Watermain Hydraulic Analysis

PURPOSE:

This document provides guidance for the completion of a Watermain Hydraulic Analysis which may be required for the submission of an application under the *Planning Act*. All Watermain Hydraulic Analyses shall follow the requirements referenced in this document.

A Watermain Hydraulic Analysis provides information prepared in conjunction with a Functional Servicing Report (FSR) for a proposed land use change or development. The Watermain Hydraulic Analysis is focused on the existing and proposed performance of the municipal watermain network with respect to pressure and supply. The analysis utilizes a calibrated network level model of the municipal watermain system with consideration given to any planned system upgrades.

The Watermain Hydraulic Analysis should identify any necessary improvements to municipal water infrastructure required to support the proposed land use change or development. Mitigation measures to minimize negative impacts should also be identified.

A Watermain Hydraulic Analysis may be required for a Planning Application to determine if the water demand flow exceeds the capacity of the water supply system and to demonstrate that the proposed system will not adversely affect the existing surrounding system in terms of pressure and supply. City staff may also utilize the report to evaluate the financial and infrastructure implications of the proposed land use change or development.

A Watermain Hydraulic Analysis is submitted in conjunction with development applications and typically required as part of the following development application types:

- Official Plan Amendment;
- Zoning By-law Amendment;
- Draft Plan of Subdivision/Condominium; and/or,
- Site Plan Control (upon staff request).

PREPARED BY:

A Watermain Hydraulic Analysis must be prepared by a consultant registered as a Professional Engineer (P.Eng.) in the province of Ontario. The consultant must affix their stamp and seal and specifically identify the engineer who prepared the work. The consultant is expected to be experienced in civil/water resources.

CONTENTS:

The applicant is encouraged to discuss the need, scope, and the proposed water distribution concepts and design assumptions with City staff prior to preparing the Analysis.

A Watermain Hydraulic Analysis is based on established municipal engineering design principles, applicable guidelines, regulations, and by-laws, as well as information available from the City. The developer's consulting engineer should contact Hamilton Water to obtain the most up-to-date network level hydraulic model.

In general, the Watermain Hydraulic Analysis should include the following information:

- Introduction and Existing Conditions (site location, pressure district, background info, description of boundary conditions and study area);
- Proposed Conditions (land use, scenario development, network connections, summary of boundary conditions and/or hydrant flow tests);
- Design Criteria (unit counts and population densities, daily domestic and fire flow water demands, modelling parameters [peaking and friction factors, minor losses, pressure, and velocity restrictions, etc.]);

- Modelling Approach and Analysis (backflow assumptions, system upgrades, pump configurations, model calibrations, schematics);
- Results (residual pressures, available flows, flushing requirements, impacts, upgrade requirements); and,
- Conclusions and Recommendations.

Typically, the Watermain Hydraulic Analysis is circulated to the City of Hamilton for review. As such, the Proponent is responsible for obtaining and submitting the necessary documentation, as specified in the City's Development Guidelines Manual. Some of those documents include, but are not limited to the following:

- Watermain Design Checklist, obtained from the City's Public Works Department;
- Part 2 of Form 1 – Record of Watermains Authorized as a Future Alteration, Ontario Ministry of the Environment, Conservation and Parks (MECP);
- Construction Inventory Sheet, obtained from the City's website (Planning Policies & Guidelines);
- Watermain Fire Flow Report, obtained from the City's website (Planning Policies & Guidelines); and,
- Appropriate Design Drawings to obtain approvals and a Sewer and Water Permit in accordance with the City's Sewer and Water Permit Process.

