63	8  7. 19 9 9	
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEF ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. St. LD BE SM EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14	CPUIOUS LOS Drage (Abc ALLER OR EC I. BASEFLOW IE OPEAK (cms) .599 .599 .599 .599	29 SSES: DVAL 7 ANY. TPEAK (hrs) 1.333 1.483 	.38 R.V (mm 28.63 28.63 	8  )) 99 99  R.V.	DWF
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. St LD BE SMU EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14	CPUIOUS LOS Drage (Abc ALLER OR EC I. BASEFLOW IE OPEAK (cms) .599 .599 .599 .599	29 SSES: DVAL 7 ANY. TPEAK (hrs) 1.333 1.483 	. 38 R.V (mm 28.63 28.63 	8  )) 99 99  R.V.	DWF
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. St. LD BE SMI EFFICIENT INCLUDE 1 AREA (ha) 6.14 6.14 6.14	CPEAK (Cms) .599 .599	29 SSES: DVAL 7 ANY. TPEAK (hrs) 1.333 1.483 	. 38 R.V (mm 28.63 28.63 	8  )) 99 99  R.V.	DWF
RUNOFF COEFFICIEN (i) CN PROCEDUR CN* = 59.0 (ii) TIME STEP ( THAN THE ST (iii) PEAK FLOW D 05:0006 SHIFT HYD(S-EXT2 IN= 3> OUT= 4 SHIFT= 10.0 min ID= 3:EXT2 SHIFT ID= 4:S-EXT2 05:0007 ADD HYD (S-EXT1+2 ) I	T = E SELECT Ia = DT) SHOU ORAGE CC OES NOT 	.97 ED FOR PI Dep. Stu LD BE SMM EFFICIEN: INCLUDE 1 AREA (ha) 6.14 6.14 6.14 1 HYD	CPUIOUS LOS Drage (Abc ALLER OR EC I. BASEFLOW IE OPEAK (cms) .599 .599 .599 .599	29 35ES: )VAL 7 ANY. 7 ANY. 1, 333 1, 483 1, 483 2,	.38 R.V (mm 28.63 28.63 	8  )) 9 9  R.V. (mm) 16.68	DWF (cms) .000

