3.1.3 Evaluation Criteria

The overall evaluation criteria for the land use and road options are addressed in the Phase 2 Summary Memorandum, and include the evaluation of each land use option with respect to servicing. In addition the evaluation of the proposed servicing alternatives is described below. Particular additional evaluation criteria that feed into the above overall criteria include flexibility to accommodate planning and demand changes, provision of phasing opportunities, and adequacy of the supply system that is being connected to.

Aspects such as efficiency of use of resources and appropriateness and reliability of technologies are considered as design factors that are common to all the formulated alternatives.

3.1.4 Assessment and Evaluation of the Alternative Solutions

3.1.4.1 Development Costs

Development costs associated with Alternatives 2, 3 and 4 are provided below. These costs are preliminary and assume works related to the sewer only – no costs are carried relating to the associated road construction that would most likely occur at the same time the sewers are installed.

Table 3-5 shows the estimated cost of Alternative 2.

Table 3-5 Alternative 2 Costs

Infrastructure	Cost
Pipes (250mm to 525mm) total length 9,570m	$ 8,253,012.75
MH (1200mm)	$ 152,500.00
Miscellaneous Work	$ 840,500.00
Engineering And Contingencies	$ 1,387,000.00
TOTAL	**$ 10,633,012.75**

Pipe cover was calculated using the existing ground elevations.

Table 3-6 shows the estimated cost of Alternative 3.

Table 3-6 Alternative 3 Costs

Infrastructure	Cost
Pipes (250mm to 525mm) Total length 8,456m	$ 8,050,000.00
Force Main (200mm) Total length 1,069m	$ 267,500.00
MH (1200mm)	$ 125,000.00
Pumping Station (does not include land costs)	$ 1,000,000.00
Miscellaneous Work	$ 945,000.00
Engineering And Contingencies	$ 1,555,000.00
TOTAL	**$ 11,942,500.00**

Pipe cover was calculated using the existing ground elevations

Table 3-7 shows the estimated cost of Alternative 4

Table 3-7 Alternative 4 Costs

Infrastructure	Cost
Pipes (250mm to 525mm) Total length 8,133m	$ 7,050,735.00
Force Main (200mm) Total length 1,446m	$ 362,500.00
MH (1200mm)	$ 120,000.00
Pumping Station (does not include land costs)	$ 1,000,000.00
Miscellaneous Work	$ 855,000.00
Engineering And Contingencies	$ 1,410,000.00
TOTAL	**$ 10,798,235**

Pipe cover was calculated using the existing ground elevations.

3.1.4.2 Evaluation of the Alternative Solutions

Alternative 1: **Do Nothing (Existing Secondary Plan)**

As noted previously, Alternative 1 is considered the same as Alternative 2 given their similarities in their proposed road networks and population densities/land uses. In this assessment the Do Nothing alternative represents the scenario of build out in accordance with the existing Secondary Plan.

Alternative 1 therefore has the same assumed capital costs and has the same servicing constraints with respect to the capacity available in the existing public sewers surrounding the DASP.

Alternative 2: Construct all internal wastewater sewers as new and connect to Sewershed as directed by City of Toronto

Under this alternative the wastewater network is to be connected to the Black Creek sewershed, while Allen District area is connected to the West Don sewershed.

This alternative is considered a viable option, but the existing pipes along Almore Ave need to be upgraded to accommodate the flows from Allen District. In addition to the pipes along Almore Avenue, there are downstream pipes along Timberlane Drive and on easement conveying this flow to the West Don trunk sewer. The City of Toronto was undertaking flow monitoring of these pipes in 2009, but the results were not available at the time this report was prepared to comment on the possible upgrades to these downstream sewers.

The Black Creek trunk sewer has capacity to receive wastewater (at the outlet point from the DASP) generated by a population approximately of 45,000 people but the future York University project will need a capacity to receive flow generated by approximately 65,000 people. This means that an extra cost to upgrade the Black creek trunk sewer will be required to give it capacity to receive flow from both the DASP and York University projects together.

