OHM Advancing Communities®

Power Road Bridge Scour Project

The City of FARMINGTON Founded 1824

ENGINEERING STANDARDS & DESIGN SPECIFICATIONS

ADOPTION DATE
MAY 15, 2017

OHM Advisors®

Table of Contents

City of Farmington Engineering Standards and Design Specifications

I. INTRODUCTION TO THE STANDARDS AND DESIGN SPECIFICATIONS

A. Understanding the Standards and Engineering Process

The existence and constant improvement of the growing network of public utility, drainage and road system infrastructure within the City of Farmington demands the need to maintain an updated compilation of engineering based standards and design specifications for development and infrastructure improvements.

These standards and design specifications are intended to guide public capital improvement infrastructure projects that occur within the City and that are under the jurisdiction of the City of Farmington. These standards are also intended to serve those who wish to develop or redevelop a property within the City of Farmington and to ensure that a high level of quality planning, design and construction occurs. These specifications have been developed to focus on all engineering aspects associated with site development and infrastructure improvements and include sections specific to: topographic survey, water supply system, wastewater system, stormwater management, paving improvements, grading and earthwork, and soil erosion and sedimentation control. Industry best practices shall be implemented for both public and private development.

These standards were created to ensure infrastructure is installed at a high level of quality in the interest of promoting economic growth while facilitating maintenance and operations of the utilities.

These standards will help serve as a guide through the engineering and construction stages of a project by providing information so one can effectively and efficiently navigate through the process. Understanding these standards and the City Ordinances prior to starting design, as well as communicating with the City and agency staff throughout the process, is strongly encouraged and will help achieve positive results with regards to the proposed improvements.

These standards supplement all other applicable requirements of the City Ordinances as well as requirements of any other impacted agencies. In the event that any of the standards, ordinances, or requirements presents a conflict, the ordinance shall govern. These standards are intended to provide the minimum guidelines for engineering infrastructure plans. Throughout the planning, engineering design and construction of an infrastructure improvement, the City of Farmington can be contacted for information or to answer questions that may arise. The City can be reached at (248) 474-5500.

B. Capital Improvement and Public Infrastructure Design

For all public capital improvement and infrastructure design being conducted within the City of Farmington, the Technical Specifications sections starting with Section III. Topographic Survey through Section IX. Soil Erosion and Sedimentation Control shall be followed.

1. Permit Requirements

   For all public capital improvement designs, permits and/or waivers may need to be obtained from the City of Farmington and other applicable agencies. It is important to contact each agency prior to commencing design to obtain details on what requirements may be necessary to carry out the planning and construction, as well as what potential existing infrastructure may impact the proposed improvement. A listing of facilities, controlling agencies, and contact information has been provided below. This includes local, regional, state and franchise entities. Please note that the list below is not all inclusive and additional agencies may need to be contacted based on the uniqueness of the project area.

Local Facility	Controlling Agency	Permit/Waiver	Contact Information
Water Supply System & Wastewater System	City of Farmington Department of Public Services (DPS)	Letter of Approval	Chuck Eudy Public Works Superintendent 33720 W. 9 Mile Rd. Farmington, MI 48335 (248) 473-7250
Building Department	City of Farmington	Letter of Approval & Permits - OR - Waiver Letter	John Koncsol Building Official 23600 Liberty St. Farmington, MI 48335 (248) 474-5500
Economic and Community Development	City of Farmington		Kevin Christiansen Economic and Community Development Director 23600 Liberty St. Farmington, MI 48335 (248) 474-5500
Public Roadways	Road Commission for Oakland County	Letter of Approval & Permits - OR - Waiver Letter Claiming No Jurisdiction	Danielle Deneau 31001 Lahser Rd. Beverly Hills, MI 48025 (877) 858-4804
Well/Septic Services	Oakland County Health Division	Permit - OR - Waiver Letter	Frank Rhodes 1200 Telegraph Rd. Bldg 34 E Pontiac, MI 48341 (248) 431-0956
Soil Erosion & Sedimentation Control	Oakland County Water Resources Commissioner	Permit - OR - Waiver Letter	Water Resources Commissioner One Public Works Dr. Bldg 95 W Waterford, MI 48328 (248) 858-0958

Regional/State Facility	Controlling Agency	Permit/Waiver	Contact Information
County Water Resources	Oakland County Water Resources Commissioner	Permit - OR - Waiver Letter	Water Resources Commissioner One Public Works Dr. Bldg 95 W Waterford, MI 48328 (248) 858-0958
Water Supply System	Michigan Department of Environmental Quality (MDEQ) Public Wastewater and Drinking Water Unit - Water Bureau	Act 399 Permit	Amber Lopez Southeast Michigan District Office 27700 Donald Ct. Warren, MI 48092 (586) 506-6136
Wastewater System	MDEQ Public Wastewater and Drinking Water Unit – Water Bureau Southeast Michigan District Office	Part 41 Permit	Laura Verona 27700 Donald Ct. Warren, MI 48092 (586) 753-3793
Wetlands and Impacts to Waters of the State	Michigan Department of Environmental Quality (MDEQ) and/or Environmental Protection Agency (EPA)	Permit	LWMD-PCU P.O. Box 30204 Lansing, MI 48909-7704

Franchise Facility	Controlling Agency	Permit/Waiver	Contact Information
Gas	DTE Energy (MichCon)	Letter of Approval (Projects where gas lines are impacted)	Replacement Team Noble Second Floor 3200 Hobson Detroit, MI 48201 (313) 577-7350
Electric	DTE Energy		
Telephone	ATT	Letter of Approval (Required where lines are impacted)	444 Michigan Ave. Detroit, MI 48226 (866) 620-6900
Cable Television/Internet	Comcast	Letter of Approval (Projects where lines are impacted)	P.O. Box 3005 Southeastern, PA 19398-3005

2. Standard Details

   Standard details for the water supply system, wastewater system and stormwater management features are included in the Digital Appendix (in .pdf format) included with these standards. For all proposed public infrastructure improvement projects within the City of Farmington, the standard detail sheets shall be included in the plan set.

C. General Fee Table

Review fees vary based on the proposed site design and/or improvements. Below is a general table to assist with anticipated fees for the project as a whole:

Review/Agency	Description	Reference Section
Building Permit	Fees are outlined in the Permit Application form	Code of Ordinance Part II Chapter 7
Pre-Application Meeting*	Fees are outlined on the City's website	This document D.1.a
Engineering Review*	Fees vary based on applicant's engineer's opinion of cost	Code of Ordinance Part II Chapter 35 Article 13; This document D.1.c
Construction Inspection	Determined based on the estimated duration of the construction operations and typical construction production rates	This document D.2.c.ii
City Administration	A non-refundable fee in the amount of 2% of the total site construction cost	This document D.2.c.iii
Water/Sewer Tap	Fees determined by City DPS	This document D.2.c
Planning Review	Fees are outlined on the City's website	
County SESC	Fees are outlined on the County's Permit Application form	Technical Section IX
PUD Agreements	Fees are outlined on the City's website	Code of Ordinance Part II Article 10
**Contact the Economic & Community Development Department at (218) 474-5500 Other agencies may require review and approval (e.g. RCOC, MDOT, MDEQ, etc.). It is recommended the applicant contact the City during the course of the design.*		

D. Private Development Process

The plan review process in the City of Farmington represents a phased approach aimed at first promoting discussion of design concepts, then a site plan review, and ultimately, a detailed engineering review. Detailed standards and checklists are included within this document to serve as a guide to plan development, engineering design, material selection and construction. These checklists do not necessarily include every requirement needed for approval as individual sites may have unique features that may have to be addressed in ways that are not necessarily outlined. A more comprehensive description of the review process is included in Section II. Plan Review Process. A brief summary of each phase of the plan review process is as follows:

1. Plan Review Process Overview

    a. Pre-Application Meeting

    Prior to developing plans, applicants and/or their representatives are required to schedule a pre-application meeting with the City, their consultants and local agencies to discuss design concepts, verify that the site complies with ordinances and standards, and is generally feasible. At a minimum, a sketch plan or concept plan should be submitted by the applicant to the City of Farmington to distribute for review not less than two weeks before the meeting date. All applicable fees shall be paid by the

applicant and the City will schedule this meeting to be held at the City Offices, located at 23600 Liberty Street, Farmington, MI, 48335. The City will forward invitation to all applicable local agencies to facilitate and streamline the plan review process.

b. Site, Sketch, or Plot Plan Review

The City of Farmington will require that any development subject to review (site plan, sketch plan, or plot plan) per the City Ordinance create and submit a plan to the City for review. The City will also determine if the review will need to be approved by the Planning Commission or be approved administratively. A final site plan may also be required based on the City Ordinances. The applicant shall submit plans and fees to all applicable agencies for review. These submittals can be coordinated through the City. With each submittal, review fees shall be paid to the City, in accordance with the City Fee Schedule, for tracking and distribution. It should be noted that other agencies, including the Road Commission for Oakland County (RCOC), the Oakland County Water Resources Commissioner (WRC), and Michigan Department of Environmental Quality (MDEQ) may also have review fees that are not covered by those collected at the City. The City and/or their consultants and other agencies will then review the plans and prepare letters to be sent back to the City within three (3) weeks of distribution. If City staff determines the plans to be in good order, then City staff will present the submitted plan to the City Planning Commission for action. The Planning Commission may approve, approve with conditions, table, deny or make a recommendation to the City Council regarding the plan submission. More detail regarding preliminary site, sketch, and plot plan reviews can be found in Section II.

c. Detailed Engineering Plan Review

Prior to proceeding to construction or obtaining City Council approval of the final site plan (where required), the applicant shall submit detailed engineering and soil erosion and sedimentation control plans for review. The detailed engineering plan phase represents an in-depth review of the design plans that includes verifying site grading, water supply system, wastewater system, stormwater designs and paving improvements. The applicant shall submit signed and sealed plans by a licensed State of Michigan Professional Engineer, a detailed engineering submittal form (included in Appendix B), an engineer's opinion of cost, and the appropriate review fees to the City. The City staff with then distribute the plans to their consultants and other agencies to review. Review and approval by all applicable agencies is required prior to commencement of construction activity. More detail regarding the detailed engineering review can be found in Section II.

d. Permit Requirements from Other Agencies

As part of the design phase of the project, the applicant shall explore all requirements of any impacted public infrastructure. Further, as the site improvements are engineered and developed, the applicant shall be aware

that proposed improvements may result in having to obtain approvals, permits or waivers from various agencies. Aside from the required reviews from the City Planner, City Engineer, and the City of Farmington Department of Public Services (DPS), the applicant is encouraged to review the list (Section I.B.1) of various utilities and government entities owning facilities that are typically impacted as part of work in the City. The applicant is strongly encouraged to contact these agencies early in the design process to discuss potential impacts to the site.

