



Report to: General Committee

Report Date Authored: October 14, 2011

SUBJECT: West Thornhill Stormwater Flood Control Implementation Strategy
PREPARED BY: Robert Muir, Senior Stormwater/Environmental Engineer, Asset Management, Ext.2894

RECOMMENDATION:

- 1) THAT the report titled “West Thornhill Stormwater Flood Control Implementation Strategy” be received;
- 2) AND THAT staff be authorized to retain consultants to refine West Thornhill Phase 1 and Phase 2 solutions, conduct Value Engineering, complete an assessment of local improvement and control measures that may be implemented in the short term, and to complete preliminary design of Phase 1 works in the amount of \$250,000 including HST impact to be funded from accounts 058-6150-8530-005 and 050-6150-9330-005;
- 3) AND THAT staff continue to advance the Stormwater Funding Study to identify financing options for subsequent implementation Phases in West Thornhill, and Town-wide improvements, and to report back to Council on a regular basis;
- 4) AND THAT capital project 050-6150-9330-005 with a current balance of \$1,970,888 and capital project 050-5350-10281-005 with a current balance of \$2,000,000 be consolidated to support West Thornhill Phase 1 improvements identified in the Strategy;
- 5) AND THAT staff be authorized and directed to do all things necessary to give effect to this resolution.

EXECUTIVE SUMMARY:

The West Thornhill Flood Control Implementation Strategy is intended to implement recommendations of the West Thornhill Stormwater Flood Remediation Class Environmental Assessment (Class EA Study). The following is a chronology of events related to the Class EA Study and the associated Ministry of Environment (MOE) approval process.

1. Aug. 2005 storm resulted in extensive flooding in West Thornhill
2. Staff present system review and are authorized to conduct Class EA (Sept. 2007)
3. Class EA Study initiated 2008;
4. Staff report to General Committee with preferred alternative solution (Dec. 2009);
5. Issued EA Notice of Completion / 1st Public Review (Feb.-Mar. 2010);
6. Resident filed objection (requested Part II Order) (Mar. 2010);
7. MOE requires documentation updates and further consultation (Aug. 2010);
8. Consultation with requester and report updates (Sept.-Nov. 2010)
9. Re-issued Class EA / 2nd Public Review (Nov.-Dec. 2010);
10. MOE approval received (Aug. 2011)

Given the overall capital cost and complexity of the recommended Class EA solution, implementation requires consideration of financing and resource requirements and also phasing. Value engineering can ensure that innovative and cost effective methods are

considered in the design and construction of the recommended study alternative. Council has requested staff to develop an implementation strategy addressing the above considerations and to develop a detailed design and construction schedule for the initial phases. Each of these elements is summarized below.

Phasing: The Class EA recommended solution includes storm sewer improvements within thirteen (13) separate networks that can be implemented independently of each other. Phasing of improvements will be based on prioritization of flooding risks and the need to coordinate storm system improvements with improvements to other services, particularly the wastewater (sanitary) system. Improvements within a particular network may be staged depending on availability of funding. The Phase 1 stormwater implementation area is within the Bayview Glen area and the Phase 2 implementation area is within the Grandview area. These areas are shown on Attachment A. The schedule for Phases and stages of works within the Phases is contingent upon the availability of funding.

Beyond capital-intensive sewer capacity improvements, the Class EA recommended solution includes several low-cost elements such as the installation of inlet control devices and extensive roof downspout disconnection. Where these elements are not contingent on related storm sewer capacity improvements to convey additional flows, and where overland flow capacity is available, they may proceed in the short term. These measures will be evaluated for implementation both within and beyond the priority capital improvement areas.

Town-wide Implications: While this strategy primarily addresses storm flood risk reduction in West Thornhill, there are potential Town-wide implications resulting from the approved level of service recommended in the Class EA. If other older development areas across the Town were to experience the same extreme rainfall that occurred in West Thornhill in 2005, similar flooding problems would likely occur. A methodology for a more detailed screening and prioritizing other Town-wide study areas is proposed. A timetable for other Town-wide studies will be developed based on results of the on-going Stormwater Funding Study.

Value Engineering: Value engineering is proposed to review the Town's flood risk reduction activities, the West Thornhill flood remediation strategy and methods. Value engineering sessions will be incorporated into the design process and will engage experts in technical fields including design and construction. The purpose is to 'brainstorm' and investigate methods to reduce overall life-cycle costs while achieving design objectives. Results of the session will guide the refinement of storm improvement alternatives and their design.

Design and Construction Schedule - Initial Phases/Stages: The design and construction schedule has been developed for the initial Phases of large-scale capital works consisting of storm sewer replacement or twinning, and final design for the first stage of Phase 1 works for which funding is available. Improvements within a particular network may be staged, beginning with outfall works and downstream segments, and proceeding

upstream. The schedule for implementation of subsequent Phases and stages of works within the Phases will be contingent upon the availability of funding. Less capital-intensive sewer capacity improvements noted under Phasing above may proceed in some areas in the short term, depending on local suitability.

Background data collection activities (e.g., archaeological and engineering surveys) have been identified to support design and construction for initial improvement works. A consultant or consultants will be retained to collect and incorporate this data, conduct the Value Engineering exercise, refine Class EA alternatives and complete preliminary design for Phase 1 and 2 works. The consultant will also evaluate the implementation of cost-effective, short-term local improvements and controls both within and beyond the priority capital improvement areas. Funding for these tasks will be through accounts 058-6150-8530-005 and 050-6150-9330-005 as per Recommendation number 2. The tender for stage 1 of Phase 1 works is expected in fall 2012.