Table 3-8 shows the estimated population to be added into the system for this alternative.

Table 3-8 Estimated population for Alternative 2

	Black Creek Trunk Sewer	West Don Trunk Sewer
POPULATION	19,800	16,820

Wilson District and Bombardier/DND population don't have additional development, the number of population are based on existing employment that will remain.

Alternative 3: **Construct all internal wastewater sewers as new and connect to the Black Creek sewershed**

Alternative 3 is configured to adequately service the proposed developments, is considerably more expensive to build than Alternative 2 because it needs a pumping station to direct wastewater from the Allen District area to the Black Creek sewershed.

The Black Creek trunk sewer has capacity to receive wastewater (at the outlet point from the DASP) generated by a population approximately of 45,000 people but the future York University project will need a capacity to receive flow generated by approximately 65,000 people. This means that an extra cost to upgrade the Black creek trunk sewer will be required to give it capacity to receive flow from both the DASP and York University projects together.

Table 3-9 shows the estimated population to be added into the system for this alternative

Table 3-9 Estimated population for Alternative 3

	Black Creek Trunk Sewer	West Don Trunk Sewer
POPULATION	36,621	0

Wilson District and Bombardier/DND population don't have additional development, the number of population are based on existing employment that will remain.

Alternative 4: **Construct all internal wastewater sewers as new and connect to the Black Creek sewershed**

Alternative 4 is configured to adequately service the proposed developments, is considerably less expensive to build than Alternative 3 but its design is subject to any valid standard or special permit for construction of utilities crossing airport runways.

The Black Creek trunk sewer has capacity to receive wastewater (at the outlet point from the DASP) generated by a population approximately of 45,000 people but the future York University project will need a capacity to receive flow generated by approximately 65,000 people. This means that an extra cost to upgrade the Black creek trunk sewer will be required to give it capacity to receive flow from both the DASP and York University projects together.

Table 3-10 shows the estimated population to be added into the system for this alternative

Table 3-10 Estimated population for Alternative 4

	Black Creek Trunk Sewer	West Don Trunk Sewer
POPULATION	36,621	0

Wilson District and Bombardier/DND population don't have additional development, the number of population are based on existing employment that will remain.

3.1.5 Phasing

It is assumed that development in the Secondary Plan area will be completed in phases. Various phasing issues such as market demands, availability of transportation and servicing infrastructure capacity, triggers for required upgrades, etc will be addressed in the Phase 4 report to establish the phasing requirements for the infrastructure improvements.

3.1.6 Preferred Wastewater Collection Solution

Either of Alternative 2, 4, or the Do Nothing option is the preferred servicing configuration from a cost perspective. All of these options have a similar cost.

From an operations and maintenance perspective, Alternative 2 or the Do Nothing option would be the preferred option because in either of these two options all sanitary sewers would be connected to appropriate sewersheds by gravity as directed by the City of Toronto. These options would not require pumping stations nor would any sewers have to be over-sized to accept flow from another sewershed.

Any of these options may impact the existing network during wet weather flow conditions, and this still requires the City of Toronto address this broader network issue as part of a solution within the larger area impacted by development in the DASP.

4. Stormwater Management Alternatives

4.1 Stormwater Collection and Treatment Network

4.1.1 Rationale for the System

The development in the DASP will require the creation of a network of stormwater collection pipes and management ponds. The DASP is at the height of land between two existing watersheds, and the objective of the new servicing is to direct runoff at pre-development levels to the appropriate watershed.

This will create a stormwater system that is virtually identical for all of the development scenarios. It will be assumed for this exercise that no pumping will be allowed from one watershed to another given the detailed analysis required for TRCA consideration.