2. Pre-Construction Phase

After receiving plan approvals or waivers from all affected agencies and all applicable City approvals, the applicant shall compile and submit all relevant items as requested by the City or the City Engineer. Once these items have been properly completed, the applicant will be able to proceed with construction activity.

a. Preconstruction Requirements

Upon approval of the detailed engineering plans, a letter outlining required fees, escrows, performance and maintenance guarantees, and insurance will be prepared and forwarded to the applicant. This letter provides a detailed calculation of the required escrow account deposit based on the amount of infrastructure proposed by the applicant and an assumed production rate. The applicant acknowledges understanding of the document by submitting all applicable documents and attending the preconstruction meeting. If any of the items listed in this letter are not in place at the start of the preconstruction meeting, the City holds the right to reschedule the preconstruction meeting to a later date when all items have been properly submitted to the satisfaction of the City and the City Engineer.

b. Performance Guarantees

As part of the site development process, the City of Farmington requires that all projects post sureties to ensure the timely and complete construction of approved site infrastructure. The applicant shall furnish security and guarantee in accordance with the City of Farmington Code of Ordinances.

i. The City will require a performance guarantee in an amount determined by the City Engineer but not less than 50% of the engineer's opinion of cost for the water supply system, wastewater system, stormwater management system, grading, paving, SESC, landscaping and other site related improvements (excluding the building) as defined in Item I.C.1.c. prior to construction. Where performance guarantees exceed $500,000, City Administration may make revisions on a case by case basis. An irrevocable standby letter of credit shall automatically renew on its own term for periods of no less than one year unless written notification to the City from the financial institution is received sixty (60) days prior to its expiration date. This security shall remain on deposit with the City

until the recommendation of final acceptance of the infrastructure improvements is given by the City Engineer.

ii. Every performance guarantee shall obligate the applicant to comply with all of the provisions of the City Code and to complete all conditions required by the permit or approved site or plot plan or plat within the time limit specified.

iii. If the applicant fails to timely complete all improvements and/or timely take the required action for which the performance guarantee was required, the applicant shall be deemed to be in default. Unless a shorter period has been specified in a permit or approval issued, or elsewhere in this Code, "timely" completion of improvements shall mean no longer than two (2) years from the date of issuance of the initial permit for improvements and the necessary performance guarantees therefor, unless such time is extended by the building official or is otherwise specified in a PUD Agreement or other development agreement entered into between the applicant and the City.

iv. In the event of a default, the city shall, following notice to the applicant and opportunity for the applicant to cure such default, as specified in the notice, have the right (but not the obligation) to use the performance guarantee deposited to complete the improvements or take the appropriate actions to achieve completion, or alternatively, restoration, if appropriate, and the application for site or plot plan or plat approval, building permit, temporary certificate of occupancy, or similar approvals shall be deemed to have authorized the right of the city to enter upon the property to bring about such completion. A notice to the applicant given under this section may be provided by one (1) or more of the following methods: regular first class mail to the address on the application for permit; delivery of the notice to the applicant at such address; hand-delivery to the applicant; or posting the property.

v. The Economic and Community Development Department may authorize exceptions to the requirements and conditions as set forth in this section, including, but not limited to, the form, timing, waiver, or reduction of performance guarantee amounts.

vi. The Building Official may also authorize the issuance of permits, approvals, or temporary certificates of occupancy before all requirements for issuance under this chapter have been met, where the applicant has demonstrated that unusual or unique circumstances exist, that work is proceeding toward completion, and that any delay in completion is not unreasonable or dilatory. In addition, the council shall consider such factors as the size and nature of the development project and the existence of matters beyond the control of the applicant (such as weather conditions, delay in securing permits/approvals from other regulatory agencies,

or unforeseen economic events or conditions). If any such exceptions are granted, a written completion agreement may be required, in a form to be established by the city.

vii. In the event the performance guarantee posted is insufficient in amount to allow the city to complete the improvements and/or actions, the applicant shall be required to pay to the city such additional costs as are needed for the completion of such improvements and/or actions. Should the city use the performance guarantee, or a portion thereof, to achieve such completion, any amounts remaining shall first be applied to the city's administrative costs, which shall be equal to twenty (20) percent of the cost of such completion, and to payment of actual attorney's fees, consultant fees, and like fees expended in connection with securing the guarantee and completing the improvements and/or actions; the balance remaining thereafter (if any) shall be refunded to the applicant.

viii. In the event of default, the city may contract with a third party to complete work required pursuant to this chapter.

ix. The applicant shall be responsible for ensuring that the required performance guarantees remain in place until all site improvements are complete and the guarantees have been released by the building official. Bonds and irrevocable letters of credit shall not be permitted to lapse or expire without renewal or replacement. The city may call or collect upon any such guarantee prior to its expiration if it reasonably appears to the building official that the guarantee will be permitted to lapse or expire.

x. Partial releases of the performance guarantee may be granted prior to acceptance upon request of the applicant, provided commensurate construction is satisfactory. In such cases, the minimum retained balance of the guarantee shall be not less than 10% of the original amount. Any reduction of these guarantees will only be considered after a written request has been submitted to the City during construction and after substantial completion of the project.

xi. A record drawing and easement guarantee in the form of a cashier’s check or cash is required prior to proceeding with construction. The City Engineer will determine this amount based on an estimate of what it would take for the City Engineer to complete this work. This deposit shall be made to the City at the same time the construction services escrow is established. If AutoCAD drawings are not provided immediately following detailed engineering approval, the cost will include performing a full topographical survey. The applicant’s AutoCAD files will only be used to create record drawings in the event the applicant’s engineer does not produce them.

xii. Additional guarantees may be required by other affected agencies.

c. Construction Fees, Escrows and Other Deposits

All past review fees not paid to date to the City must be paid in full prior to commencement of construction.

All City tap, meter fees, and the construction phase escrow deposit shall be paid to the City prior to the start of any construction. All tap and meter fees shall be verified with the City of Farmington for annual updates. The City can be contacted at (248) 473-7250.

i. The applicant shall establish a construction phase escrow account in accordance with these standards, as specified herein, to cover costs associated with the inspection of all public improvements. This account shall be maintained by the City unless directed otherwise by the City.

ii. The construction phase escrow deposit amount will be determined based on one of the following methods:

- The deposit will be based on the estimated duration of the construction operations based on typical construction production rates.
- The deposit may be adjusted based on the schedule proposed by the applicant's contractor. Said schedule shall be provided to the City Engineer no later than one week prior to the preconstruction meeting.

iii. The City will add a non-refundable administrative fee amounting to 2% of the total site construction cost as outlined on the approved final engineer's opinion of cost. This fee shall be paid prior to the detailed engineering review process.

iv. The applicant shall deposit the construction phase escrow monies (including the non-refundable administrative fee) with the City at least 48 hours prior to the preconstruction meeting. Instructions regarding the construction phase escrow will be provided in the preconstruction meeting requirements letter from the City Engineer. The applicant shall provide the City Engineer with a copy of the receipt verifying the appropriate deposit has been made.

v. In addition to the observation of the public improvements, the escrow account will be used to reimburse the City and/or the City Engineer for construction phase effort, including review of any field design changes or evaluations/interpretations of the plans, review of the record drawings and easements, and any other work associated with bringing the site into conformance with these standards.

vi. Construction phase services will be invoiced monthly against the construction phase escrow account based upon the established hourly rate by the City and/or the City Engineer. The City Engineer will track these escrow accounts and, if necessary, send notifications to the attention of the City and the applicant if production rates are less than anticipated and create the possibility of a deficit or negative balance. The City Engineer will monitor the escrow accounts and send notices to the City and the applicant at 75% escrow depletion and 90% escrow depletion if the actual production rate in the field is behind the rate in which the escrow is being depleted. If additional deposits are required, the City will then determine an appropriate amount using the same method as above and by adjusting production rates to an appropriate and more realistic level.

vii. Prior to reaching a negative balance, all construction services will be stopped until the applicant deposits additional escrow monies with the City. In addition, the City will add a nonrefundable administrative fee amounting to 10% of the additional escrow deposit to be paid at the time the additional funds are deposited with the City. Prompt attention to maintaining the account will prevent construction operations from being stopped and/or occupancy permits being withheld.

viii. Upon formal acceptance of the project, any funds remaining in the construction phase escrow account will be returned to the applicant.

d. Insurance

Prior to the construction, the applicant's contractor will procure public liability and property damage insurance with a responsible insurance company which meets the approval of the City of Farmington. These insurances must be maintained for the entire duration of the project. The amounts must be adequate to protect the public and all parties of interest, and will not be less than the limits set forth as follows:

Type of Insurance:

i. Workmen's Compensation Insurance and Employer's Liability. Limits as required by laws of the State of Michigan.

ii. Public Liability and Property Damage:

▪ Bodily Injury:	Each Occurrence	$500,000
	Aggregate	$1,000,000
▪ Property Damage:	Each Occurrence	$250,000
	Aggregate	$500,000

iii. Owner's and Contractor's Protective Liability and Property Damage:

▪ Bodily Injury:	Each Occurrence	$1,000,000
▪ Property Damage:	Each Occurrence	$250,000
	Aggregate	$500,000
	Or combined single limit of	$1,500,00

iv. Motor Vehicle (including Owner, Hired, and Non-Owned Vehicles):

- Bodily Injury: Each Occurrence $500,000
- Property Damage: Each Occurrence $200,000
  Combined single limit $1,000,000

Policies will be made available to the City of Farmington for examination as to their validity. Any undesirable exclusions deemed improper by legal opinion rendered to the City will be required to be removed.

Underground construction, where applicable, will be specified in the coverage.

Certificates of coverage signed by the insurance carriers will include a guarantee that thirty (30) days written notice will be given by the insurance carrier to the City prior to the cancellation of, or any change in, the respective policies. In the event that the insurance is cancelled, operations will cease prior to the cancellation date and will not resume until evidence is provided that proper insurance is again in effect.

The policy shall be in conformance with Public Act 271 and endorse as additionally insured under Owner's and Contractor's Protective Liability and Property Damage Insurance the City of Farmington; the City of Farmington City Council, jointly and individually; all City employees; and all City employees, agents and consultants, individually.

e. Construction Drawings

Prior to the preconstruction meeting, the applicant's design engineer shall submit six (6) sets of the approved detailed engineering plans to the City Engineer for processing and distribution to the appropriate parties. In addition, a digital version of the construction drawings shall be provided that includes both AutoCAD and Adobe PDF files. AutoCAD data shall be projected to the State Plane Coordinates and shall use NAVD '88 vertical datum.

3. Construction Phase

a. Preconstruction Meeting

Prior to starting any construction operations, the applicant must obtain all required permits and attend a preconstruction meeting. Unless otherwise specified, all meetings will be held at the City Offices. The applicant shall contact the City to schedule the meeting. The City shall notify all required and applicable attendees in writing outside of the local agencies listed in Section I.B.1.