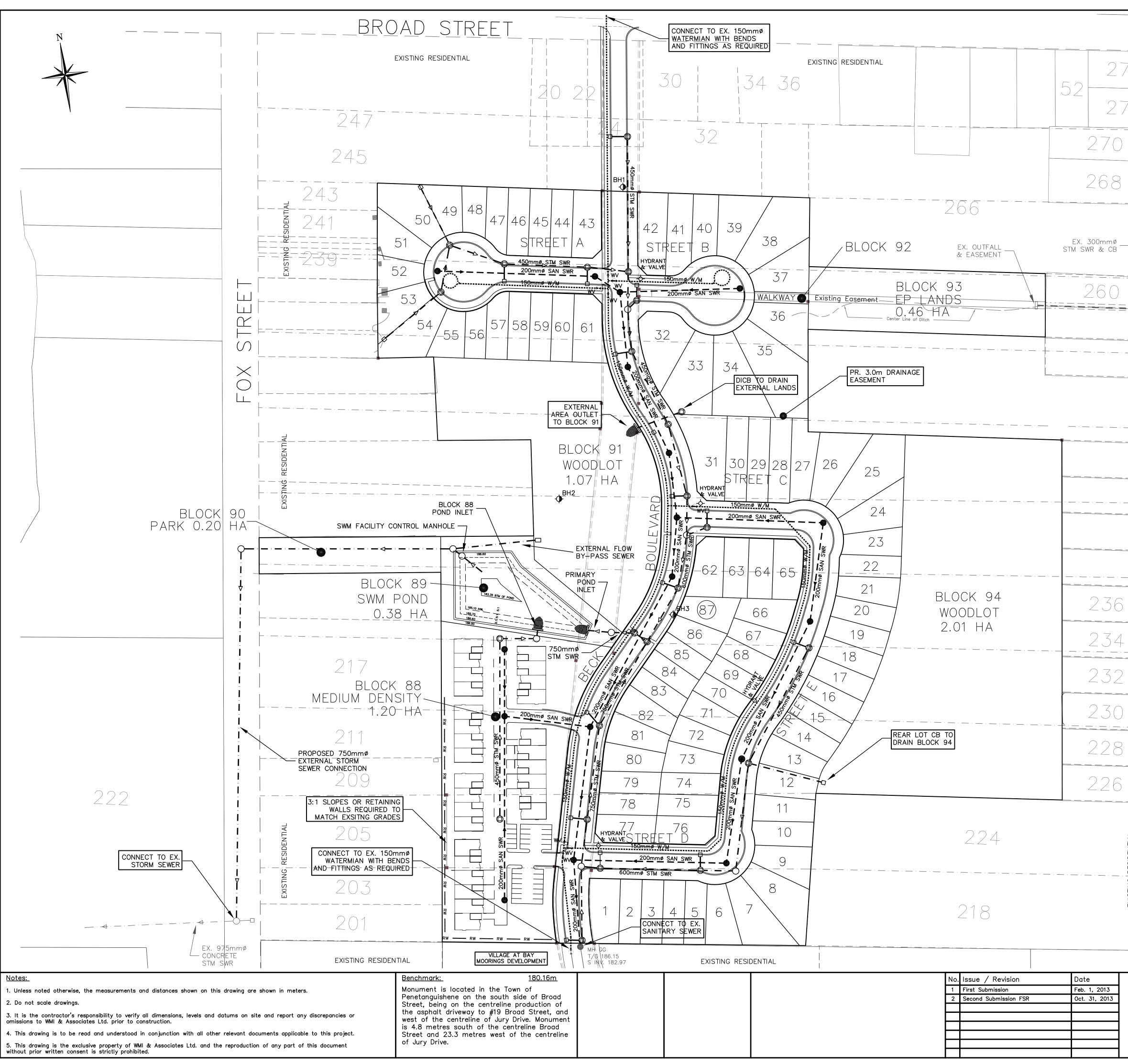
01/02/2013 11:22:22 AM

SUM 05:S-EXT1+2       13.92       .718       1.50       21.96       .000         NOTE:       PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.         005:0006	:0002
SUM 05:S-EXT1+2       13.92       .718       1.50       21.96       .000         NOTE:       PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.         05:0006	:0002 FINISH WARNINGS / ERRORS / NOTES
205:0008	**************************************
ROUTE RESERVOIR               Requested routing time step = 1.0 min.         IN>01:(101)	
ROUTE RESERVOIR       Requested routing time step = 1.0 min.         IN>01:(101 ) (       OUTFLOW STORAGE TABLE ====================================	Simulation ended on 2013-01-06 at 15:05:02
ROUTING RESULTS       AREA       QPEAK       TPEAK       R.V.         INFLOW >01: (101 )       11.05       1.454       1.333       29.511         OUTFLOW<06: (POND 0)       11.05       .255       2.017       29.510         FEAK       FLOW       REDUCTION [Qout/Qin] (%) =       17.542         TIME SHIFT OF PEAK FLOW       (min) =       41.00         MAXIMUM STORAGE       USED       (ha.m.) =       .1751E+00         PO5:0009	
TIME SHIFT OF PEAK FLOW       (min)= 41.00         MAXIMUM STORAGE USED       (ha.m.)=.1751E+00         005:0009	
CALIB NASHYD         Area       (ha) =       4.36       Curve Number       (CN) = 57.00         08:EXT3       DT =       1.00         Ia       (mm) =       6.900 # of Linear Res.(N) =       3.00          U.H.       Tp(hrs) =       .553         Unit Hyd Qpeak       (cms) =       .301         PEAK FLOW       (cms) =       .115 (i)         TIME TO PEAK       (hrs) =       2.017         RUNOFF VOLUME       (mm) =       17.330         TOTAL RAINFALL       (mm) =       73.838	
PEAK FLOW $(cms) = .115$ (i)         TIME TO PEAK $(hrs) = 2.017$ RUNOFF VOLUME $(mm) = 17.330$ TOTAL RAINFALL $(mm) = 73.838$	
TIME TO PEAK (hrs)= 2.017 RUNOFF VOLUME (mm)= 17.330 TOTAL RAINFALL (mm)= 73.838	
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	
05:0010	
05:0002	
05:0002	