4.1.1.1 Wet Weather Flow Management Policy

Any proposed stormwater flows will need to adhere to the requirements of the City of Toronto's Wet Weather Flow Master Plan. The guiding principles for management of Wet Weather Flows (WWF) are:

1. As a priority, rainwater (including snowmelt) should be managed where it falls on the lots and streets of our City, particularly before it enters a sewer.
2. Wet weather flow will be managed on a watershed basis with a natural systems approach being applied to stormwater management as a priority.
3. The maximum pre-development run-off co-efficient is 0.5.
4. A hierarchy of wet weather flow solutions will be implemented – starting with:"at source", then "conveyance", and finally "end of pipe".
5. Toronto's communities need to be made aware of wet weather flow issues and involved in the solutions.

In general three key WWF Management targets (Interim) are:

1. Water Balance (or annual runoff volume) – for erosion control, groundwater recharge and downstream habitat protection;
2. Water Quality – for protection of downstream water resources;
3. Water Quantity - peak flow control for flood management; and both peak flow and runoff controls to mitigate erosion impacts.

All future development within the Downsview lands will need to meet the targets set out within the WWF Master Plan for water balance, water quality and water quantity.

4.1.1.2 Land Use and Percent Imperviousness

As shown in **Figure 14** the alternative that has emerged has the preferred is a combination of the other alternatives combining aspects of each reviewed option. Impervious or hard surfaces generate significant amounts of runoff when compared to landscaped or soft surfaces within the urban catchment. Therefore an important calculation for estimating of stormwater flows is the amount of impervious area within a drainage catchment. The type of land use corresponds to a typical percent imperviousness which than can be used for stormwater calculations. **Figure 14** depicts the area devoted to each land use. Typical percent imperviousness assigned to each land use is shown in **Table 4-1**. The existing employment areas (TTC, DND and Bombardier lands) as well as the south employment area are existing developments that will not change in land use for the timeline of this project. Therefore, these lands have not been analyzed for proposed development flows.

Table 4-1 Percent Impervious

Land Use	Percent Impervious
Neighbourhood	60 %
Apartment Neighbourhood	70 %
Mixed Use	90 %
Employment	90 %
Existing Employment	55[1] %
National Urban Park	10 %
National Urban Park – Employment	55[2] %
Other Park	10 %
Woodlot	10 %

[1] Employment lands are generally 90 % imperviousness. In this case the Airport lands and the TTC yards provide significant unpaved areas to lower the amount of imperviousness.

[2] This area includes the sports commons which includes parking and existing building areas used for indoor sports.

The land use plan was then correlated to the above percent imperviousness to obtain a combined percent imperviousness for each district. The detailed analysis can be found in **Appendix C-1**, while the results are summarized in **Table 4-2** below. Also included in **Table 4-2** is the proposed SWM Facility number to which district drains.

Table 4-2 Stormwater Statistics by District

District	Total Area (Ha)	Combined Percent Imperviousness
Sheppard	48.79	80
Chesswood	33.32	90
Allen West	15.93	84
Allen East	32.14	65
Existing Employment	202.15	55
Wilson District	20.83	90
Stanley Greene	14.41	63
National Park Lands	85.45	16
National Park - Employment	39.27	55
William Baker	25.30	48

4.1.1.3 Water Balance Requirements

- Retain stormwater onsite to the extent practicable to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions.
- If the allowable annual runoff volume from the development site under post-development conditions is less the pre-development then the more stringent runoff control becomes the governing target for the development site. The maximum allowable runoff from any development site is 50% of the total annual runoff depth.
- In all cases, the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event – typically 5mm (In Toronto, storms with 24 hour volumes of 5mm or less contribute about 50% of the total average rainfall volume) through infiltration, evapotranspiration and rainwater reuse.