Resource Requirements: Additional staffing resources may be required to assist in aspects of the West Thornhill Stormwater Flood Control Implementation Strategy including activities related to implementation of local improvements and controls. Requirements will depend on the findings and recommendations of the design study. Staffing resources in Engineering to administer tendering and construction of stormwater works are required and may exceed current staffing capacity. Staffing requirements in Engineering in the near term for the West Thornhill works and in the long term for any Town-wide works will depend largely on the implementation schedule determined in the Stormwater Rate Study.

Financing: Financing for approximately 5.2 % of the estimated \$40 million improvement cost is currently in place in accounts 058-6150-8530-005 and 050-6150-9330-005. Available financing will be directed to the analysis and design activities described in Recommendation 2, followed by system improvements in the most vulnerable areas identified in the Class EA. More comprehensive Phase 1 works can be completed if funding identified in account 050-5350-10281-005 for other potential improvements areas outside West Thornhill is reassigned to the West Thornhill area. This could provide an additional 5% of the estimated improvement costs and therefore it is recommended that the two remaining capital projects be consolidated as per recommendation number 4. Financing for Phase 2 improvements will be determined as part of a sustainable funding initiative for the Town's water infrastructure, including flood control activities within the stormwater management strategy (i.e., Stormwater Funding Study).

PURPOSE:

The purpose of this report is to seek Council's endorsement for the recommended West Thornhill Stormwater Flood Control Implementation Strategy including phasing strategies, Town-wide implications, value engineering, detailed design and construction schedule for the initial phases, resource requirements and financing options.

BACKGROUND:West Thornhill Stormwater Flood Remediation Class EA Study

The report to General Committee dated December 7, 2009 provides background related to flood susceptibility in the West Thornhill area, as well as the findings of the West Thornhill Stormwater Flood Remediation Class Environmental Assessment Study (Class EA Study). The study recommendations are intended to minimize potential for basement flooding, protect the human and built environment, and reduce the cost of flooding for residents. A preferred alternative solution providing a 100 year level of protection for the West Thornhill stormwater system improvements was approved by Council on December 15, 2009. Improvement areas are shown on Attachment A.

Ministry of the Environment (MOE) Approval Process

A Notice of Study Completion for the Class EA Study (February, 2010) was issued on February 11, 2010 and comments on the Project File (i.e., the study report) were received during the 30 calendar day public review period from February 25, 2010 to March 27, 2010. Comments regarding the effect of the preferred solution on downstream design flows were received from the City of Toronto and have been addressed to their satisfaction through revisions to the report. Comments were also received from the MOE and the Toronto and Region Conservation Authority regarding permits that may be required for proposed sewer twinning and design standards that shall be followed at a later date during detailed design of remedial measures. Extensive questions on many aspects of the study were received from one area resident with whom Town staff and the study consultant met in an effort to provide additional information and clarification. The comment period was extended at the request of the resident who subsequently made a Part II Order request to MOE for an Individual Environment Assessment for the study.

The Town responded to concerns expressed in the Part II Order Request in May 2010 and the MOE initiated a detailed review of concerns in July 2010. MOE's main concern was the way in which the four alternative evaluation criteria weightings were assigned and that the weights are not balanced and heavily loaded on Technical Engineering (i.e., weightings were 75% for Technical and Engineering, 15% Economic Environment, 7.5% Natural Environment, 2.5% Social and Cultural Environment). Town staff and the consultant met with MOE and provided additional clarification and documentation related to the concerns throughout July and August, 2010. In late August 2010, MOE provided a review of these concerns, requested that additional documentation on weighting selection be provided in the Project File, and that the EA Report be re-issued for a second 30-day public review.

The EA Report (November, 2010) was updated with additional documentation and was filed for a second 30 day public review commencing November 18, 2010 and ending December 17, 2010. No objections to the study were made during the second public review period. The MOE has denied the original Part II Order request and approved the EA Study in August 2011. Accordingly, the Town has approval to proceed to

implementation of the preferred alternative (100 year protection) to reduce flood risks.

Implementation Strategy

Staff has been directed to report back to Council on an implementation strategy for the preferred alternative solution. The implementation strategy would address the following components discussed in Section A below:

- i) phasing strategies,
- ii) Town-wide implications,
- iii) value engineering,
- iv) a detailed design and construction schedule for the initial phases,
- v) resource requirements, and
- vi) financing options,

These components of the strategy are presented in the following sections.

OPTIONS/ DISCUSSION:

A. Phasing Strategies

The phasing of West Thornhill Flood Control Implementation is related to the prioritization of projects based on flood vulnerability, and integration with related studies and works, particularly with wastewater system improvements.

Initial implementation efforts will focus on highest priority areas identified in the Class EA study. The Phase 1 capital improvement area is the Bayview Glen Area, identified as a high risk flood cluster.

A1. Risk Prioritization

The Phase 1 and Phase 2 improvement areas (see Attachment B) have been prioritized based on flood susceptibility defined by service calls, damage claims and technical assessments completed as part of the Class EA study. The Phase 1 area is the Bayview Glen Area, also identified as 'Area 3' in the Class EA. The Phase 2 area includes the Grandview Area systems in the lower part of the Class EA 'Area 1'. Future phase areas are shown on Figure 2.