### and the second second

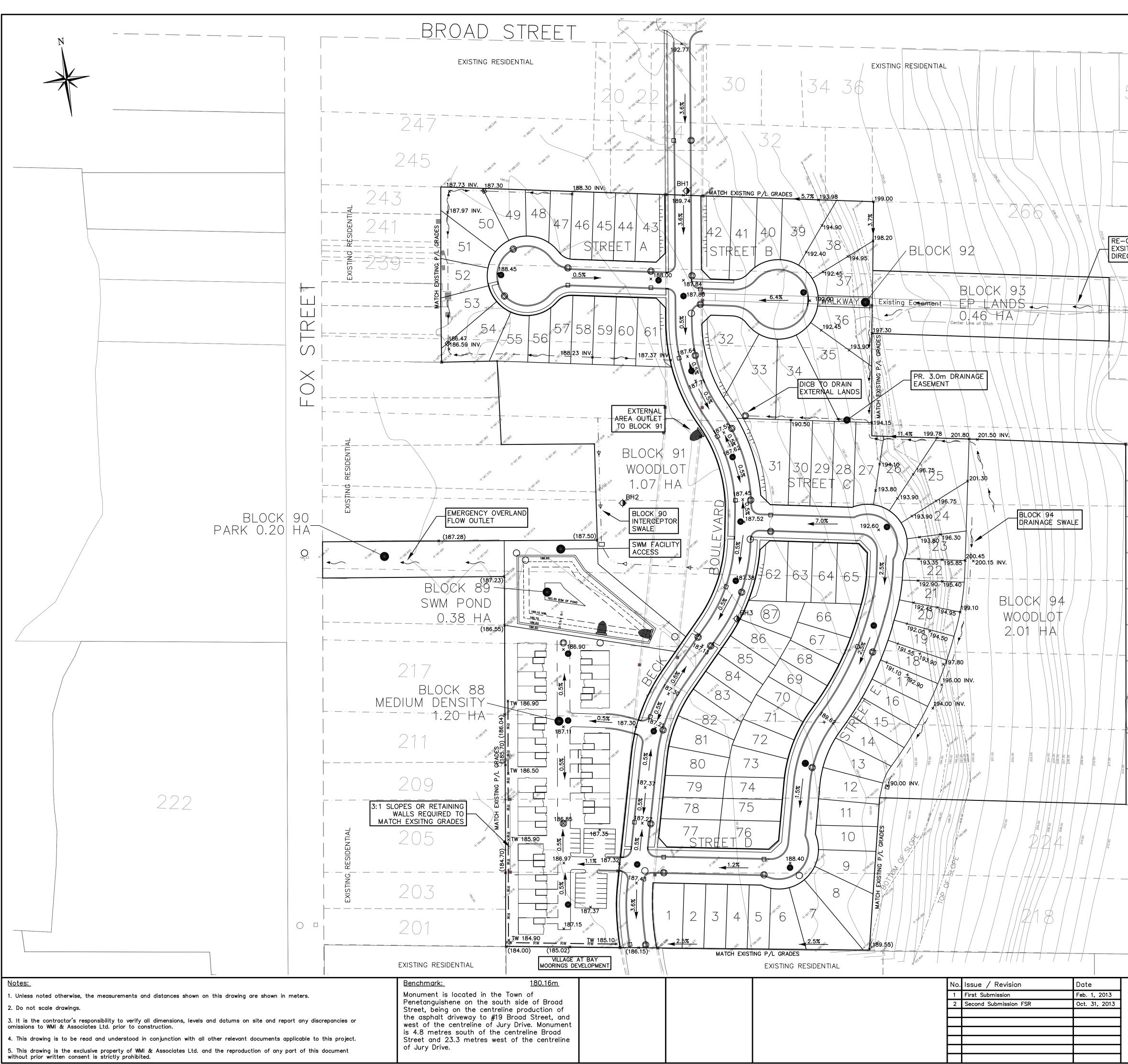
**General Servicing and Lot Grading Concept Plans** 

Appendix D



\Wmi—server\wmi—server\Data\Projects\2009\09-062\CAD\WMI\2nd_Subm\131030-Base.dwg, 2013-10-31_10:58:23_AM, 1:1

				Key Plan:
74		283 60	6 {	SUBJECT SITE
		277 275		Legend: EXISTING FEATURES (EX) EX SIB EX SIB EX IB EX IRON BAR EX WS EX WS EX WATER SERVICE EX IB EX IRON BAR EX HYD EX FIRE HYD. EX SIGN
		273	12	SS EX STOP SIGN 123.45 EX ELEVATION X EX FENCE EX U/G GASMAIN EX U/G BELL EX WY EX WY
		271	8	EX SAN @ 0.0% EX SAN @ 0.0% EX STM @ 0.0% EX STM @ 0.0% EX STM SEWER & MH PROPOSED FEATURES (PR) 
RESIDENTIAL		267		
EXING RES				Image: Description of the second s
E K		265		00mmø W/M PR WATERMAIN & VALVE → PR FIRE HYDRANT PR WATER VALVE 0m-00mmø SAN @ 0.0% PR SAN SEWER
 		263		MH K PR SANITARY MANHOLE Om-00mmø STM @ 0.0% MH 4 PR CATCHBASIN MANHOLE
 		261		MH 4       PR MANHOLE         PR CATCHBASIN         000.00       PROPOSED ELEVATION         x       (000.00)         MATCH GRADES AT P/L         x       PR SWALE
   		257		
	URC URC			
EXISTING RESIDENTIAL				
EXISTING				
TIAL				
EXISTING RESIDENTIAL				
EXISTIN				
	221 50	DX STREET SUBDIVISION	<u>Client:</u> Queen's Court	WMI & Associates Limited 119 Collier Street
	<u>GEN</u>	NERAL SERVICING CONCEPT PLAN	Queen's Court Development Limited 55 Temperance St. Suite 700 Toronto, Ontario	Barrie, Ontario L4M 1H5 Ph 705-797-2027 www.wmiengineering.ca
				Drawn By TG Checked By DAI Drawing No. Scale 1:1000 Project No. 09-062 GEN