Typical ways for the DASP lands to deal with the water balance will be:
- Rainwater harvesting for grey water and irrigation uses;
- Soak-a-way pits;
- Landscaping to promote zero runoff through use of permeable pavements for hardscapes, rain gardens to capture, store and promote infiltration of runoff preferably arranged in a cascading manner to promote the treatment train approach;
- Decrease the paved road widths to decrease the amount of runoff generated;
- Use of permeable pavement for side road parking areas;
- Stormwater tree pits for road side trees;
- Use of ditches rather than traditional storm sewers to slow water passage and promote filtration and water uptake by plantings;

In addition to the above opportunities more impervious uses with higher density uses may also consider the following:
- Green roof technologies;
- Plant trees/ bushes;
- Pervious Pavement in parking areas;
- Route parking lot runoff to bio-retention areas.

4.1.1.4 Water Quality Requirements

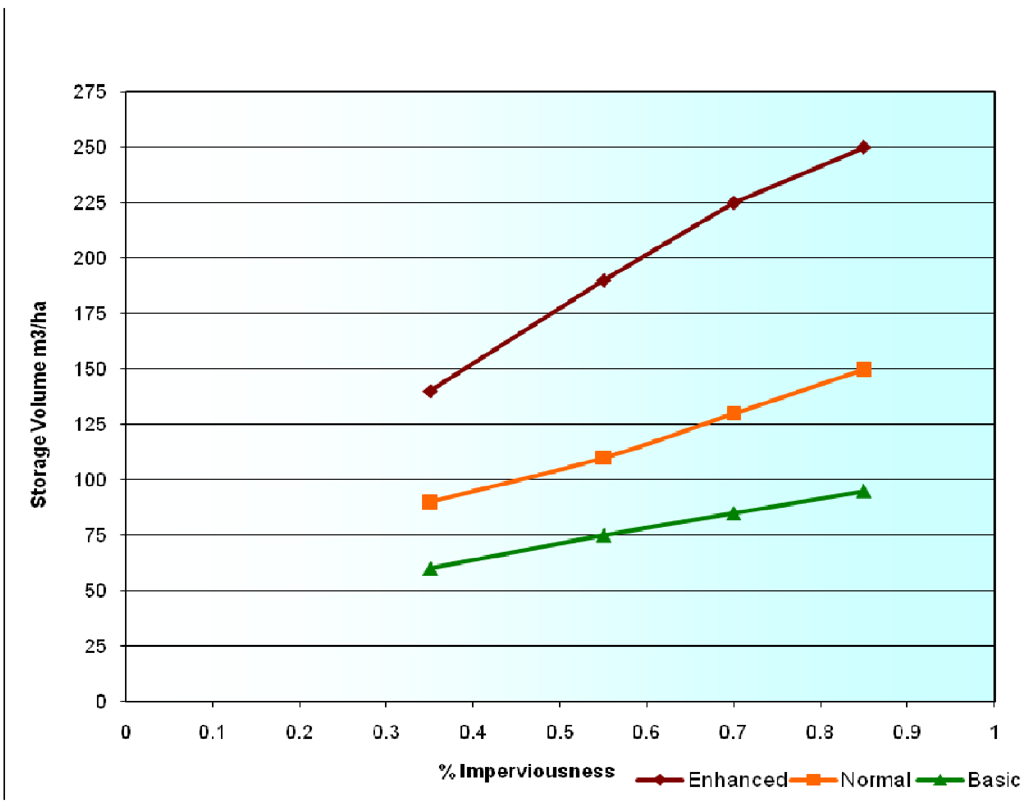
Require long-term average removal of 80% of TSS on an annual loading basis from all runoff leaving the site.

The MOE 2003 Stormwater Management Planning and Design Manual Table 3.2 relates drainage area, percent imperviousness and desired TSS. For the purposes of this study it will be assumed that a wet pond will be the most desirable alternative to achieve end of pipe water quality objectives. The techniques mentioned in the water balance section will provide water quality treatment but it is foreseeable that an end of pipe solution will still be required. **Figure 12** depicts the relationship of required storage volume (m^3/ha) to percent imperviousness. **Table 4-3** relates the storage volumes required for water quality based on the drainage areas.