While Phase 1 and Phase 2 areas had equally high flood susceptibility during the August 2005 extreme storm event, the Phase 1 area currently has the higher susceptibility given effective risk reduction measures implemented in the Phase 2 area in 2008-2009. Specifically, inflow reduction measures including downspout disconnection and manhole sealing for the sanitary sewer system has made the Phase 2 area resilient to impacts from the storm drainage system. Further infiltration reductions for Phase 2 are planned through relining of the sanitary sewer mainline and service laterals as discussed in Section A2. Storm system improvements in Phase 1 areas are expected to provide the

greatest relative benefits in terms of risk reduction.

A2. Integration with Related Initiatives

As noted above, flooding risks are related to both the storm system capacity and the sanitary (or wastewater), system capacity. During flooding events, runoff that exceeds the storm drainage system capacity can enter the sanitary system (e.g., from basement floor drains via low-lying openings including windows, reverse-slope driveways, walk-outs, etc.), contributing to sanitary back-ups. Works to increase capacity or reduce flow rates may be required in either system or both to achieve flood risk reduction objectives. As storm system capacity improvements can consist of twinning large diameter sewers within the Town's right-of-way, coordinated phasing with adjacent services is required. For example, it would not be cost effective to reline or replace sanitary sewers that may have to be relocated to accommodate storm system improvements.

The proposed storm system improvements avoid conflicts with potential wastewater system improvements as part of initiatives described below.

West Thornhill Sanitary Sewer System Inflow and Infiltration Reduction

The West Thornhill Sanitary Sewer System Inflow and Infiltration Reduction program is managed by Environmental Services and addresses unwanted wet weather flows in the sanitary sewers. Excessive inflows and infiltration during wet weather can contribute to basement flooding risks if the sanitary sewer capacity is exceeded.

Bayview Glen Area Improvements

The Bayview Glen Area was identified as a high sanitary inflow and infiltration area in the Waterworks Inflow and Infiltration Reduction program. Consequently, it has also been identified for inflow and infiltration reduction activities as part of pilot studies under the Waterworks Inflow and Infiltration Reduction Strategy. The strategy's goal of reducing the volume of inflows and infiltration is intended to reduce transmission and treatment costs as well as potential overflows.

Field investigations and monitoring of the sanitary system did not identify direct inflow sources that could be readily disconnected in the area. Secondary infiltration sources including cracks in sewers and manholes within the right-of-way were observed within the downstream areas, and repair and lining activities may be considered.

While the inflow and infiltration strategy has specific goals and targets for inflow and infiltration reduction, no targets are currently in place related to private property improvements. Works to reduce the primary inflow and infiltration contributions which are expected from private sources (e.g., foundation drains and sump pumps) are not addressed in Waterworks' program in the short term. Further flow reductions or capacity improvements are necessary to manage flows within the sanitary system capacity and are being pursued by the Town. Storm system improvements remain a priority in the area

given that sanitary inflows and infiltration cannot be readily addressed in the short term.

It terms of coordinating storm and sanitary improvements, it is noted that the potential sanitary lining and repair program corresponds to the lower portion of the Phase 1 storm implementation area, and that storm system improvements are predominantly in the upper portion. For the most part, the sanitary and storm improvements can be pursued independently. Sanitary lining and repair work proposed along Valloncliffe Road, however, should be deferred until any sanitary capacity constraints are addressed and until storm sewer upgrades are confirmed in preliminary design.

It is noted that while storm sewer improvements are focused in the upper portion of the Phase 1 area (e.g., Doncrest Dr., Poinsetta Dr., Daffodil Ave., and upper Laureleaf Rd.) , level of service improvements are achieved in the lower portion (Valloncliffe Rd., lower Laureleaf Rd., and Canadiana Dr.) as well. Improvements capture major overland runoff in the upper portion and divert it from the lower portion where capacity for the un-diverted flows is limited and can contribute to sanitary inflows. In effect, storm system capital works in one area can provide direct benefits to adjacent, downstream areas as well.

Grandview Area Improvements

The Grandview Area was identified as high sanitary inflow and infiltration area in the Region of York and the Town's Inflow and Infiltration Reduction program and the Town targeted this area for its Pilot Sanitary Downspout Disconnection Program Evaluation.

Direct inflow reductions through downspout disconnection have been completed in the Grandview Area (Phase 2 storm implementation area), which has significantly reduced basement flooding risks due to the sanitary system performance during extreme rainfall events. Specifically, the level of service in the sanitary system has been estimated to have been raised up to 100 years, based on the Town's pre- and post-disconnection monitoring and hydraulic model calibration. In addition, sanitary sewer manhole lids in the Grandview area have been sealed in October 2009 to limit inflows from roadway runoff and ponding during extreme rainfall events.

The above low-cost measures have eliminated the need for extensive sanitary sewer replacement in the Grandview area, and have made the sanitary system significantly more resilient to impacts from the storm drainage system performance.

Further sanitary infiltration reduction works including the lining of mainline sanitary sewers and laterals have been identified to advance other Inflow and Infiltration Reduction Strategy goals. Lining work in the eastern part of the Phase 2 storm improvement area was identified previously for construction in 2011. Class EA recommended storm sewer upgrades could, however, conflict with lining work and therefore lining is currently on hold pending the preliminary and final design of storm sewer improvements that may affect the adjacent sanitary sewer. Preliminary design of Phase 2 storm improvements will be completed in conjunction with Phase 1 design so

that sanitary lining works may proceed outside of expected Phase 2 work areas.