Attendees at the preconstruction meeting (as well as any project progress meetings) shall include representatives from the City, the City Engineer, the Building Department Director, the Fire Marshal, the applicant, and the applicant's design engineer, as well as both the applicant's prime contractor

and underground contractor. In addition, representatives from any utility companies whose facilities may be affected by the project, as well as any state, county or other agencies having jurisdiction over portions of the project shall be invited to attend. It shall be the responsibility of the applicant to contact the City Engineer a minimum of 10 calendar days prior to the desired start of construction to schedule the preconstruction meeting. The preconstruction meeting shall be scheduled a minimum of 5 days prior to the start of construction. The preconstruction meeting will not be scheduled until all required approvals and documentation have been received by the City.

b. Construction

The City or designated representative(s) will provide observation of construction of all public utilities and improvements within 10 feet of any proposed or existing building. Full time observation will be provided for water supply systems, wastewater facilities, stormwater management facilities, sidewalk ramps connecting to the street or sidewalk along common areas, and approaches in the public right-of-way. Part time observation will be performed for all onsite paving, grading, and soil erosion and sedimentation control measures. On all part time observation items, the contractor or applicant shall provide third party certifications, density, and/or material testing reports if requested by the City or designated representative.

Any work occurring within 10 feet of any existing or proposed building may require the inspection and permit of the City of Farmington Building Department. Prior to working within this 10-foot envelope, the City of Farmington Building Department must be contacted.

The Road Commission for Oakland County (RCOC) will provide inspection work within the existing right-of-way and on any road improvements that will be dedicated as public facilities.

The Oakland County Water Resources Commissioner (WRC) will provide inspection for work associated with county drains or other water courses within their jurisdiction. The City, or their designated representative(s), may provide assistance with observing portions of the project for the other agencies.

The applicant or the applicant's contractor shall notify the City or designated representative(s) of those entities a minimum of three (3) working days prior to the start of any construction operations.

All improvements requiring observation shall be field staked in accordance with the approved detailed engineering plans. The applicant shall be responsible for field staking and providing appropriate cut sheets to the City or designated representative(s).

Deviations from the approved detailed engineering plans that are determined to be significant by the City, or designated representative(s), will require the

review and approval of the City, or designated representative(s). Deviations that are deemed to be significant will need to be submitted in writing (with revised plans, as necessary) to the City or designated representative(s) for review.

The applicant's contractor shall be responsible for ensuring that all construction operations are conducted in conformance with the MIOSHA safety standards.

c. Substantial Completion

At the completion of the installation and successful testing of all underground utilities and the completion of the majority of paving improvements, said facilities will be subject to a preliminary walk-through inspection. This preliminary walk-through may include representatives from the City, the City Engineer, and other appropriate agencies. At this meeting, a preliminary punch list will be generated and distributed by the City Engineer. Once all punch list items are addressed to the satisfaction of the City Engineer, a substantial completion letter will be issued by the City Engineer. Only after this point can the performance guarantees be reduced. This reduction may be accomplished by submitting a request, in writing, to the City. The applicant should understand that substantial completion does not, in any way, represent final acceptance. The substantial completion letter will indicate all remaining items that need to be completed. After substantial completion, the utilities are still under the ownership of the applicant and not that of the respective agency.

During the time between substantial completion and final acceptance of the underground utilities and paving improvements, said facilities will be subject to periodic inspection by the City or designated representative(s) during the completion of all surface improvements (commercial buildings, residences, etc.).

Upon the completion of all improvements associated with the project, the underground utilities and paving improvements will be subject to a final walk-through inspection. No facilities to be designated as public will be accepted until they have passed the final walk-through inspection. The applicant shall be responsible for providing all labor and equipment to accommodate inspection of the system(s) by the governing municipality and/or agencies having jurisdiction over the project. A project cannot receive a final walk-through inspection until all landscaping is complete and all portions of the site are complete. For residential projects, a final walk-through inspection will not be conducted until the site is 90% complete (Certificate of Occupancy issued). All final walk-through inspections shall include one representative each from the City, the City Engineer and the applicant's representative.

4. Project Completion

a. Record Drawings

To ensure that accurate records exist for all newly installed infrastructure within the City of Farmington, a set of record drawing requirements has been created. All projects require that accurate record drawings are produced and approved in advance of final project acceptance.

It is required that the applicant submit a complete digital file of the construction drawings including all details, plan and profile views to the City of Farmington at the time of the preconstruction meeting. The digital file should follow the template for digital submittals that is located in the Digital Appendix.

The applicant shall post a guarantee in an amount determined by the City and/or the City Engineer to ensure completion of the record drawings in a timely manner. The record drawing guarantee shall be presented in the form of a cashier's check, cash deposit, or irrevocable standby letter of credit.

The applicant has 90 calendar days after substantial completion (from the date of the issued substantial completion letter) to prepare and submit to the City Engineer an approvable set of record drawings. These record drawings shall be submitted in a digital format (AutoCAD and pdf) and on bond. Digital record drawing specifications are included in the Digital Appendix.

In the event the applicant fails to submit the required approvable record drawings to the City Engineer within the 90 day period, the City will utilize the applicant's record drawing guarantee to have the required record plans prepared by the City Engineer.

If this occurs, the City will direct the City Engineer to prepare the record drawings utilizing the digital plans previously submitted. Once this notification to proceed has been given to the City Engineer, delivery of the record drawings to the City will be made within 90 days of that date.

A copy of the record drawing requirements checklist is provided in Appendix A.

b. Easements

The applicant shall have easement documents prepared for all public sanitary sewer and water main on site unless located in a public right-of-way. In addition, any public storm sewer not in a public right-of-way or ingress/egress easements shall have easement documents prepared and submitted to the City Engineer and the appropriate legal counsel for review and approval. Once these are approved, the easements shall be forwarded by the applicant to the County Register of Deeds and recorded. Copies of recorded easements shall be forwarded to the City and the City Engineer for their records. Sample easement documents for water supply and wastewater systems can be found in Appendix D of this document.

c. Grading Certificate

The applicant shall submit a grading certificate upon the completion of construction, certifying that the site grading was completed in accordance with the approved detailed engineering construction plan. The grading certificate shall be signed and sealed by a Professional Engineer or Surveyor licensed to practice in the State of Michigan. A blank grading certificate is provided in Appendix E of this document.

d. Maintenance and Guarantee Surety

Prior to final acceptance by the City, the applicant shall post a two (2) year Maintenance and Guarantee surety with the City. The guarantee shall be presented in the form of a cashier's check or irrevocable standby letter of credit for 50% of the engineer's opinion of cost of the proposed public water supply system and public wastewater system improvements, as defined in Item I.C.1.c. It should be noted that other agencies having jurisdiction over the project or any portion thereof may also require maintenance guarantees.

e. Final Acceptance

Final acceptance will not be issued until all improvements shown on the approved detailed engineering plans are completed. For residential developments, final acceptance of the water supply system and wastewater system improvements will not take place until at least 90% of the residences are built and occupied.

II. PLAN REVIEW PROCESS

A. Introduction

The site plan review process will follow the procedures and standards prescribed by the City of Farmington Code of Ordinances and as described herein. These engineering standards are not intended to repeal, annul, or in any manner interfere with the existing regulations or laws of the City of Farmington, nor conflict with any statutes of the State of Michigan or Oakland County. The only exception being that these standards will prevail in cases where they impose a greater restriction than is being provided by the existing statutes, laws or regulations.

B. Pre-Application Meeting

The applicant seeking site plan approval from the City of Farmington is required to set up a pre-application meeting with the City staff, their consultants and other appropriate agencies prior to plan preparation. The purpose of this meeting is to discuss the concept, land use, location of utilities, and access to the site, as well as to share information that will help the applicant in preparing a preliminary site plan. At a minimum, a preliminary sketch plan showing location, proposed layout, preliminary utility layout and a narrative explaining the intent and nature of the use should be prepared and submitted to the City two (2) weeks in advance of scheduling this meeting.

C. Preliminary Site Plan Review

Following the pre-application meeting, the applicant will gather feedback and prepare to submit a preliminary site plan. The applicant shall contact the City of Farmington to determine review fees and the number of plans to be submitted. When the completed plan and associated fees have been received by the City, the plan will be distributed to the City staff and consultants for review and comments. The plans will be reviewed to determine the practicality of the project and the impact on services and surrounding properties. Compliance with the City Standards and Ordinances will also be reviewed. Special engineering design considerations may also be addressed.

It is important that the plan reflects the requirements needed to assure passage through the City reviews and approvals. It is recommended that the applicant review their prepared site plan in comparison with the site plan checklist found in Appendix A-1 of this document. While this checklist may not include everything necessary to receive approval because of certain site characteristics, it is intended to help guide and assist the applicant.

Once the City has received all reviews from the various agencies, as well as completing their own review, the City will administratively determine if the package is ready to be forwarded to the City Planning Commission for their consideration. All documents and fees required for Planning Commission approval must be received by the City according to the dates established on the Planning Commission calendar. The City staff will assemble all comments and provide them to the Planning Commission for their review.

If the plan is approved by the Planning Commission, or when applicable, the City Council, the applicant may submit detailed engineering and soil erosion construction plans. No construction work can begin with only preliminary site plan approval.

If the plan is not approved or is tabled by the Planning Commission, the applicant will have to address the applicable comments and resubmit if approval is desired. The plan will be returned to the applicant as often as necessary to meet City requirements.

All documents and fees required for Planning Commission approval must be received by the City no later than 14 working days prior to the next regularly scheduled meeting. A schedule of regular meeting dates is posted for public display at the City Offices building or online at: http://www.farmgov.com/

D. Plot Plan Review

The plot plan review process will follow the procedures and standards prescribed by Farmington Code of Ordinances, Chapter 35 – Zoning and as specified herein. These engineering standards are not intended to repeal, annul or in any manner interfere with the existing regulations or laws of the City of Farmington, nor to conflict with any statutes of the State of Michigan or Oakland County. The only exception being that these standards will prevail in cases where they impose a greater restriction than is provided by the existing statutes, laws or regulations.

The plot plan submittal should provide information on the lot, the proposed building and information on the proposed use. Also, the plot plan must indicate that the basement elevation is above the high groundwater mark or the applicant must make necessary arrangements with City Building Department if this cannot be accomplished. A checklist for Plot Plan requirements is supplied in Appendix A-2 of this document.

E. Detailed Engineering and Construction Plan Review

The final site plan process will follow the procedures and standards prescribed by Farmington Code of Ordinances, Chapter 35 – Zoning and the requirements specified herein.

The applicant shall contact the City to determine the number of complete final site plans that will be needed for review. The plans, a completed application form, a completed construction cost opinion form, and the required fees shall be submitted to the City. A sample estimate and engineering submittal form has been included in Appendix B of this document.