OTHER INFORMATION:

City of Hamilton – Comprehensive Development Guidelines and Financial Policies Manual (latest edition)

- A.7.6 – Watermain Hydraulic Analysis Report
- D.1.3 – Size and Layout
- M.1. Appendix A – Watermain Hydraulic Report

https://www.hamilton.ca/build-invest-grow/planning-development/planning-policies-guidelines/comprehensive-development

City of Hamilton – Watermain Fire Flow Requirement Design Guidelines Policy (2019)

Ministry of the Environment, Conservation and Parks (formerly Ministry of the Environment) – Design Guidelines for Drinking-Water Systems (2008)

https://www.ontario.ca/document/design-guidelines-drinking-water-systems-0

Fire Underwriters Survey (FUS) – Water Supply for Public Fire Protection (2020)

Water Supply for Public Fire Protection in Canada 2020.pdf (SECURED)

Ontario Building Code (OBC)

- Volume 1 – Division B – Part 3 – Fire Protection, Occupant Safety and Accessibility (2024)
- Volume 2 – Appendix A-3 – Application of Part 3

https://www.ontario.ca/page/ontarios-building-code

Office of the Fire Marshall (OFM) – Fire Protection Water Supply Guideline for Part 3 in the Ontario Building Code (1999)

https://www.ontario.ca/page/fire-safety-legislation-and-ontarios-fire-code

American Water Works Association (AWWA)

- Manual M68 Water Quality in Distribution Systems (2017)
- Manual M31 Distribution System Requirements for Fire Protection (2008)
- Manual M32 Computer Modelling of Water Distribution Systems (2017)

https://store.awwa.org/manuals

REVIEWED AND APPROVED BY:

Development Planning, Planning and Economic Development Department

Development Approvals, Planning and Economic Development Department

Source Water Protection, Public Works

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APPENDICES:

Watermain Hydraulic Analysis – Summary Checklist

Watermain Hydraulic Analysis – Standard Format for Table of Contents

Watermain Hydraulic Analysis Report – Summary Checklist

The form is to be completed by the Professional that prepared the Watermain Hydraulic Analysis Report.

Use of the form by the City of Hamilton is not to be construed as verification of engineering/scientific content.

Refer to the Terms of Reference for the Watermain Hydraulic Analysis Report: Link to Terms of Reference

If any of the requirements listed below have not been included in the watermain hydraulic analysis report, the study will be considered incomplete.

Study Information	Notes
Site Address	
Property Owner	
Project Description	
Land Use	
Date Prepared	
Prepared By	

Summary of Key Information:

Item	Study Information	Notes	Page # & Section # of Report	Report Includes this Information. City Staff (Check)
1.	Is this a Preliminary or Final Report?			
2.	Have the subject lands been clearly identified?			
3.	Has a Location Plan been included? Does the Location Plan clearly identify the property limits, owner(s), adjacent land uses and/or owner(s)?			
4.	Reference to documents or policies that govern the development.			
5.	Have any relevant Master Drainage Plans been discussed and/or used?			
6.	Have the appropriate Pressure Zone / HGL / boundary conditions been used? Has the information been provided by the City or hydrant flow test(s)?			

Item	Study Information	Notes	Page # & Section # of Report	Report Includes this Information. City Staff (Check)
7.	Has a Water Distribution Plan been included? Does it clearly identify existing and proposed pipe sizes, junction labels, network connections, street names, appropriate legend?			
8.	What unit count was used? Which Plan was used to determine the count?			
9.	What population density was used? (upha or ppha)			
10.	What average daily water usage demand was used? List all land uses that apply. (L/d/c or L/s/ha)			
11.	Which peaking factors were applied? Are they representative of the total proposed population?			
12.	What is the required fire flow (RFF) under OBC?			
13.	What is the City's Target Available Fire Flow? See Policy PW19096.			

Item	Study Information	Notes	Page # & Section # of Report	Report Includes this Information. City Staff (Check)
14.	Has a table summarizing the modelled available fire flow(s) been included?			
15.	Does/do the available fire flow(s) meet or exceed the larger of #12 and #13?			
16.	Does the residual pressure remain above 140kPa for all fire flow scenarios?			
17.	Have the appropriate pipe friction factors been used?			
18.	Have minor losses through the pipes been appropriately calculated? Have they been included?			
19.	Has a table summarizing the daily domestic pressures been included?			
20.	Are daily domestic pressures within acceptable ranges?			
21.	Are maximum pipe velocities exceeded? If so, why/where?			