Royal Orchard Area Improvements

The Royal Orchard Area is identified as a future phase storm implementation area. It is identified as a low inflow and infiltration area and, accordingly, the sanitary system is not identified for remediation as part of the Inflow and Infiltration Reduction Strategy. However, based on the March 23, 2009 report to General Committee, the Town's assessment of sanitary sewer capacity relative to design standards, potential improvements were identified in this area. This need has been confirmed through subsequent verification with field data and hydraulic model calibration. Storm system improvements were identified along Royal Orchard Blvd. in the storm system Class EA and included sewer twinning between Knotty Pine Trail to east of Blue Spruce Lane. Any sanitary system improvements should make allowance in the right-of-way for storm sewer twinning considering required diameters in the "without diversion" scenario.

Local Improvements and Controls

The Class EA recommendations include several low cost measures such as inlet control devices (ICDs) and downspout disconnection to reduce the amount of runoff entering some undersized storm sewer systems. These measures are proposed in conjunction with storm sewer capacity improvements within the Class EA flood cluster areas and as stand-alone measures in less flood-prone areas. Where no other capacity improvements are being made, the overland flow system downstream of these measures must have adequate capacity and a defined flow route through appropriate right-of-ways in order to manage surface flooding risks. Subject to meeting these conditions local improvements and controls may be implemented in the short term, well in advance of capital intensive storm sewer upgrades.

Inlet Control Devices (ICDs)

ICDs can increase storm runoff depth on roadways and have the potential to increase unwanted inflows into the sanitary sewer system (e.g., through ponding over manhole lids). Accordingly, ICD installations will be coordinated with sanitary sewer inflow controls such as manhole seals both in the vicinity and downstream of proposed ICDs to prevent increased inflows, and, where possible, to reduce existing inflows. The implementation of ICDs, including locations, inlet capacities, maintenance requirements, and related sanitary inflow control requirements will be determined through the design process described in Section D.

Downspout Disconnection

Similar to ICDs, downspout disconnection can increase storm runoff depth on roadways and have the potential to increase unwanted inflows into the sanitary sewer system. In isolated cases where downspouts ultimately discharge to the sanitary sewer, the benefit of disconnection from the sanitary sewer performance outweighs the potential impact to the

storm surface drainage system. This is the case in the Grandview area's Pilot Sanitary System Downspout Disconnection Program Evaluation where disconnection of 6% of rooftops provided significant sanitary wet weather flow reductions. In contrast, where downspouts ultimately connect to the storm sewer, and where widespread disconnection is considered, impacts of disconnection to the surface drainage system must be carefully considered.

The Class EA recommendations include widespread disconnection of downspouts. The design process described in Section D will determine where downspout disconnection can proceed in advance of other storm system improvements. This will include an evaluation of surface drainage capacity for additional surface flow generated, and identify related sanitary inflow control requirements needed to prevent inflows to that system.

A3. Integration with Other Services

Storm sewer improvements will be coordinated with other service improvements such as sanitary sewers, watermain replacement and road rehabilitation projects.

B. Town-wide Implications

As noted in the December 7, 2009 report to General Committee, the majority of the storm system infrastructure in West Thornhill, like many other older areas across the Town, was built to accommodate a 2 year storm with no provision for overland flow routes. This was the accepted and affordable design criteria at the time the homes that were developed. Although the design standards for stormwater systems have changed significantly, these systems have performed reasonably well over the past 50 years. However, due to the severe rainfall event on August 19, 2005, West Thornhill encountered flooding problems in certain areas. If the other older areas across the Town were to experience the same rainfall, similar flooding problems would likely occur.

Estimated costs (including sanitary improvements) for Town-wide (as presented at June 2, 2009 Special DSC) were as follows:

Table 1 - Flood Control and Sanitary Improvement Estimated Costs

Level of Protection	West Thornhill (Estimated)	Rest of Town (Projected)	Total Cost
Stormwater – 100 year level of protection	\$40 Million	\$ 77 Million	\$117 Million
Sanitary	\$37.5 Million	\$ 72 Million	\$109.5 Million
Total	\$77.5 Million	\$149 Million	\$226.5 Million

The cost associated with the rest of Town is an estimate only, assuming a 100 year level of protection and based on prorating the cost of the Thornhill area and applying it to the

rest of the Town. The actual cost may be substantially different depending on the results of future detailed studies. The cost of the West Thornhill stormwater system will be refined based on preliminary and final design described in Section D below.

Table 1 addresses costs related to an increased level of service for storm sewer and overland flow systems. The level of service is assumed to be the 100 year event beyond West Thornhill, however, this will be confirmed through the Stormwater Funding Study. Flood control costs for river-based flood protection in areas such as the Don Mills Channel would be in addition to the storm sewer and overland flow system costs shown in Table 1. Following completion of the Stormwater Funding Study and identification of funding options, the Don Mills Channel Class EA will be completed and a preferred alternative, level of service and funding mechanism will be recommended. The cost to provide a 100 year level of protection to the Don Mills Channel system is estimated to be \$112 M (presentation to council Sept. 29, 2009).

The December 7, 2007 General Committee report noted that further discussions regarding Town-wide implication will be part of a future implementation report. It is proposed that a Town-wide implementation report be completed following completion of the Stormwater Funding Study described in Section F2. The funding study will identify Town-wide levels of service, implementation timeframes, and the scope of funded works (public vs. private infrastructure) beyond the West Thornhill study area. The funding study will also identify funding sources.