Three (3) copies of a detailed, itemized construction cost opinion for all water supply system, wastewater system, storm sewer, retention/detention basins, grading, paving, clearing and restoration improvements shall be submitted to the City at the time of the initial final site plan submittal. The cost opinion must be signed and sealed by the applicant's design engineer.

The City will then forward the application and final site plans to the necessary staff, consultants and other reviewing agencies as appropriate. All reviews will be submitted back to the City.

A checklist for detailed construction and engineering plans is provided in Appendix A-3 of this document. While this checklist may not include everything necessary to receive approval because of certain site characteristics, it is intended to help guide the applicant and assist them in submitting a complete application. The applicant is also strongly encouraged to review the technical sections provided in these standards. These sections provide an in-depth baseline for minimum design, material, and construction standards to be used in the City.

The detailed engineering construction plan phase represents an in-depth review of the engineering plans that includes the review of site grading, water supply system, wastewater system and storm water designs.

If plan revisions are required following the reviews, the applicant shall prepare revised plans accompanied by a complete list of all changes, certified as such by the applicant's design engineer. Full sets of plans must be resubmitted to the City. Submittals will not be reviewed unless they are received from the City. After two (2) reviews without approval, the applicant, the applicant's engineering, the City Engineer, and a representative from the City, as well as any other applicable parties, shall meet to discuss the review comments. This meeting is mandatory prior to proceeding to a third review.

If the City Engineer recommends approval, but significant changes occur after the fact due to another agency's review, the plans must be resubmitted to the City for a final review. Approval from all applicable agencies is required prior to proceeding with any construction activity.

F. Soil Erosion & Sedimentation Control Plan Review

The Soil Erosion and Sediment Control (SESC) permit and plan review process will follow the procedures and standards as prescribed by the City of Farmington Code of Ordinances and the requirements specified herein. These engineering standards are not intended to repeal, annul, or in any manner interfere with the existing regulations or laws of the City of Farmington, nor to conflict with any statutes of the State of Michigan or Oakland County. The only exception being that these standards will prevail in cases where they impose a greater restriction than is provided by the existing statutes, laws or regulations.

The Oakland County Water Resources Commissioner (WRC) is designated as the Soil Erosion and Sedimentation Control Municipal Enforcement Agency for the City of Farmington. All applications, plan reviews and permitting requirements will be addressed by the WRC. When work occurs within the public road right-of-way of either the Road Commission of Oakland County (RCOC) or the Michigan Department of Transportation (MDOT), the SESC falls under the jurisdiction of those respective entities as they are an Authorized Public Agent (APA). The SESC work is subject to Michigan Department of Environmental Quality (MDEQ) inspections and audits.

A WRC SESC permit is required for any activity that facilitates an earth change which disturbs one or more acres of land, or that which is within 500 feet of a defined lake, stream or county drain. No work, including site clearing or earth disturbance, can commence on any project that requires an SESC permit until that permit has been obtained from the City. If the disturbed area is five (5) or more acres in size, an NPDES permit from the MDEQ will be required in addition to the SESC permit from the WRC.

The SESC plan review and permit process begins by completing the City Detailed Engineering Submittal Form. The plans, a completed application form, and the required review fees shall be submitted to the City. This application should be submitted at least thirty (30) days prior to the anticipated date of the start of earth disruption.

A checklist for the SESC plan requirements can be found in Appendix A-4 of this document. This checklist may not include all necessary items to receive approval, as it is only intended to

assist the applicant in providing a complete submittal. The applicant is also strongly encouraged to review Section IX. Soil Erosion and Sedimentation Control of this document as well as the Oakland County Water Resources Commissioner Erosion Control Manual.

G. Variance from Engineering Standards

Upon application, a specific variance to a substantive requirement of these standards may be granted, subject to the following criteria. Where the proposed activity requires site plan or plat approval, or otherwise involves the design or construction of a facility intended to be public, the variance application shall be submitted to the City Engineer who will make a recommendation to City Administration. Where the proposed activity does not otherwise require site plan or plat approval, the variance application shall be to the construction board of appeals.

A variance may be granted when all of the following conditions are satisfied:

a) A literal application of the substantive requirement would result in exceptional, practical difficulty to the applicant;

b) The alternative proposed by the applicant shall be adequate for the intended use and shall not substantially deviate from the performance that would be obtained by strict enforcement of the standards; and

c) The granting of the variance will not be detrimental to the public health, safety or welfare, nor injurious to adjoining or neighboring property.

The city council may, by resolution, establish an application fee for requests for variances from these standards.

III. TOPOGRAPHIC SURVEY

A. General Requirements

1. A complete topographical survey is required for all proposed projects. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements shall also be shown on the plan view of the existing conditions.

2. A minimum of two (2) benchmarks are required for vertical control. All benchmarks shall be clearly indicated on the plans. All elevations shall be to North American Vertical Datum – 1988 (NAVD -88).

3. Horizontal control shall be established for each site by utilizing the Michigan State Plane Coordinates, Michigan South Zone Coordinate System NAD 83 (CORS).

4. Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. Onsite, intermittent elevations and/or defined contours (minimum contour interval of two (2) feet) are required to establish the existing site drainage patterns.

5. Existing features shall be located and shown within 100 feet of the project. Existing features to be shown shall include, but may not be limited to, the following items:

    a. Ditches.
    b. Culverts.
    c. Water supply system, stormwater management, and/or sanitary sewer facilities, including inverts and casting elevations at all structures.
    d. Gas, telephone, electric and cable television lines, including manholes and/or utility poles.
    e. Pedestrian facilities.
    f. Trees and other landmark vegetation.
    g. All streams, lakes and/or county drains with names shown.
    h. Existing buildings and other permanent structures.

6. Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:

    a. Right-of-way or easement lines.
    b. Ditch centerline.
    c. Top of bank.
    d. Edge of shoulder.
    e. Edge of pavement or top of curb.
    f. Crown or centerline.

7. Modifications to topographic survey requirements will be determined by the proposed site development, improvements, and/or modifications to the overall site, on a case-by-case basis.

IV. WATER SUPPLY SYSTEM

A. General

1. Water supply system improvements shall be designed and constructed in accordance with the requirements of the Michigan Safe Drinking Water Act, Act 399 of the Public Acts of 1976, as amended; as well as the latest revisions of the standards and manuals of practice published by the American Water Works Association (AWWA), the Great Lakes Water Authority (GLWA), and as specified herein.

2. All water supply system improvements will require the review and approval of the City of Farmington Department of Public Services (DPS) and the City Engineer. The majority of water supply system improvements will also require the review and approval of the MDEQ. Water supply system components are typically considered public facilities when two or more connections are made to the same water main. In most instances, including multiple unit developments, the water supply system may have to be public even though the project has one owner. The extension of water mains will generally be required across the entire frontage of the site. Any water main and/or hydrant lead extension may require an MDEQ permit at the discretion of the DPS.

3. City approval will be required for connection of private water supply systems ("customer site piping") to the public water supply system. Installation of and/or improvements to customer site piping will require the installation of a master meter and/or suitable backflow prevention devices at any interfaces between the public water supply system and customer site piping.

4. Water supply system improvements identified in the latest revision of the City of Farmington Water Reliability Study of 2014 may be required as part of the project. The applicant shall contact the City of Farmington DPS to determine if any improvements identified in the latest revision of the City of Farmington Water Reliability Study will need to be incorporated as part of the project.

5. Plan and profile views shall be provided for all proposed water supply system improvements including water mains and fire hydrant leads. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.

    a. A water main quantity list shall be provided on the cover sheet of the detailed engineering plans. The quantity list shall be delineated by existing or proposed road right-of-way or easement.

    b. The following information must be shown in the plan view of the proposed water supply system improvements:

        i. Type, class and size of pipe.

        ii. Length between fittings and/or appurtenances.

        iii. Water service locations and sizes. In addition to domestic water services, water services for fire suppression and/or irrigation purposes must be shown on the plans.

iv. Where required, a dedicated water main easement must be shown on the plans. The easement width shall be the greater of the following: Twice the depth of bury plus the pipe diameter plus 2'(rounded to the next largest full foot), or 15'. Where water main is adjacent to and parallel to the right-of-way, a water main easement must be extended across the entire frontage of the property.

c. The following information must be shown in the profile view of the proposed water supply system improvements:

i. Type, class and size of pipe.

ii. Length between fittings and/or appurtenances.

iii. Top of casting elevation on valve wells and/or boxes as well as the finished grade for fire hydrants.

iv. Crossing of all existing and proposed utilities, including leads.

v. Granular backfill, trench details, special bedding, bores and/or other special construction methods.

vi. Existing and proposed ground elevations.

d. Design details of joints and joint restraints, including any necessary design calculations, shall be provided on the plans.

e. Plans showing any proposed water supply system improvements, public and/or private, shall be accompanied by the City water supply system standard detail sheets. The standard details are included in the Digital Appendix.

6. Connection of individual residences or buildings to water distribution mains will require the submittal of a utility service plan for review and approval by the City. Utility service plans can be submitted on 8 ½" by 11" white paper with blue or black lines. The following information must be shown on the utility service plan:

a. The applicant's name, address, telephone number and email address (if available).

b. The name, address, telephone number, and email address for the applicant's engineer/surveyor.

c. The utility service plan shall be prepared to a scale of 1" = 40'. Alternate scales will be considered on a case-by-case basis. The following items must be shown on the utility service plan:

i. A legal description of the parcel, including tax identification number, along with a sketch showing all property lines including the bearing and distance.

ii. All sides of the proposed or existing building.

iii. Existing and/or proposed driveways and sidewalks, including materials and thicknesses.

iv. Existing and/or proposed utilities on the parcel or in the adjacent public right-of-way or easement. Utilities to be shown include, but may not necessarily be limited to: water supply, wastewater, storm sewer, gas, telephone, electric and cable television.

v. Existing and/or proposed water services, building sewers, and storm sewer laterals (for sump pump discharges, if applicable). Information shall include proposed material and size. Dimension all pipes, as well as the curb stop and box, from the building corners.

7. Tap fees and meter fees may apply to water supply system improvements and/or connections to the existing water supply system. The schedule for each of these fees is available by contacting the City DPS.