\Wmi-server\wmi-server\Data\Projects\2009\09-062\CAD\WMI\2nd_Subm\131030-Base.dwg, 2013-10-31_10:59:46_AM, 1:1

		1 1	
274 52 272 272	283 60	226.00	Key Plan:         SUBJECT         SITE         SITE         Legend:         EXISTING FEATURES (EX)
268         grade ditch within ting easment to ct flows to new dice         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         260         270         280         291         202         203         204         205         205         206         207         208         209         200         200         200         200         200 <t< th=""><th>275 ¹⁰⁰ 273 273 271 267 265 263 261</th><th></th><th>EX SIB       EX STD IRON BAR       EX WATER SERVICE         EX IB       EX IRON BAR       EX HYD EX FIRE HYD.         EX UP       EX UTILITY POLE       INS EX ST NAME SIGN         EX BELL PED       SS EX STOP SIGN         123.45       EX ELEVATION         EX U/G GASMAIN       EX U/G GASMAIN         EX U/G BELL       EX U/G BELL         EX STM @ 0.0%       EX STM SEWER &amp; MH         EX STM @ 0.0%       EX STM SEWER &amp; MH         EX STM @ 0.0%       EX STM SEWER &amp; MH         EX STM @ 0.0%       FR STREET NAME SIGN         EX STM @ 0.0%       PR STREET NAME SIGN         EX STM @ 0.0%       PR STREET NAME SIGN         FR SS       PR STREET LIGHT         PR STREET LIGHT       PR W         PR STREET LIGHT       PR WATER SERVICE         PR HYDRO TRANSFORMER       OOMMØ W/M         OOMMØ W/M       PR WATER VALVE         PR FIRE HYDRANT       PR SAN SEWER         OMH K       PR SAN SEWER         MH 4       PR KATER SERVICE         PR SAN SEWER       MH 4         PR CATCHBASIN       PR SAN SEWER         MH 4       PR KANHOLE         PR SWALE       PR SWALE   </th></t<>	275 ¹⁰⁰ 273 273 271 267 265 263 261		EX SIB       EX STD IRON BAR       EX WATER SERVICE         EX IB       EX IRON BAR       EX HYD EX FIRE HYD.         EX UP       EX UTILITY POLE       INS EX ST NAME SIGN         EX BELL PED       SS EX STOP SIGN         123.45       EX ELEVATION         EX U/G GASMAIN       EX U/G GASMAIN         EX U/G BELL       EX U/G BELL         EX STM @ 0.0%       EX STM SEWER & MH         EX STM @ 0.0%       EX STM SEWER & MH         EX STM @ 0.0%       EX STM SEWER & MH         EX STM @ 0.0%       FR STREET NAME SIGN         EX STM @ 0.0%       PR STREET NAME SIGN         EX STM @ 0.0%       PR STREET NAME SIGN         FR SS       PR STREET LIGHT         PR STREET LIGHT       PR W         PR STREET LIGHT       PR WATER SERVICE         PR HYDRO TRANSFORMER       OOMMØ W/M         OOMMØ W/M       PR WATER VALVE         PR FIRE HYDRANT       PR SAN SEWER         OMH K       PR SAN SEWER         MH 4       PR KATER SERVICE         PR SAN SEWER       MH 4         PR CATCHBASIN       PR SAN SEWER         MH 4       PR KANHOLE         PR SWALE       PR SWALE
C HOUNT 236 234 232 230 2230 2230 2228 226 UNING RESIDENTIAL EXISTING RESIDENTIAL			
221 FOX STREET SUB LOT GRADIN( CONCEPT PLA	<u>2</u> Developme	nt Limited nce St. Suite 700	WMI & Associates Limited 119 Collier Street Barrie, Ontario L4M 1H5 Ph 705-797-2027 www.wmiengineering.ca Drawn By TG Scale 1:1000 Project No. 09–062 LGR