Item	Study Information	Notes	Page # & Section # of Report	Report Includes this Information. City Staff (Check)
22.	Have any solutions been proposed to reduce maximum pipe velocities, if applicable?			
23.	Can the proposed watermains withstand transient pressures?			
24.	Can the minimum flushing velocity (0.8m/s) be met?			
25.	Has a development plan (Site, Draft, Condo, etc.) been included?			
26.	Have the City's boundary conditions or hydrant flow test results been included?			
27.	Have domestic demand calculations been included?			
28.	Have fire flow demand calculations been included?			
29.	Have the appropriate modelling output files been included?			
30.	Has the analysis considered the 2031 Horizon forecast?			

Item	Study Information	Notes	Page # & Section # of Report	Report Includes this Information. City Staff (Check)
31.	Has the model been appropriately calibrated? Are the results included?			
32.	Has the City's Watermain Design Checklist been completed and included?			
33.	Has Part 2 of Form 1 been completed and included?			
34.	Has the Report been sealed by a licensed Professional Engineer?			

Qualified Professional who completed this report summary:

Name:_____

Email:_____

Phone:_____

Date:_____

Signature and Stamp:_____

Guideline for Applicants completing the Summary Checklist for Watermain Hydraulic Analysis Report

Site Address: provide municipal address, or lot and concession

Property Owner: provide company name if applicable and name of key contact person

Project Description: provide brief description – e.g. 20 Ha residential subdivision

Land Use: e.g. residential, industrial, commercial/ mixed use residential and commercial

Date Prepared: provide the date the study was completed

Prepared By: provide name of consulting firm that completed the study

1. **Is this a Preliminary or Final Report?**
   Indicate whether this is a Preliminary or Final report. If Final, also list the date of the Preliminary report.
2. **Have the subject lands been clearly identified?**
   Ensure the property is properly and adequately described in the Introduction.
3. **Has a Location Plan been included? Does the Location Plan clearly identify the property limits, owner(s), adjacent land uses and/or owner(s)?**
   Ensure a Location Plan is included, which clearly identifies the items listed above. Ensure the description in the text matches what is shown in the figure.
4. **Reference to documents or policies that govern the development.**
   List all relevant Municipality, Agency, Conservation Authority, etc. policies and/or reports that may be relevant to the design and/or property.
5. **Have any relevant Master Drainage Plans been discussed and/or used?**

If the subject lands are located within the study area of any Master Plan, has it been used and adequately described in the opening sections of the report. Ensure any and all recent and/or future upgrades or changes to the distribution system and/or pressure zone(s) have been incorporated into the analysis.

6. **Have the appropriate Pressure Zone / HGL / boundary conditions been used? Has the information been provided by the City or hydrant flow test(s)?**
   Ensure it is clear to the reader what boundary conditions are being used and how they were obtained. If the information is not provided by the City, confirmation from the City may be required to ensure the appropriate Pressure Zone and data is used.

7. **Has a Water Distribution Plan been included? Does it clearly identify existing and proposed pipe sizes, junction labels, network connections, street names, appropriate legend?**
   Ensure a layout plan is included, which clearly identifies the items listed above.

8. **What unit count was used? Which Plan was used to determine the count?**
   What is the total unit count used, broken down by land use types (e.g. singles, townhomes, commercial, etc.). List where this information was obtained (i.e. Draft Plan, Site Plan, etc.), including company name and date of publication.

9. **What population density was used? (upha or ppha)**
   List the residential densities and equivalent ICI densities used to calculate population. (units per hectare or people per hectare) Do they meet the City's requirements?

10. **What average daily water usage demand was used? List all land uses that apply. (L/d/c or L/s/ha)**
    What is the average daily usage rate used for calculations. List all that apply (i.e. L/d per capita/person for residential or L/s per hectare for ICI lands). Do they meet the City's or MECP's requirements.

11. **Which peaking factors were applied? Are they representative of the total proposed population?**
    Refer to the City's standards, or the MECP's 2008 *Design Guidelines for Drinking-Water Systems*.