B. Design Criteria

1. Water Transmission and Distribution Mains (Public)

   a. The minimum size pipe allowed for use in the distribution system is an 8" diameter. Other allowable pipe sizes for use in the distribution system are 12" and 16" diameter. The larger diameter distribution mains may be required as a minimum for distribution on non-residential sites, major streets, collector streets, and elsewhere as directed by the City. Water mains larger than 16" diameter are considered transmission mains.

   b. Terminal dead end water mains with domestic service connections are discouraged and will not be permitted without the written approval of the City. Where the City permits terminal dead end water mains to be installed, a gate valve and fire hydrant shall be provided at the terminus of the main. The following are the maximum allowable lengths for terminal dead end water mains:

      i. 40' for 6" diameter fire hydrant service pipe. If hydrant leads exceed 40', 8" diameter water main shall be used and reduced to 6" prior to attaching the hydrant.

      ii. 600' for 8" diameter water distribution mains (residential areas only).

   c. Wherever possible, water mains and appurtenances shall be located outside the influence of existing or proposed pavement. Within existing or proposed public road right-of-ways, water main alignments and appurtenance locations should be in accordance with the requirements of the agency having jurisdiction. Alignments and locations within private road easements should be in accordance with the requirements of the agency having jurisdiction over the adjacent public road right-of-way. Water main alignments and appurtenance locations in easements outside of the public road right-of-ways will be evaluated individually.

d. A minimum 10’ horizontal separation shall be maintained between water main and sanitary sewers and/or storm sewers. A minimum of 5’ horizontal separation shall be provided between water mains and other underground utilities and/or structures.

e. Where water main alignments cross alignments of other utilities, the angle between the horizontal alignments at the crossing shall not be less than 45°.

f. Water main shall be designed and constructed with a minimum 5½’ depth of cover over the top of pipe as measured from the proposed final grade. A minimum 18” vertical clearance shall be maintained between water mains and other underground utilities. Where the vertical alignment of the water main must be deflected in order to achieve the required vertical clearance, the length of the deeper main shall be kept to a minimum and standard 45° bends shall be used to achieve the necessary deflection. Depending on groundwater conditions, vertical alignment changes may be allowable utilizing joint deflection only when the elevation change is less than or equal to 18” and the depth of the water main remains above the groundwater elevation. Soil borings that have been obtained from the site shall be provided to the City in order to determine if joint deflection will be acceptable.

g. Where changes in the finish grade occur subsequent to installation of water mains or are proposed over an existing water main, all manhole castings, valve boxes, curb stop boxes, hydrants and blow-offs shall be adjusted to the revised grade as part of the project. When such changes in the finished grade will result in a depth of cover of less than 5’ or more than 7’, the existing water main shall be relocated as part of the project in accordance with the requirements of Item IV.B.1.g.

2. Joint Restraint

a. Joints shall be restrained per the pipe material manufacturer’s recommendations. For ductile iron pipe, joint restraints shall conform to the most current edition of the Ductile Iron Pipe Research Association’s (DIPRA) Thrust Restraint Design Procedure for Ductile Iron Pipe or as approved by the City.

b. Concrete thrust blocks are only permitted in addition to restraint joints and shall be approved by the City prior to installation. Where allowed, concrete thrust blocks shall bear against undisturbed earth in all instances and shall have sufficient bearing area to develop the full resultant axial thrust of the pipe at test pressure. The concrete thrust block shall not cover fastener nuts and/or threaded connections that would hinder future maintenance or repairs of fittings or valve assemblies.

3. Valves

a. General

i. Water supply system improvements shall be designed to include adequate valves to properly isolate sections of water main and control flow and pressure as needed without adversely impacting significant portions of the system.

ii. All valves shall be installed in a three-piece adjustable valve box with the following exceptions: Valves shall be installed in wells where the valve will be

located within existing or proposed (1:1) influence of the road, or the valve is located on a water main larger than 16" diameter, or the valve is part of a tapping valve connection to an existing water main requiring the use of a saddle sleeve.

iii. Valves shall be located such that the valve box cover or valve well cover will not be in street pavements, sidewalks, or driveways.

b. Isolation Valves

i. Isolation valves on water mains 16" diameter or smaller shall be gate valves and valves on water mains larger than 16" diameter shall be butterfly valves.

ii. Valves shall be place such that no more than three (3) valves are required to isolate any section of water main (four maximum).

iii. No more than 800' of water main may be out of service for 8" diameter water main; not more than ¼ mile of water main may be out of service for mains 12" diameter and larger.

iv. No more than two (2) fire hydrants may be out of service.

v. No more than 24 single family residences or 30 multiple family residences may be out of service.

c. Tapping Valves

i. The connection of the proposed water mains to existing water mains shall be accomplished by means of a tapping sleeve and valve unless the connection can be made without interrupting service to existing customers, or if the existing water main is 16" diameter or larger.

ii. Use of a tapping sleeve and valve will also require a separation isolation valve downstream of the connection.

d. Control Valves

i. Valves to control flow and/or pressure may be required to ensure proposed water supply improvements will not adversely impact the existing system or that the proposed improvements will operate as intended without being adversely impacted by the existing system.

ii. Such control valves, when deemed necessary by the City, shall be included in the design of the proposed water supply system improvements.

4. Fire Hydrants

a. Fire hydrants shall be located such that not more than 250' of fire hose would be required to reach the farthest corner of any proposed or existing building.

b. Hydrants within residential areas shall be located between the back-of-curb and sidewalk no closer than 20' off the back of sidewalk of the cross street at intersections. Hydrants not located at the intersections shall be located at the extension of the side property lines between lots.

c. Spacing of hydrants along water transmission mains and around multiple family residential, commercial, or manufacturing establishments shall be considered on an individual basis and shall be determined by consultation with the City DPS and the City Fire Marshal.

d. The distance of the hydrant from buildings will depend on the height of the building. The hydrant will be located at least a distance equal to the height of the building from the building's exterior walls. At a minimum, fire hydrants shall be located at least 25' from the exterior wall of any masonry building, and at least 50' from any exterior wall of frame building or equivalent construction, including brick and stone veneer.

e. All buildings with sprinkler systems shall have a fire hydrant located within 100' of the fire pumper hose Siamese connection located on the building exterior.

f. Proper access shall be provided to all hydrants. A minimum 20' wide aisle shall be provided between the travel way and the hydrant. No parking shall be provided within 15' on each side of a fire hydrant (measured perpendicular from the centerline of the hydrant to the road or travel way).

5. Water Services

    a. General

        i. Size

            1. Domestic water services shall be a minimum of 1" diameter in the City. Larger diameter domestic water services will require the review and approval of the City.

            2. Irrigation water services for single-family residences, multiple-family residences, and non-residential properties with a single water service to the entire building shall be no larger than the domestic water service upstream of the domestic water meter. Sizing of the irrigation water services for multiple-family residences and non-residential properties where the irrigation water service will be connected directly to a City water main will be evaluated individually.

            3. Fire suppression water services shall be designed by the applicant and will require review and approval by the City.

            4. Larger diameter water services, when approved by the City, shall be at least one standard size smaller than the water distribution main it connects to.

ii. Responsibility for Connections

1. Connections to City distribution mains for single-family residential property that does not require a permit from any agency having jurisdiction over work within a public road right-of-way will be completed by the City, except in circumstances where the City is unable to complete such work due to elevated groundwater table, excessive depth of existing distribution mains, or similar extenuating circumstances.

2. Connections to City distribution mains for single-family residential property that requires a permit from an agency having jurisdiction over work within a public road right-of-way shall be the responsibility of the applicant.

3. Connections to City distribution mains for multiple-family residential and non-residential properties shall be the responsibility of the applicant.

4. Connections to City distribution mains solely for fire suppression or irrigation purposes shall be the responsibility of the applicant.

iii. Location

1. Water services shall be connected to distribution mains such that the water service pipe within the public road right-of-way or easement is perpendicular to the centerline of the public road right-of-way or easement.

2. The minimum allowable horizontal separations between water services and other facilities are as follows:

    a. Other water services – 2’ each.

    b. Sanitary sewer leads – 3’.

    c. All other utilities and structures – 5’.

3. The curb stop and box or shut off valve on a water service shall be located at the right-of-way line for water services within public roads and the easement line for water services outside of public road right-of-way.

4. Curb stop boxes and/or shut off valves shall be located such that the stop box cover, valve box cover, and/or manhole cover will not be in street pavements, sidewalks, or driveways.

iv. The City will be responsible for maintaining water service(s) and appurtenances from the City distribution main up to and including the curb stop and box or shut off valve. The property owner will be responsible for maintaining the water service(s) and appurtenances from the curb stop and box or shut off valve, including the outlet coupling, to the building.

b. Domestic

i. Each individual residence or building connected directly to the City distribution main shall have a separate water service and curb stop and box. Multiple-family residences may be served either through separate water services to each unit or through a single water service to the entire building. Non-residential buildings, even those with multiple tenants, shall have a single water service as only one City meter will be issued.

ii. No domestic service connections will be permitted from 6" fire hydrant leads or transmission mains.

c. Irrigation

i. Irrigation water services for single-family residences shall be connected to the domestic water service immediately upstream of the domestic water meter. Irrigation water services for multi-family residences and non-residential properties may be connected either directly to the City distribution mains or to the domestic water service upstream of the domestic meter. Irrigation water services connected directly to City distribution mains require a meter and shall be protected against backflow.

ii. All irrigation systems connected to the water supply system shall be equipped with an approved backflow prevention device. Suitable backflow prevention devices include double check valve assemblies, reduced pressure zone assemblies, and pressure vacuum breakers.

d. Fire Suppression

i. Fire suppression services shall be completely separate from either domestic or irrigation water services.

ii. Fire suppression systems directly connected to a City distribution main only, with no physical connections to other supplemental water supplies, will not require backflow prevention provided that no antifreeze or other additives of any kind are used and the sprinkler system drains to the atmosphere.

iii. Fire suppression systems directly connected to a City distribution main and also having supplemental supplies of non-potable water, or being located within 500 feet of a body of water, shall be isolated from the City distribution main by an approved backflow prevention device.

iv. Fire suppression systems directly connected to a City distribution main and which incorporate an elevated storage tank for fire protection shall be isolated from the City distribution main by an approved double check valve assembly.

v. Fire suppression systems shall be equipped with detector checks to prevent cross connections with the metered potable water system internal to the building.