As input to the funding study and the Town-wide implementation report, Asset Management, ROW & Environmental Asset Section will develop a Town-wide flood risk screening to identify and prioritize subsequent areas for repairs, maintenance and/or detailed technical studies (e.g., Municipal Class Environmental Assessment Studies). The screening will expand upon the December 2009 report that considered stormwater management standards in place prior to development, and may include:

- i) sanitary sewer susceptibility to storm drainage inflows (e.g., type of foundation drain connection, monitored wastewater flows relative to design flows, high groundwater levels and inflows, improvements achieved through inflow/infiltration reduction strategy);
- ii) susceptibility of private property to major overland flow (e.g., extent of roadway sags, presence of reverse-slope driveways, potential drainage of large areas through private property);
- iii) historical flooding incidents (e.g., service calls, historical insurance risks (Insurance Bureau of Canada (IBC) screening maps (no individual records));
- iv) storm sewer inspection records (e.g., defects identified through closed-circuit television reports);
- v) critical infrastructure and/or facilities for flood protection.

Areas outside the West Thornhill Wards 1 and 2 study area include developments with no specific overland flow design for major rainfall events, and sanitary sewer systems that may be susceptible to limitations in the storm drainage system. Based on the relative

extent of susceptible development, the following areas would be proposed for subsequent study:

1. Markham – Ward 4 & 5
2. Unionville – Ward 3
3. Wards 6 & 7
4. Wards 2 & 8

These areas are illustrated in Attachment C. A more detailed risk screening based on the above factors will confirm the prioritization and order of these areas. It is possible that funding options may accelerate improvements in particular areas if there is an accepted local funding structure determined through the current Stormwater Funding Study. Regardless of the funding structure, however, the implementation schedule for Town-wide improvements will be a key aspect of the funding strategy.

Storm system improvements in other Town-wide areas will be coordinated with other related initiatives, similar to the approach described in Section A above. This includes the Region and Town's Inflow and Infiltration Reduction Strategy which is expected to be completed over the next 20 years.

C. Value Engineering

Value engineering is defined as an organized methodology that identifies and selects the lowest lifecycle cost options in design, materials and processes that achieve the desired level of performance, reliability and customer satisfaction. The process seeks to eliminate unnecessary costs in the above areas and is often a joint effort with cross-functional internal teams and relevant suppliers. Given the magnitude of the investment in storm system improvements approved for West Thornhill and, potentially Town-wide, Value Engineering session is proposed to identify the most cost effective methods to achieving flood risk reduction. Value Engineering will be integrated as part of the alternative refinement of Phase 1 and 2 alternatives. Lead by the design consultant, the Value Engineering exercise will include brainstorming sessions involving industry experts from various organizations such as municipal staff, other design consultants and, where appropriate, contractors. The focus of Value Engineering will be the implementation of initial projects and may include a review of the overall strategy for flood risk reduction.

Findings from the Value Engineering exercise may guide the implementation of specific projects within West Thornhill (i.e., evaluate design options for capacity improvements (e.g., twinning or replacement), guide future Town-wide flood remediation studies, or evaluate and vet the Town's overall flood reduction strategy for its sewer systems. Funding for this task will be through accounts 058-6150-8530-005 and 050-6150-9330-005 as per Recommendation number 2.

D. Design and Construction Schedule - Initial Phases/Stages

The Class EA recommended solution includes storm sewer improvements within thirteen (13) separate networks that can be implemented independently of each other. Phasing of improvements will be based on prioritization of flooding risks and coordination with other services. The design and construction schedule below addresses alternative refinement for initial Phases (i.e., Phase 1 and 2) of large-scale capital works consisting of storm sewer replacement or twinning, and final design for the first stage of Phase 1 works for which funding is available. Improvements within a particular network may be staged, beginning with outfall works and downstream segments, and proceeding upstream to various branches. The schedule for subsequent Phases and stages of works within the Phases will be contingent upon the availability of funding.

Beyond capital-intensive sewer capacity improvements, the Class EA recommended solution includes several low-cost elements such as the installation of inlet control devices and extensive roof downspout disconnection. Where these elements are not contingent on related storm sewer capacity improvements to convey additional flows, and where overland flow capacity is available, they may proceed in the short term. These measures will be evaluated for implementation both within and beyond the priority capital improvement areas (i.e., flood cluster areas identified in the Class EA study).

The following activities are planned to support the refinement of improvement alternatives within initial phases, and the design and construction of initial stages of works:

- 1) Complete background data collection activities including:
 - i. Downspout connection survey (all West Thornhill excluding areas completed for Grandview Downspout Disconnection Pilot Study),
 - ii. Foundation connection survey-inventory (all West Thornhill to determine where storm sewer surcharge can be permitted without back-up into private property),
 - iii. Complete Archaeology Report (added emphasis on diversion locations and enlarged outfalls, to support refinement of Class EA alternatives),
 - iv. Sewer invert surveys (to support hydraulic model refinement)
- 2) Engage engineering consultant to:
 - i. Conduct Value Engineering exercise to guide refinement of Class EA alternatives and review overall flood reduction strategy,
 - ii. Refine Class EA alternatives in Phase 1 and 2 storm improvement areas, considering:
 - a. storm sewer diversions
 - b. roadway grading to limit street flooding
 - c. the cost effective use of storage
 - d. more extensive use of inlet control devices (ICDs)
 - e. allowing sewer surcharge where there are no dwelling foundation connections (e.g., foundations are connected to

- sanitary system)
 - f. securing easements to protect private flow paths (to offset storm sewer costs), and
 - g. lot level measures that address localized risks.
 - iii. Identify systems where ICD installation, downspout disconnection, or minor grading can be implemented in the short-term both within and beyond Class EA flood cluster areas, prior to other large-scale capital improvements,
 - iv. Complete preliminary design of Phase 1 and 2 improvements,
 - v. Identify stages for Phase 1 and Phase 2 implementation including cost estimates to support future budget requests for construction works.
- 3) Complete final design of Phase 1 staged works and submit for approvals;
- 4) Tender stage 1 of Phase 1 works in 2012/2013

Funding for these tasks will be through accounts 058-6150-8530-005 and 050-6150-9330-005 as per Recommendation number 2.