Table 4-3 MOE Water Quality Sizing Requirements

SWM Facility No.	Drainage Area ha	% Imperviousness	Storage Volume (m^3/ha)	Required Storage Volume m^3
1A	48.79	80	240	9758
1B	32.14	90	250	6997
2	32.14	65	165	4018
3	15.93	84	250	3335
4	185.7	33	100	18570
5	25.3	48	145	3669

Figure 12 - Wet Pond Sizing Guidelines (MOE)



4.1.1.5 Pre-Development and Post Development Flows

For the preferred alternative, a combined percent imperviousness for each district was calculated. The program Visual Otthymo was then used to calculate peak flows and runoff volumes for the pre-development and post development drainage in each catchment area. **Table 4-4** summarizes the pre and post development flows for each catchment area.

Table 4-4 Pre-Development and Post Development Flows

District	Return Period Years	Pre-development Flow (m^3/s)	Post Development Flow (m^3/s)
Sheppard	2	1.79	3.87
	5	3.10	6.57
	25	5.28	10.90
	100	7.04	14.33
Chesswood	2	0.84	3.60
	5	1.64	5.83
	25	3.01	8.99
	100	4.21	11.59
Allen West	2	0.27	1.77
	5	0.53	2.71
	25	0.97	4.27
	100	1.36	5.52
Allen East	2	0.21	2.33
	5	0.46	3.92
	25	0.74	6.72
	100	1.04	8.94
Stanley Greene National Park Lands Sports Centre	2	1.51	1.80
	5	2.55	2.30
	25	4.17	4.84
	100	5.56	6.40
William Baker	2	0.14	0.27
	5	0.23	0.44
	25	0.39	0.70
	100	0.52	0.92

As to be expected the greater the increase in percent imperviousness the greater the increase in post development flows. As discussed in previous phases of this report there is no additional capacity for increased flows within the existing sewer system or roadways.

4.1.1.6 Water Quantity Requirements

The required level of peak flow control for the Black Creek and West Don River watersheds is 2 through 100 year Post to Pre. The unit flow relationships for the Humber River is detailed below in **Table 4-5**.

Table 4-5 Unit Flows for Humber River

Return Period	Humber River where Q= unit flow rate in l/s/ha
100 year	Q = 22.973 – 2.256 In A
25 year	Q= 17.381 – 1.690 In A
5 year	Q= 11.468 – 1.123 In A
2 year	Q= 7.745 – 0.762 In A

In addition the runoff from a 25mm design storm shall be detained and released over a minimum of 24 hours for erosion control of flows that ultimately release to the Black Creek and West Don Rivers.

Sheppard District Pond 1A

The Canadian National Railway that divides the Sheppard and the Chesswood districts will most likely be a barrier to future grading of overland flows. It currently runs at approximate elevation 194.0m though the north section of the PDPI lands. In order to avoid the low point that has no outlet at the CN underpass on Sheppard Avenue, overland flows must be graded to drain to the Chesswood Drive intersection (elevation 194.24m). If the potential minor arterial crossing is grade separated then a further barrier will be created for overland drainage. The existing warehouse complex in the Sheppard District is currently sitting in a “bowl”, at elevation 193.0m, which is lower than the surrounding lands. To have positive drainage these lands would need to be raised to around 199.0, approximately 6.0m of fill depth. The current drainage is trapped in this area and directed to a minor system outlet. Therefore stormwater quantity controls to service this area will need to detain all flows to the 2 year predevelopment flow rate.

Chesswood District Pond 1B

Flows will discharge to the Chesswood Trunk sewer and Chesswood Drive. Post development flows will be detained to predevelopment levels.

Allen West Pond 2

The Allen Expressway separates the storm drainage for the east and west side of the Allen district. Post development flows will be detained to predevelopment levels.

Allen East Pond 3

The Allen Expressway separates the storm drainage for the east and west side of the Allen district. Post development flows will be detained to predevelopment levels.