6. Meters

   a. General

      i. Each residence or building connected to the City distribution system shall be equipped with a meter on each water service entering the property. Multiple-family residences with a single water service will be provided a single meter. All non-residential properties will only be provided a single meter. The user will be required to pay a service charge equal to the cost of the meter to the City upon making the application for service. Ownership of the meters will remain with the City.

      ii. The City reserves the right to review and approve the size of the meter requested for each meter installation. For premises to be served by a 1¼" or larger water service, the applicant shall provide a complete itemized building fixture count to the City for use in the sizing of the meter and service.

      iii. Irrigation systems connected to the water supply system shall be equipped with a meter. Meters issued for irrigation system use at single-family residences shall be no larger than the diameter of the domestic water service. Irrigation meters for multiple-family and non-residential properties will be evaluated individually.

      iv. Fire suppression services shall be equipped with a 1" diameter detection meter.

   b. Meter Locations

      i. Water meters shall be located in basements, utility rooms, boiler or mechanical rooms. The meter shall be positioned a maximum of 24" from the service entrance outside wall and located a minimum of 18" to a maximum of 48" above the basement or lowest floor. Valve size shall be equivalent to the respective meter size and shall have two (2) valves placed, one upstream and one downstream of the meter. The meter shall always be located in an easily accessible area which is heated and protected from the weather. The locating of water meters in such areas as crawl spaces and under kitchen sinks, etc., is not considered as an easily accessible area. Nothing shall be stored or placed in the area of the meter which would hinder City personnel from accessing the meter for the purpose of reading, inspecting, repairing, or replacing it.

      ii. Meters on irrigation water services connected directly to City distribution mains where the meter cannot be located within a building shall be installed in an above ground meter enclosure, such as a Lock Box as manufactured by Hot Box or approved equal.

      iii. All meters shall be installed in a horizontal orientation. No vertical installations will be permitted.

   c. Master meters for multiple-family residential and non-residential properties are permitted, subject to the approval of the City. Water supply system components

downstream of master meters will be considered customer site piping. Operation and maintenance of customer site piping will be the responsibility of the customer. Upon acceptance of the water supply system improvements, ownership of the meter and vault will be the responsibility of the City. Master meters will be reviewed on an individual basis and shall include such auxiliary equipment as deemed necessary by the City, including, but not necessarily limited to the following:

i. Any master meters installed in an underground vault shall provide adequate access provided to operate and maintain the meter, isolation valves and appurtenances.

ii. Master meter vaults shall be protected from physical damage during a 100-year flood and remain operable and accessible during a 25-year flood.

iii. Master meter vaults and equipment shall be protected from vehicular traffic. Provisions for maintenance vehicles shall be provided, including pavement with sufficient space to park and maneuver, as well as a curb cut to allow ingress/egress from the adjacent roadway.

iv. A sketch of the typical master meter vault layout, including some of the standard equipment requirements, is provided in the Digital Appendix. The master meter vault must include an external bypass, as well as redundant isolation valves both upstream and downstream of the meter. Master meter vaults shall be equipped with a steel bolt-on ladder and a Ladder Up Safety Post as manufactured by The Bilco Company or approved equal.

v. Electrical, instrumentation and control devices may be required.

7. Corrosion control, in addition to polyethylene encasement, may be required for ductile iron water main and appurtenances depending on, but not necessarily limited to, the following items: soil characteristics and/or proximity to petroleum pipelines. The designer shall contact DIPRA for evaluation and determination of the required corrosion control. A copy of DIPRA's evaluation and recommendation shall be provided to the City.

8. Design of other water supply infrastructure, including, but necessarily limited to, pressure reducing valves, storage facilities, and booster pump stations, will be evaluated and approved by the City individually. Design of these types of water supply infrastructure will likely require electrical, instrumentation, and control devices, including adequate alarms and backup power.

C. Materials

1. Water Transmission and Distribution Mains

    a. Water transmission and distribution main pipe shall be ductile iron manufactured in accordance with AWWA C151 (ANSI A21.51), latest revision thereof.

    b. Ductile iron shall be thickness Class 54 for pipes up to 20" diameter and thickness Class 56 for pipes 24" diameter and larger. Ductile iron pipe shall be standard cement double thickness lined in accordance with AWWA C104 (ANSI A21.4), latest revision thereof. Pipe exterior shall be seal coated with an approved asphalt seal coat.

    c. If other materials are proposed for use, the applicant shall furnish the necessary design date for the proposed depth and operating conditions. Use of materials other than ductile iron will not be allowed unless approved by the City.

2. Fittings

    a. Fittings shall be ductile iron, 350 psi working pressure rating, meeting the requirements of AWWA C110 (ANSI A21.10), or AWWA C153 (ANSI A21.53) compact fittings, with cement mortar lining. Cement mortar lining shall meet AWWA C104 (ANSI A21.4) specification for a double thickness lining with an asphalt seal coat or fusion bonded epoxy meeting the requirements of AWWA C116, as approved by the City.

3. Joints

    a. Joints shall be push-on type meeting the requirements of AWWA C111 (ANSI A21.11). Mechanical or flanged joints will be allowed for special applications, subject to the approval of the City. Sealing gaskets, retainer glands and lubricants for joints shall meet the pipe manufacturer's specifications.

    b. The lubricant shall have no deleterious effect upon the color, taste or odor of potable water and shall not be corrosive to either the pipe or gasket.

    c. Where bell and spigot pipe and fittings may be necessary for connection to existing water mains, shop drawings of such pipe and fittings shall be submitted to City by the applicant for approval.

4. Joint Restraint

    a. Ductile iron joints, where required, shall be restrained by an approved instant push-on restraining device or mechanical retaining gland.

    b. Push-on joints shall be restrained with approved instant joint-restraining devices such as Field Lock Gasket manufactured by U.S. Pipe Company or approved equal.

    c. Mechanical joint-restraining glands shall be the Megalug Series as manufactured by EBAA Iron or approved equal.

d. Thrust blocks, where allowed, shall be made of 3,000 psi concrete and of adequate size and shape to resist all design working and surge pressures to which the main will be subjected.

e. Harnessed joints and steel reinforced concrete anchorage may be required on pipes larger than 16" diameter.

5. Valves, Wells and Boxes

a. Valves shall open counter-clockwise (left) in the City. All valves shall be equipped with an operating nut 2" square at the base tapering to 115/16" square at the top. The operating nut on clockwise-opening (right) valves shall be painted red.

b. Gate valves shall be ductile iron body and bonnet, fully bronze mounted, reduced wall, resilient-seated valves with non-rising stems conforming to the applicable requirements of AWWA C500, C509, and C515, latest revisions. Valves shall have a minimum non-shock W.O.G. working pressure of 200 psi. The wedge shall be ductile iron with rubber-encapsulated seating surfaces. Stems shall be bronze of non-rising design with double O-ring packing.

c. Butterfly valves shall conform to AWWA C504, latest revision, and GLWA Specification S-363, Butterfly Valves for Distribution System.

d. Tapping Sleeves and Valves

i. Tapping sleeves, when specified, shall conform to AWWA C223, latest revision and shall be full length of heavy-duty stainless steel construction designed for use with the type of pipe to be tapped. Tapping sleeve body shall be 18-8 type 304 stainless steel. Flange shall be CF8 cast stainless steel. Bolts shall be 304 stainless steel. Gasket shall be full circumferential SBR compounded for water service. Tapping sleeve shall contain a test plug to assure seal prior to tapping.

ii. Tapping valves shall meet the specifications for gate valves except that the valve shall have a flange compatible with the tapping sleeve.

e. Swing check valves shall have a cast or ductile iron body and bolted cap with a minimum non-shock W.O.G. working pressure of 150 psi. Seats shall be bronze and shall be screwed into the valve body. The disc shall be bronze or cast iron with permanently rolled in bronze faces. The disc hinge pin shall have ANSI 125 pound standard drill flat-faced flanges unless otherwise specified or shown on the Plans. Valves shall have outside weighted arm.

f. Air release valves, when specified, shall be designed to operate under a maximum operating pressure of 300 psi and capable of venting 200 CFFAS (cubic feet of free air per second). Valves shall be cast iron with bronze internal parts and Type 304SS float.

g. Valve Boxes

i. Boxes shall be three-piece screw-type, gray iron, with 5 ¼" shaft, such as East Jordan Iron Works #8560 or approved equal.

ii. Valve box lids shall be gray iron, non-locking, drop-in type, with the word "Water" in raised letters, such as East Jordan Iron Works #6800 or approved equal. Valve box lids shall be non-locking type unless otherwise directed by the City.

iii. Valve boxes shall be equipped with a valve box adaptor as manufactured by Adaptor, Inc., or approved equal. The valve box base shall not rest upon the valve assembly.

h. Valve Wells

i. Valve wells and covers shall be provided in accordance with the requirements of Item V.C.3, Wastewater System, Materials, Manholes and Vaults. Valve wells constructed over an existing water main shall have a doghouse mudded to an 8" thick cookie.

ii. Covers shall have the words "Water Supply" in raised letters spaced in from the periphery of the cover.

iii. Valves in wells shall be at least 6" above the floor of the well, supported with either precast or formed concrete.

iv. Connections of water mains 6" through 24" diameter to valve wells shall be through:

1. A flexible rubber boot which shall be securely clamped into a core-drilled pipe port. Pipe ports shall be core-drilled at the point of valve well manufacture and shall be accurately located within ½" of proposed water main centerline (Kor-N-Seal or approved equal).

2. A self-adjusting mechanical pipe to manhole seal which provides a resilient flexible and infiltration-proof joint (Res-seal or approved equal).

3. A flexible rubber wedge firmly rammed into a rubber gasket which is cast into the valve well (Press Wedge II or approved equal).

4. Neoprene rubber for the manhole boot shall meet ASTM Specification C443 and shall have a minimum thickness of 3/8". Pipe clamp bands shall be of corrosion-resistant steel.

5. Connection of water main larger than 24" diameter to valve wells shall be approved by the City.

6. Fire Hydrants

    a. Fire hydrants shall be East Jordan Iron Works Model 5-BR250 or Mueller A-425 Super Centurion, conforming to AWWA C502, breakable flange type, opening counter-clockwise, with a 5¼" valve seat opening and 6" diameter inlet. All hydrants shall be 6' bury.

    b. Fire hydrants shall be fully bronze mounted, including top of the operating stem where it passes through the double o-ring seal in the bronze packing gland. The forged operating stem in the base and the valve seat shall also be of bronze. The molded valve shall be of composition rubber and the cast iron valve clamps shall be packed with o-ring seals and held tight to the stem by a threaded bronze hex retainer ring and threaded bronze locknut, anchored with set screws.

    c. Hydrants shall have nut type caps with chains. Top operating nut shall be 1½" pentagonal.

    d. All hydrants shall have one 4" Storz adapter with two (2) 2½" National Standard 7½ threads per inch. The adapters shall be constructed of a A-356 High Strength Aluminum Alloy, painted orange. The Storz sealing surface shall have a machined metal seat. The threads and metal seat areas shall be Teflon coated. The adapters shall be equipped with a set of Type 302 stainless steel butterfly vanes designed to automatically open, by use of stainless steel torsion spring, with water flow and automatically close when flow is stopped. The adapter shall be installed on the left side of the hydrant when facing the hydrant.

    e. Hydrant extensions shall be limited to no more than 18".

    f. All hydrants shall be constructed with a companion gate valve in a valve box.

7. Water Services

    a. Water services 1" to 2" diameter shall be Type K copper. Pipe material for water services larger than 2" diameter shall be in accordance with Item IV.C.1.b. Water service pipe material shall be homogenous between the City distribution main and curb stop box.

    b. Couplings for water services 1" to 2" diameter shall have a three-part union, and both inlet and outlet connections shall be able to receive the flared end of the copper water service pipe. Joints for water service pipe material larger than 2" diameter shall be in accordance with Item IV.C.3.

    c. Water service locations in residential subdivisions where the houses are not currently being constructed shall be marked at the right-of-way or easement line with a Utility Warning Marker as manufactured by Carsonite International or approved equal.