It is noted that the Town has completed small scale improvements to the storm sewer system to address local flood risks as part of routine inspection and maintenance programs. For example, through the review of closed-circuit-television (CCTV) inspection records several instances of debris accumulation, broken sewers, and encrustation were identified and addressed through maintenance and repairs, restoring the flow capacity of the existing sewers. In addition, inlet capacity improvements have been made at several locations including culvert grates to avoid debris accumulation and improve flow capacity for extreme events, and in a problematic rear lot with a non-effective inlet. Routine inspection and maintenance programs will continue.

E. Resource Requirements

Additional staffing resources may be required to assist in aspects of the West Thornhill Stormwater Flood Control Implementation Strategy including activities related to implementation of local improvements and controls. Requirements will depend on the findings and recommendations of the design study described in Section D. For example, staffing resources in Engineering to administer tendering and construction of stormwater works are required and may exceed current staffing capacity. Staffing requirements in Engineering in the near term for the West Thornhill works and in the long term for any Town-wide works will depend largely on the implementation schedule determined in the Stormwater Funding Study.

F. Financing Options

F.1 Overall Funding Options

The West Thornhill Flood Control Implementation Strategy is one component of flood control within the Town's overall Stormwater Management (SWM) Strategy. A funding study is underway to investigate sustainable funding options for the SWM Strategy

including flood control implementation in West Thornhill and other vulnerable areas Town-wide. The study is integrated into an overall review of water, wastewater and stormwater system funding, and will investigate funding options including cost recovery structures and rates for stormwater works and programs, including various levels of flood control that are not currently funded by Life Cycle Reserves or Development Charges.

The Stormwater Funding Study recommendations, scheduled for 2012, are expected to define the annual funding requirements and implementation timetable for capital intensive works in West Thornhill, service level improvements in the remainder of the Town, and potential service level improvements in other areas (e.g., Don Mills Channel). If a stormwater funding program (i.e., utility) is not established, funding for subsequent Phases and stages within Phase 1 could be through annual budget requests.

F.2 Phase 1

The preliminary design of Phase 1 area improvements will identify stages within the Phase 1 Area so that improvements may proceed in line with available funding identified in the financial considerations. More complete works can be carried out on individual systems if additional funding is available. Therefore, it is recommended that [the two remaining capital projects be consolidated as per recommendation number 4 \(i.e, account #50-5350-10281-005 Storm Sewer Upgrades with a budget of \\$2 million be made available to fund the first stage of Phase 1 improvements in West Thornhill\)](#). Following this consolidation, a total of approximately \$4 million would be available for the first stage of works within the Phase 1 area. The preliminary design study will also identify any further funding for Phase 1 works that could be requested in the future budgets.

Funding beyond the first stage of Phase 1 works will be contingent upon annual funding requests for subsequent stages or sustained funding determined through the Stormwater Funding Study. That study, initiated in 2010, is ongoing and in the process of data collection required to formulate funding options for evaluation. Given the expected Phase 1 estimated cost, a multi-year implementation timeframe is expected. Cost estimates will be refined following preliminary design and alternative refinement.

F.3 Related Wastewater System Works

Funding of sanitary sewer system flow reduction and capacity improvement measures are not addressed as part of this report. In the West Thornhill area, these improvements are funded through various sources including the water/wastewater rate (downspout disconnection, sewer relining, capacity upgrades), and Regional grants (sewer relining).

FINANCIAL CONSIDERATIONS AND TEMPLATE:

The following table summarizes the financial considerations for this report:

Account Name	Account #	Budget Amount	Spent to date	Committed	Budget Available
Thornhill Stormwater Flood Remediation Study	058-6150-8530-005	\$500,000.00	\$389,741.00	\$14,702.00	\$ 95,557.00
Thornhill Storm Sewers Upgrades	050-6150-9330-005	\$2,000,000.00	\$28,608.00	\$504.00	\$1,970,888.00
Storm Sewer Upgrades	050-5350-10281-005	\$2,000,000.00	\$0.00	\$0.00	\$2,000,000.00
Total		\$4,500,00.00	\$418,349.00	\$15,206.00	\$4,066,445.00

HUMAN RESOURCES CONSIDERATIONS

Roles and Responsibilities

1. Asset Management, ROW & Environmental Asset Section is to manage and report back on the West Thornhill Stormwater Flood Control Implementation Strategy including stormwater models, monitoring, studies, and recommendations for implementation.
2. Asset Management, ROW & Environmental Asset Section is to develop and report back on Town-wide flood risk screening to identify and prioritize subsequent areas for repairs, maintenance and/or detailed technical studies (e.g., Municipal Class Environmental Assessment Studies), as input to a Town-wide Stormwater Flood Control Strategy.
3. Asset Management, ROW & Environmental Asset Section is to continue to advance the Stormwater Funding Study to determine funding for later Phases of the West Thornhill Strategy and as input to a Town-wide Flood Control Strategy. Staff is to continue working closely with Finance, Waterworks and the Sustainability office, and to consult with Council on rate structures, level of service and resulting rates to sustain funding.
4. Environmental Services is to manage and report back on items necessary for integration of storm and sanitary service improvements including the sanitary sewer inflow/infiltration reduction program which includes mandatory/voluntary downspout disconnection program, sanitary sewer relining, capacity upgrades, monitoring, and liaison with York Region on regional inflow/infiltration reduction requirements.
5. Engineering is to implement capital projects as recommended by Asset Management Department under the West Thornhill Stormwater Flood Control Strategy including detail design, tendering, and construction of the capital program.
6. Asset Management is to identify financing requirements to complete Phase 1 and 2 storm system improvements and to develop financing options as part of the Stormwater Funding Study.