PDPI, Sports Common, Stanley Greene and Existing Bombardier Pond 4

The proposed National Park, Sports Common, Stanley Greene District and the existing Bombardier plant will drain to a common facility. This facility is a private facility that will be owned by the PDP. The flows will need to be controlled to the rates specified in **Table 4-5**.

William Baker District Pond 5

The William Baker district will outlet to Sheppard Avenue. Post development flows will need to be contained to the rates as specified in **Table 4-5**.

In order to achieve the water quantity requirements for the DASP lands the following will also need incorporation into the development design;

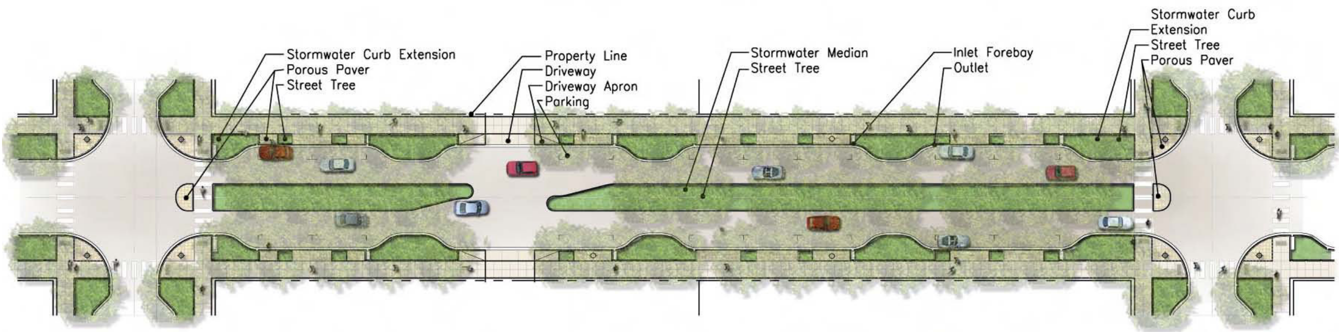
- Roof top restrictors;
- Catchbasin restrictors in parking lots to allow surface ponding;
- Underground storage;

4.1.2 Public Right of Ways

Given the existing conditions that the DASP is currently open space with low runoff coefficients, any development, even the existing secondary plan, will require the creation of a collection and retention/treatment system to meet current criteria**.**

The preferred solution emphasizes control of rainwater at its source through innovative design. For example a depressed median area in the typical road cross section will provide for a linear storm pond. Stormwater curb extensions along the road side provide additional volume to meet water quality and water balance targets. Water quantity will increase with increase in impermeable surfaces. Soils within the DASP may not support the use of options such as permeable pavements to decrease runoff therefore other options include decreasing pavement widths especially on local streets and/or underground storage to meet post to pre development target flow rates. **Figure 13** below is a schematic of a street plan that includes a stormwater median and stormwater curb extensions.

Figure 13: Typical Street Plan with Depressed Median and Stormwater Curb Extensions



4.1.3 Phasing

The stormwater system may be phased like the other piped infrastructure. Again, like the sewer and water systems, it is assumed that development will occur in phases and/or stages, and any construction of the stormwater management system must begin at the individual outlets/connection points. Any development will require the construction of the individual retention/treatment device that it drains to along with the requisite components of sewer system. The order and extent of any phasing is subject to the detailed design and review by City at the time of development approval.

4.1.4 Preferred Stormwater Collection and Treatment Solution

The preferred stormwater collection and treatment system is shown on **Figure 14**. The estimated costs for constructing this system are as shown in **Table 4-6**. Like the other piped systems, it has been assumed that all trunk sewers will be constructed on the public right-of-way.

It should be noted that the pipe sizes have been established to meet the theoretical requirements of the contemplated development – it may be possible to reduce the pipe sizes through the use of various on-site works and controls.

In addition, the City of Toronto Transportation Department will also be evaluating the use of bio-swales or other remedial measures to reduce both pipe and pond sizes.