12. **What is the required fire flow (RFF) under OBC?**
    List the maximum required fire flow per Section A-3 (Appendix A) of the OBC.

13. **What is the City's Target Available Fire Flow? See Policy PW19096.**
    List the maximum Target Available Fire Flow per the City's Policy PW19096.

14. **Has a table summarizing the modelled available fire flow(s) been included?**
    Ensure the report includes a table summarizing the available fire flow at all proposed junctions.

15. **Does/do the available fire flow(s) meet or exceed the larger of #12 and #13?**
    Does the table from #14 clearly demonstrate that all maximum fire flows can be met?

16. **Does the residual pressure remain above 140kPa for all fire flow scenarios?**
    Ensure this is true for all modelled junctions and fire flow scenarios.

17. **Have the appropriate pipe friction factors been used?**
    Refer to the City's standards. Has the model been properly set up with this parameter?

18. **Have minor losses through the pipes been appropriately calculated? Have they been included?**
    If a Preliminary report (i.e. uncertain final design – appurtenances), has an appropriate minor loss coefficient been allocated to all pipes in the model? If a Final report, have the minor losses been accurately calculated? Ensure those calculations are appended to the report.

19. **Has a table summarizing the daily domestic pressures been included?**
    Ensure the resulting daily pressures (average day, max day, min hour, and peak hour) have been summarized and discussed in the report. Resulting modelling output files should also be appended to the report.

20. **Are daily domestic pressures within acceptable ranges?**
    Refer to the City's or MECP's standards. Typically, average day and max day (350-550kPa) and min hour and peak hour (275kPa-700kPa).

21. **Are maximum pipe velocities exceeded? If so, why/where?**
    Refer to the City's standards. A standard example is a restrictive maximum of 5.0m/s during fire flow scenarios. If applicable, does the model show any exceedances? Clearly identify where these happen.

22. **Have any solutions been proposed to reduce maximum pipe velocities, if applicable?**
    Have pipe sizes been revised to eliminate these higher velocities? Are velocities found in looped distribution mains or along dead-end reaches? Is there a potential for stagnant water conditions in oversized main?

23. **Can the proposed watermains withstand transient pressures?**
    Has a transient pressure analysis been performed? Clearly identify the results in the report and include calculations/output in the appendices. Conclude on the results.

24. **Can the minimum flushing velocity (0.8m/s) be met?**
    Has a watermain flushing analysis been performed? Clearly identify the results in the report and include calculations/output in the appendices. Conclude on the results.

25. **Has a development plan (Site, Draft, Condo, etc.) been included?**
    Ensure a copy of the plan used for the layout design, unit counts, demands, etc. has been included.

26. **Have the City's boundary conditions or hydrant flow test results been included?**
    Ensure the information or results from the City and/or independent hydrant flow test is appended to the report.

27. **Have domestic demand calculations been included?**

Ensure the domestic flow demand calculations have been appended to the report.

28. **Have fire flow demand calculations been included?**
Ensure the fire flow demand calculations have been appended to the report.

29. **Have the appropriate modelling output files been included?**
Ensure all relevant modelling output files and figures have been appended to the report.

30. **Has the analysis considered the 2031 Horizon forecast?**
Yes or No. If No, explain why.

31. **Has the model been appropriately calibrated? Are the results included?**
Has the model's pump curve(s) been compared against the results of an adjacent/local hydrant flow test? Ensure the calculations have been included and comment on the results.

32. **Has the City's Watermain Design Checklist been completed and included?**
To be obtained from the City's Public Works Department.

33. **Has Part 2 of Form 1 been completed and included?**
Obtain a Form 1 from the government of Ontario's website (https://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/MinistryDetail?OpenForm&ACT=RDR&TAB=PROFILE&ENV=WWE&NO=012-2202E). Part 2 to be completed and submitted to the City.

34. **Has the Report been sealed by a licensed Professional Engineer?**
Yes or No. If No, explain why?