ALIGNMENT WITH STRATEGIC PRIORITIES:

This report is consistent with the Building Markham's Future Together strategic priority on the "Growth Management" and "Environment" as it considers sustainability on the built environment.

BUSINESS UNITS CONSULTED AND AFFECTED:

The Environmental Services and Finance Departments have been consulted and have reviewed this report and their comments have been incorporated.

RECOMMENDED BY:

Gary Adamkowski, P.Eng.
Director,
Asset Management

Brenda Librecz
Commissioner, Community
and Fire Services

ATTACHMENTS:

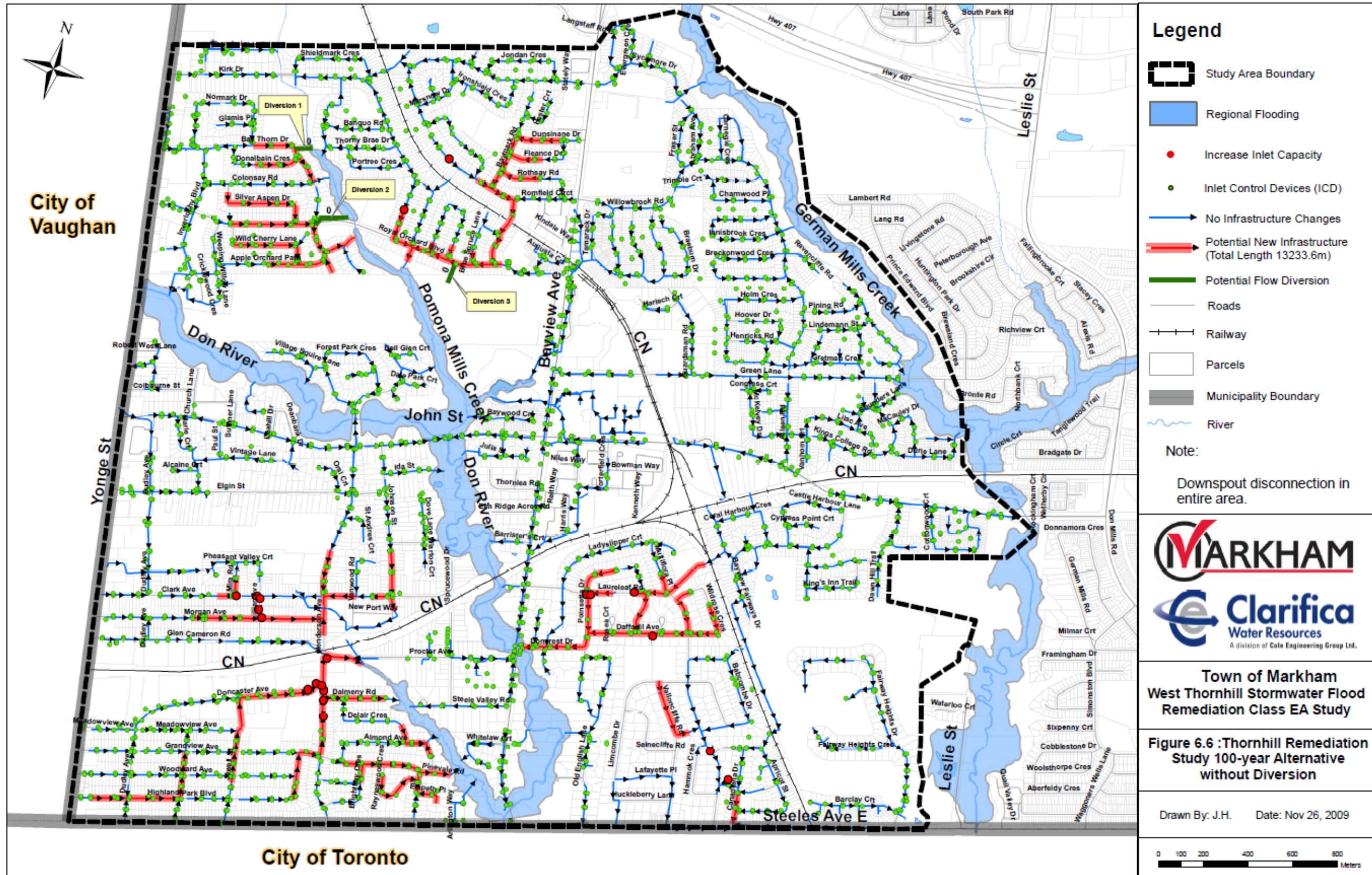
Attachment 'A' – Potential New Storm Sewer Infrastructure - West Thornhill Stormwater Flood Remediation Class EA Study (Nov. 2010)

Attachment 'B' – Phasing of Potential New Storm Sewer Infrastructure

Attachment 'C' – Town-wide Stormwater Study Areas

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Attachment 'A' – Potential New Storm Sewer Infrastructure - West Thornhill Stormwater Flood Remediation Class EA Study (Nov. 2010)



Legend

- Study Area Boundary
- Regional Flooding
- Increase Inlet Capacity
- Inlet Control Devices (ICD)
- No Infrastructure Changes
- Potential New Infrastructure (Total Length 13233.6m)
- Potential Flow Diversion
- Roads
- Railway
- Parcels
- Municipality Boundary
- River

Note:
Downspout disconnection in entire area.