Table 4-6 SWM Collection System Cost Estimates

Area	Infrastructure	Cost
Sheppard	Sewer 950m 1350mm	$1,140,00
	MHs 2400mm	$100,000
	Engineering and Contingencies 20%	$248,000
	Total	$1,488,000
Chesswood	Sewer 700m 1350mm	$840,000
	MHs 2400mm	$70,000
	Engineering and Contingencies 20%	$182,000
	Total	$1,092,000
Allen West	Sewer 400m 1050mm	$400,000
	MHs 2400mm	$40,000
	Engineering and Contingencies 20%	$88,000
	Total	$528,000
Allen East	Sewer 600m 1200mm	$660,000
	MHs 2400mm	$60,000
	Engineering and Contingencies 20%	$144,000
	Total	$864,000
PDP	Sewer 900m 1050mm	$900,000
	MHs 2400mm	$90,000
	Engineering and Contingencies 20%	$198,000
	Total	$1,188,000
Total Trunk Sewers		$5,160,000

5. Draft Recommended Option

Throughout the review and evaluation of the servicing issues pertaining to the Downsview Area Secondary Plan Review Study, it has been noted that there are two major issues affecting both the DASP and areas outside it:

1. Wastewater sewersheds and collection capacity/surcharging, and
2. Water supply low pressure at some locations.

Both of these items have "macro" issues affecting the City of Toronto, and they cannot be dealt with exclusively in the context of development in the DASP.

Wastewater Draft Recommended Option

From a cost perspective, either of the Draft Recommended development option and the existing secondary plan (do nothing) is preferred. Both options collect wastewater and send it by gravity to the appropriate sub-trunk/trunk sewer system. This eliminates the capital and operating costs for pumping systems in other options that send wastewater to other sewersheds.

These options, like all of the other options, still require additional engineering investigation and improvements to the wastewater network outside the DASP to address capacity in specific pipes sections and surcharging during wet weather flow conditions.

Water Draft Recommended Option

From a cost perspective, either of the Draft Recommended development option or the existing secondary plan (do nothing) is preferred. Both options could connect to Pressure District 5 or Pressure District 6.

The North York Water Distribution Study was completed in February 2009, and one of the recommendations from this study was further review of the adjustment of the boundary between PD-5 and PD-6. The City is currently assessing options for further review of this recommendation either internally or through the use of a consultant. What impacts this further review may have (financial and operating) need to be determined before the preferred water system can be determined.

Stormwater Draft Recommended Option

As noted earlier, only one stormwater servicing option has been considered for all possible development options. The preferred stormwater development option is applicable to all development options given their similarities in extent and type of impervious surfaces. This option creates a system of stormwater management ponds and collection system that is sized to meet the existing criteria and objectives of the City of Toronto and the Ministry of the Environment.

Summary of Costs

Table 5-1 Cost Estimate Summary - Draft Recommended Option

ITEM	COST
Water System	$5,110,000
Wastewater System	$10,630,000
Stormwater Trunk Sewer	$5,160,000
TOTAL	$20,900,000

From a servicing perspective, the Draft Recommended development option and the existing secondary plan are equal and should be considered the preferred option. Both development options have very similar opportunities and constraints, and in order to make a more refined decision, a greater level of detailed analysis would be required to determine the relative difference between the two.

Both options have the lowest capital and operating costs because all servicing connects to the existing adjoining collection and distribution systems and do not exceed the City's approved/contemplated capacities.

The evaluation of the servicing options looked only at the infrastructure requirements, and none of the options included land costs for possible pumping stations, pond blocks, etc.

There are specific issues relating to limitations in the existing City systems that will have to addressed as part of larger engineering studies (i.e. water pressure, sewer surcharging during wet weather flow conditions), and these issues will need to addressed in advance of development proceeding within the DASP. It may be possible to address some of the issues with specific engineering reviews like individual pipe capacities at the time of development application.