8. Corporation Stops

    a. Corporation stops shall have bronze cast bodies, keys, stems, washers and nuts. Inlet threads shall conform to the requirements specified in AWWA C800, latest revision.

The outlet connection shall be able to receive the flared end of the copper water service pipe. Corporation stops connected to ductile iron, cast iron, steel or PVC water distribution mains for water services ¾" to 2" diameter shall be Mueller Catalog No. H-15000 or approved equal.

b. Corporation stops adjacent to valves and other appurtenances shall be 1" diameter.

c. Service saddles for corporation stops not threaded directly to the water distribution main shall be bronze with double stainless steel straps and shall conform to the requirements specified in AWWA C800, latest revision. Service saddles for water services ¾" to 2" diameter shall be Mueller BR2S Series or approved equal.

9. Curb Stops and Boxes

a. Curb stops shall be fully bronze, have an inverted key stop, and both inlet and outlet connections shall be able to receive the flared end of the copper water service pipe. Curb stops for water services 1"to 2" diameter shall be Ford B22-XXXM-NL Series or approved equal.

b. Curb boxes shall be 5' extension type with 1¼" upper section such as the Ford Minneapolis Base (Catalog No. CBB) for all curb stops as manufactured by Ford or approved equal. Curb box lids shall be cast iron with a pentagon head plug such as the Ford Minneapolis Base (Catalog No. CBB) as manufactured by Ford or approved equal.

c. Rods and pins are not permitted for curb stops and boxes.

10. Meters

a. Except for master meters, meters will be furnished and installed by the City.

b. Master meters 12" and smaller shall be Badger E-Series Meters manufactured by Badger or approved equal. Compound meters are acceptable, subject to review and approval by the City. Meters larger than 12" diameter will be considered on an individual basis. Registers on master meters shall be a Badger Meter as manufactured by Badger or approved equal and shall indicate consumption in hundreds of gallons.

c. Master meter vaults shall be precast reinforced concrete in accordance with the requirements for manholes and vaults outlined in Chapter V, Wastewater System.

d. Master meter vaults shall be equipped with steel bolt-on ladders and ladder up safety post as manufactured by Bilco Company or approved equal.

11. Backflow Prevention Devices

a. Double check valve assemblies shall conform to the requirements specified in AWWA C510, latest revision.

b. Reduced pressure zone assemblies shall conform to the requirements specified in AWWA C511, latest revision.

c. Pressure vacuum breakers shall conform to the requirements specified in ANSI 1020, latest revision.

12. Corrosion Control

a. Polyethylene encasement shall be installed on all ductile iron water main, fittings and appurtenances. Polyethylene encasement shall meet the requirements specified in AWWA C105 (ANSI 21.5), latest revision. Polyethylene encasement shall be a minimum of 8 mil thick Class aC (black) polyethylene. The encasement shall overlap the joint by approximately 12" on either side and be secured to the pipe with polyethylene adhesive tape. All pipe, fittings and appurtenances shall be encased and taped.

b. Additional corrosion control materials, if necessary, shall be in accordance with the recommendation of DIPRA.

13. Miscellaneous Materials

a. All nuts and bolts located below grade shall be Type 304 stainless steel.

b. Tracer Wire (only required for non-Ductile Iron pipe)

i. Wire to be used for tracer purposes shall be #12 THNN solid single strand copper with blue insulation.

ii. Connection shall be made using 3M DBR-09964 wire connectors, or equal.

c. Post Indicators and Valves

i. Post indicators, when specified, shall be American Flow Control Series A240 or Clow Series 2954A with aluminum plates indicating OPEN or SHUT. Post indicator shall open left.

ii. Post indicator valves shall be American Flow Control Model 2500 or Clow Model F-6120. All valves shall open left.

iii. Post indicators and their corresponding valves must be made by the same manufacturer.

d. Bollards shall be 6" diameter galvanized schedule 40 steel posts 36" to 48" tall with a minimum depth of bury of 24". The posts shall be set in and filled with 3000 psi concrete. Bollards shall be painted OSHA "Safety Yellow."

e. Casing Pipe Construction

i. Spacers for placement in the annular space between the carrier pipe and a casing pipe shall be Ranger II as manufactured by PSI or approved equal.

ii. End seals shall be Model C rubber seal with stainless steel bands as manufactured by PSI or approved equal.

f. Materials for other water supply system infrastructure, including but not necessarily limited to, pressure reducing valves, storage facilities, and booster pump stations, will be evaluated individually.

D. Construction Methods

1. General – This section applies to new water main or reconnecting existing water main to the City's system. The City Engineer and DPS shall review and approve all modifications to the system and may require MDEQ permits when applicable prior to any Construction

    a. Excavation

        i. Excavation, bedding and backfill operations shall be accomplished in accordance with requirements outlined in Chapter VIII, Grading and Earthwork, except as modified herein.

    b. Water Use

        i. Subject to approval by the City, the proprietor can use the existing water supply system to obtain water needed to complete the water supply system improvements. The proprietor shall provide suitable backflow prevention for any temporary connections to the existing water supply system. As directed by the City, any water used from the system may be required to be metered and paid for at the current City water usage rate in effect at the time of the construction of the project.

    c. Valve Operation

        i. Unless directed otherwise by the City, operation of valves on the existing water supply system will be the responsibility of the City. Any valve operation performed by a contractor shall only be observed by the City and/or its designated representative. Advanced notice to the City and/or its designated representative, as well as any City customers whose water supply will be interrupted by the valve operation, is required. Such advanced notice shall be the responsibility of the contractor and two (2) business days will be required prior to a scheduled contractor valve operation. Service interruptions shall only be scheduled to occur Monday through Thursday.

2. Submittals

    a. Certifications

        i. All pipe, fittings, and appurtenances delivered to the job shall be accompanied by certification papers showing that the materials have been manufactured and tested in accordance with all applicable standards.

b. Shop Drawings

i. Shop drawings may be required for certain materials prior to fabrication and manufacture, including, but not necessarily limited to, corrosion control measures, pressure reducing valves, storage facilities, and booster pump stations.

3. Delivery, Handling, and Storage

a. Water supply system materials shall be delivered, handled, and stored in accordance with all applicable AWWA requirements, manufacturer's recommendations and as specified by the City.

b. Upon delivery to the project site, all materials will be inspected by the City or its designated representative. Rejected materials shall be immediately removed from the project site by the proprietor.

4. Sequencing

a. In general, water supply system improvements shall be constructed in accordance with the following sequence:

i. Install new water main and appurtenances.

ii. Flushing.

iii. Preliminary hydrostatic testing (recommended, performed at the proprietor's discretion).

iv. Disinfection.

v. Flushing.

vi. Bacteriological testing.

vii. Hydrostatic testing.

viii. Connect to existing water supply system.

ix. Connect water services to new water main; abandon/remove old water main and/or appurtenances (if necessary).

x. Abandon and/or remove out-of-service water main and appurtenances, if necessary.

5. Installation

   a. GPS

      i. GPS data shall be collected for all bends, tees, valves, wells, boxes, hydrants, and curb stops.

      ii. The data shall be provided to the City and City Engineer for records.

   b. Water Transmission and Distribution Mains and Fittings

      i. Ductile iron pipe and fittings shall be installed in accordance with the requirements of AWWA C600, latest revision, and as modified herein. Installation via open-cut excavation shall be accomplished in accordance with standard laying conditions.

         1. Ductile iron pipes shall be fully enclosed in polyethylene encasement, when aggressive soils are present, and laid on a compacted sand cushion, 4" thick. Sand shall conform to fine aggregate MDOT 2NS.

         2. NS sand bedding material shall be placed around and above the pipe to a height of 12" above the pipe.

         3. Sand shall be compacted to 12" above the pipe to not less than 95 percent of the maximum unit density as determined at optimum moisture content.

      ii. Other pipe materials and fittings approved for use by the City shall be installed in accordance with all applicable standards, manufacturer's recommendations, and as directed by the City.

      iii. Water distribution and transmission mains shall be installed via open cut excavation wherever possible. Other acceptable means of installation are trenchless technologies such as horizontal directional drilling and pipe-bursting. Installations using other construction methods, including, but not necessarily limited to, casing pipe construction and river crossings shall be completed as directed and/or approved by the City.

   b. Joints and Joint Restraints

      i. All joint materials shall be assembled in accordance with standard practice, the manufacturer's recommendations and as directed by the City.

      ii. Restraints shall be applied to all joints that deflect pipe 11¼^0 or greater, including tees, hydrant shoes, reducers, plugs and caps. For push-on joints, approved restraints are required at the joint and in each direction at an adequate distance to resist the axial thrust of the test pressure. Where mechanical joints are approved by the City, proper restraints shall also be installed in each direction at an adequate distance in combination with approved mechanical restraints at the joint.

iii. No concrete thrust blocks shall be installed in combination with approved restraints unless approved by the City. Thrust blocks, where allowed, shall be formed of 3,000 psi concrete and shall be installed against undisturbed earth.

c. Valves, Wells and Boxes

i. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness or pressure containing bolting and test plugs, cleanliness of valve ports and seating surfaces. All bolts and nuts, except for adjusting bolts or screws in butterfly valves, shall be checked for proper tightness. Seat adjusting bolts in butterfly valves shall be adjusted only as recommended by the manufacturer.

ii. Water main shall be placed level through all valve wells unless specified otherwise by the City.

iii. All flexible pipe to valve well connections shall be installed per manufacturer's specifications.

d. Fire Hydrants

i. Fire hydrants shall be installed in accordance with AWWA Manual M17. Each hydrant will be set plumb and braced firmly in this position. Connection of the hydrant to the branch will be made by means of mechanical joints, as herein specified under jointing. All joints between the hydrant and the main will be restrained by the same means as used for water main as specified in Item IV.D.5.b.

ii. If hydrants are furnished with drain outlets, the outlets must be permanently capped or plugged.

iii. After the hydrant has been set, an additional 1' depth of gravel shall be spread and tamped around the hydrant. When this has been done, the remaining backfill will be placed and compacted, taking care at all times to avoid jarring the hydrant.

iv. After hydrants have been installed and tested, the portion above ground shall be painted with two (2) coats of Rustoleum OSHA "Safety Red" or equivalent.

e. Cleaning and Testing

i. Cleaning

1. Prior to disinfection and hydrostatic testing, newly constructed water mains less than 24" in diameter shall be thoroughly flushed to remove all accumulated debris that may have entered the line during construction. Flushing shall include the use of a "polly pig" or approved equal to remove accumulated deposits. The frequency of running the "polly pig" through the water mains shall be determined by the debris discharging from the effluent. Several passes with the

"polly pig" through the newly constructed system may be required before the main is acceptable. Procedures for use of the "polly pig", or approved equal equipment, may be per the manufacturer's specifications. Mains 24" in diameter and larger shall be manually cleaned and inspected during installation.

ii. Testing

1. Bacteriological

a. After flushing, the water mains shall be disinfected in accordance with AWWA 0651, latest revision.

b. The proprietor shall furnish chlorine and all necessary labor and equipment for its application. The proprietor shall make suitable arrangements with the City for bacteriological analysis. The proprietor shall dispose of high residual chlorine water by a method approved by the City.

c. Water mains 24" in diameter and larger shall be chlorinated in sections between main line valves. Chlorine solution shall be renewed and transferred to the next adjacent section of pipe, minimizing the volume of water needed to sterilize the main.