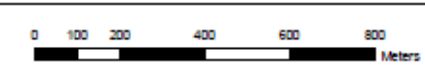
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Water Resources
A division of Cole Engineering Group Ltd.

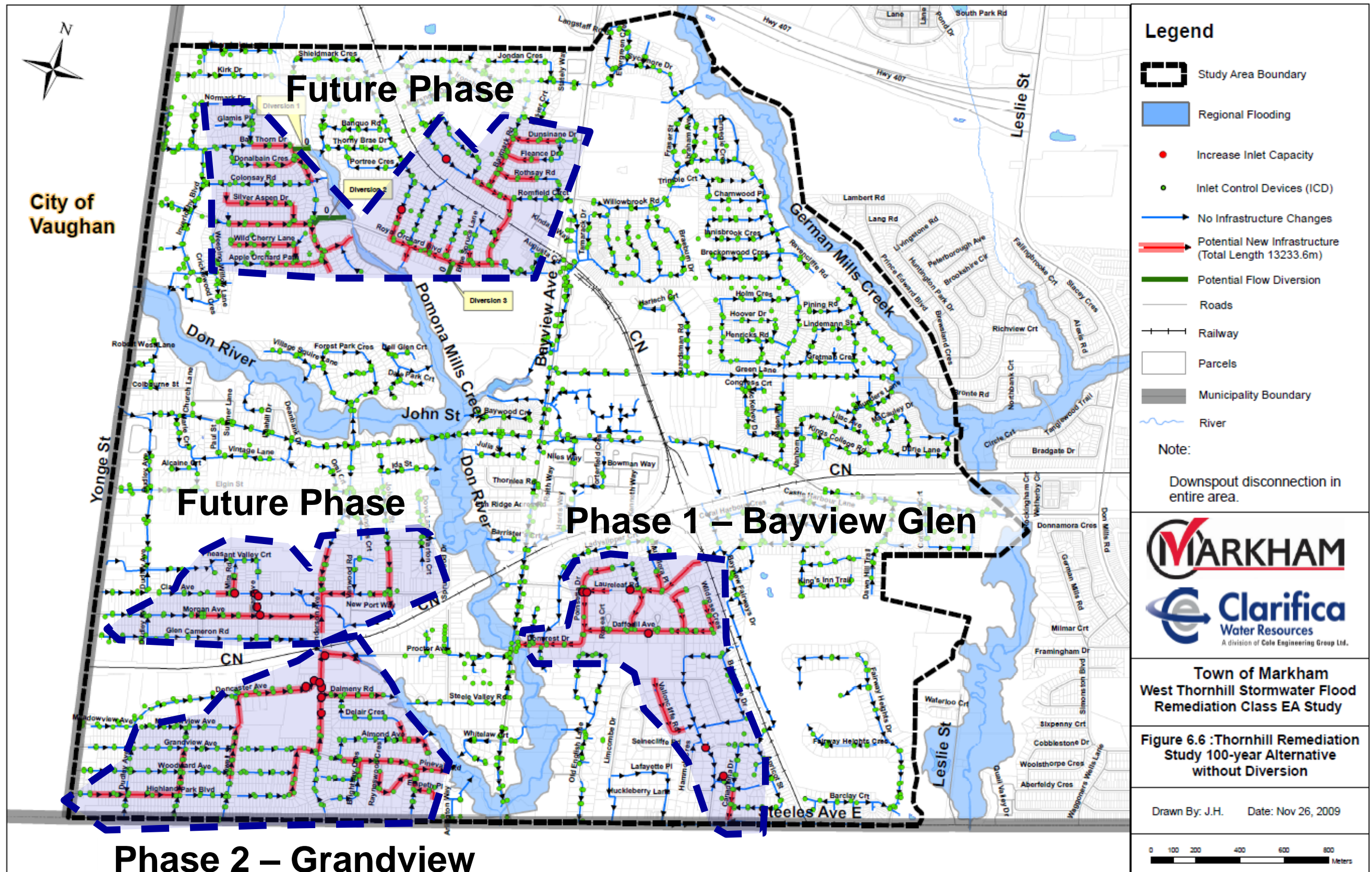
Town of Markham
West Thornhill Stormwater Flood
Remediation Class EA Study

Figure 6.6 : Thornhill Remediation
Study 100-year Alternative
without Diversion

Drawn By: J.H. Date: Nov 26, 2009



Attachment 'B' – Phasing of Potential New Storm Sewer Infrastructure



Legend

- Study Area Boundary
- Regional Flooding
- Increase Inlet Capacity
- Inlet Control Devices (ICD)
- No Infrastructure Changes
- Potential New Infrastructure (Total Length 13233.6m)
- Potential Flow Diversion
- Roads
- Railway
- Parcels
- Municipality Boundary
- River

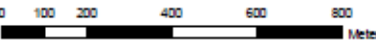
Note:
Downspout disconnection in entire area.



Town of Markham
West Thornhill Stormwater Flood
Remediation Class EA Study

Figure 6.6 : Thornhill Remediation
Study 100-year Alternative
without Diversion

Drawn By: J.H. Date: Nov 26, 2009



Attachment 'C' – Town-wide Stormwater Study Areas