2. Hydrostatic

a. Within a reasonable length of time following installation and backfilling, the proprietor shall complete all work necessary to perform hydrostatic testing.

b. The hydrostatic testing shall be conducted in accordance with AWWA C600, latest revision.

c. The proprietor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible cracks and leaks, and re-test with his/her own forces to ready the water mains for final hydrostatic inspection and testing. Immediately after the water mains have passed such preliminary tests, the proprietor shall perform a final hydrostatic inspection and test.

d. The hydrostatic test shall be conducted before the new water main is connected to the existing water system, except as specified below. The proprietor shall furnish all necessary personnel, temporary blow-offs, plugs, bracing, test pumps and all other necessary apparatus for conducting the test.

e. At the option of the City, testing may be performed against closed valves providing that the new main to be tested and the testing apparatus shall have first been flushed and

chlorinated in accordance with accepted procedure. After chlorination and subsequent flushing, a sample of water must show safe bacteriological results through a test by a recognized laboratory. In the event of an unsatisfactory hydrostatic test, the proprietor will cut the new main, install caps or plugs, pressure test and re-chlorinate.

f. Each hydrant assembly shall be tested. The test shall consist of flushing the hydrant for a minimum of 10 minutes. During the test period, the 6" gate valve shall be closed and opened. The proprietor shall provide all necessary equipment and labor for making the tests, including hoses for disposal of water. A testing schedule and method of disposing of flushing water shall be submitted to the City for approval. The testing schedule shall be coordinated with the City or its designated representative.

f. Water Services

i. Water services 1" to 2" diameter shall be installed in accordance with the manufacturer's recommendation. Water services larger than 2" diameter shall be installed in accordance with the requirements for water distribution mains.

ii. Water services from one side of the public roadway to the opposite side shall be installed in accordance with the requirements of the agency having jurisdiction over the right-of-way and as approved by the City.

g. Corporation stops and saddle sleeves, where required, shall be installed in accordance with the manufacturer's recommendations and as directed by the City. Corporation stops will be tested for proper operation by the City or its designated representative prior to backfilling.

h. Curb stops and boxes shall be installed in accordance with the manufacturer's recommendations and as directed by the City. Curb stops will be checked for accessibility and proper operation by the City or its designated representative prior to installation of a meter. Unless otherwise authorized, only City staff shall operate curb stops.

i. Meters

i. Unless otherwise authorized by the City, domestic and fire suppression meters up to 1½" diameter will be installed by City personnel.

ii. Meters larger than 1½" diameter shall be installed by the proprietor and inspected and approved by the City or its designated representative. Master meters will not be provided by the City. Master meters shall be tested and calibrated in accordance with applicable AWWA standards and the manufacturer's recommendations.

j. Backflow prevention devices shall be installed in accordance with applicable AWWA standards and manufacturer's recommendations. Backflow prevention devices shall be tested by a state certified tester and a written copy of the certification generated during the test shall be submitted to the City DPS.

k. Corrosion Control

    i. Polyethylene encasement shall be installed as specified in AWWA C105 (ANSI 21.5), latest revision.

    ii. Additional corrosion control measures, if necessary, shall be installed in accordance with the recommendation of DIPRA and/or the manufacturer.

l. Other water supply system infrastructure, including, but not necessarily limited to, pressure reducing valves, storage facilities, and booster pumps stations, shall be installed in accordance with all applicable AWWA standards, manufacturers' recommendations, and as directed by the City.

V. WASTEWATER SYSTEM

A. General

1. Wastewater system improvements shall be designed and constructed in accordance with the requirements of Part 41 of Act 451 of the Public Acts of 1994, as amended; the most recent revision of the Recommended Standards for Sewage Works by the Great Lakes – Upper Mississippi River Board of State Sanitary Engineers (commonly known as the "Ten States Standards") and as prescribed herein.

2. All wastewater system improvements will require the review and approval of the City of Farmington Department of Public Services (DPS). Proposed public wastewater system improvements will require the review and approval of the City of Farmington and the MDEQ. Wastewater facilities are typically considered public facilities when two or more connections are made to the same sanitary sewer. In most instances, including multiple unit developments, the sanitary sewer may have to be public even though the project has one owner. City approval will be required for private sanitary sewers serving more than one residence or building. The extension of the sanitary sewers will generally be required across the entire frontage of the site.

3. Plan and profile views shall be provided for all proposed wastewater system improvements, including force mains. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.

    a. Wastewater design calculations, the wastewater district map, and a wastewater system quantity list shall be provided on the cover sheet of the detailed engineering plans. The design calculations and wastewater district map shall include both current and future service areas and populations. The wastewater system quantity list shall be delineated by existing or proposed road right-of-way or easement.

    b. The following information must be shown in the plan view of the proposed wastewater system improvements:

        i. Size, material, and type of pipe.

        ii. Length between structures (and/or appurtenances for pressure sanitary sewers).

        iii. Slope of pipe between structures (and/or appurtenances for pressure sanitary sewers).

        iv. Where required, a dedicated sanitary sewer easement must be shown on the plans. The sanitary sewer easement width shall be either twice the depth of the pipe, plus the diameter of the pipe, plus 2' (rounded up to the nearest whole foot), or 25', whichever is greater.

        v. Top of casting and all pipe invert elevations with direction identified at each structure (and/or appurtenances for pressure sanitary sewers).

        vi. Progressive numbering system for structures and appurtenances.

c. The following information must be shown in the profile view of the proposed wastewater system improvements:

    i. Existing and proposed ground elevations.

    ii. Length, type, class, size and slope of pipe between structures (and/or appurtenances for pressure sanitary sewers).

    iii. Top of casting and all pipe inverts with direction identified at all structures.

    iv. All utility crossings.

    v. Special backfill areas (i.e. sand).

    vi. Provisions for infiltration testing.

    vii. Progressive numbering system on structures.

    viii. Adjacent existing or proposed utilities plotted where parallel.

d. Plans showing any proposed wastewater system improvements, public and/or private, shall be accompanied by the City standard wastewater detail sheets. The standard details are included in the Digital Appendix.

4. Connection of individual residences or buildings to the wastewater collection system will require the submittal of a utility service plan for review and approval by the City. Utility services plans can be submitted on 8½" x 11" white paper with blue or black lines. The following information must be shown on the utility service plan:

    a. The applicant's name, address, telephone number, and email address (if available).

    b. The name, address, telephone and fax numbers, and email address for the applicant's engineer/surveyor.

    c. The utility service plan shall be prepared to as scale of 1" = 40'. The following items must be shown on the utility service plan:

        i. A legal description of the parcel, including tax identification number, along with a sketch showing all property lines including the bearing and distance.

        ii. All sides of the proposed or existing building.

        iii. Existing and/or proposed driveways and sidewalks, including materials and thicknesses.

        iv. Existing and/or proposed utilities on the parcel or in the adjacent public right-of-way or easement. Utilities to be shown include, but may not be limited to: water supply, wastewater, storm sewer, gas, telephone, electric, and cable television.

v. Existing and/or proposed building sewers, water services, and storm sewer laterals (for sump pump discharges, if applicable). Information shall include proposed material and size. Dimension all pipes and any cleanouts from the building corners.

5. Trunk line and transmission charges, benefit charges, as well as tap fees and meter fees associated may apply to water supply system improvements and/or connections to the existing water supply system. The schedules for these fees are available by contacting the City Offices.

B. Design Capacity

1. Capacity Design

   a. For design purposes, population in the tributary area shall be based on a minimum of 3½ persons per single family residence, also referred to as residential equivalent unit (REU). The basis of design calculations shall include a tabulation of the proposed usage types and the conversion of the various uses into REUs. REU determination and applicable sewer tap fees may be obtained by contacting the City Offices.

   b. Wastewater collection systems shall be designed on the basis of an average daily flow of 100 gallons per capita per day. The required capacity shall be determined by the peak flow design using the peaking factor as prescribed by the Ten States Standards.

   c. All gravity sanitary sewers shall be designed to provide average velocities, when flowing full, of not less than 2 feet per second, based on Manning's formula using an "n" value of 0.013. The maximum design velocity for the gravity sanitary sewers shall be 10 feet per second with the pipe flowing full.

   d. The minimum size for gravity sanitary sewers shall be as follows:

      i. For the proposed systems discharging to existing gravity sanitary sewers 10" diameter or larger, the minimum size pipe shall be 10" diameter, with the terminal section of 10" diameter gravity sanitary sewer at a uniform slope of not less than 1.0% between structures. The minimum slope for all other sections of 10" diameter gravity sanitary sewer shall be 0.3% between structures.

      ii. For proposed systems discharging to existing 8" diameter gravity sanitary sewers, the proposed pipe shall be 8" diameter, with the terminal section of 8" diameter gravity sanitary sewer installed at a uniform grade of not less than 1.0% between structures. The minimum slope for all other sections of 8" diameter gravity sanitary sewer shall be 0.4% between structures.

      iii. No proposed discharges, including connection of building sewers, to existing sanitary sewers smaller than 8" diameter will be allowed.

   e. Non-residential dischargers to the City wastewater system may need to incorporate such measures including, but not necessarily limited to, grease separators and/or oil

separators. The need for such measures and design thereof shall be subject to the review and approval of the City.

2. Sanitary Sewer Location

   a. Sanitary sewers shall be located to provide unrestricted access for inspection and maintenance operations. Wherever possible, sanitary sewers and appurtenances shall be located outside the influence of existing or proposed pavement. Within existing or proposed public road rights-of-way, sanitary sewer alignments and appurtenance locations should be in accordance with the requirements of the agency having jurisdiction. Alignments and locations within private road easements should be in accordance with the requirements of the agency having jurisdiction over the adjacent public road right-of-way. Sanitary sewer alignments and appurtenance locations in easements outside of public road rights-of-way will be evaluated individually.

   b. A minimum horizontal separation of 10' shall be provided between sanitary sewers and water mains. Adequate horizontal separation shall be provided between sanitary sewers and all other underground utilities to allow a 1:1 trench slope from the bottom of the deeper utility such that the shallower utility will not be undermined. If it is impossible to obtain proper horizontal and vertical separation as described above, both the water main and sanitary sewer must be constructed of push-on or mechanical joint pipe complying with the requirements outlined in Chapter IV, Water Supply System. A variance will be required from both the City and the MDEQ for any proposed sanitary sewer improvements that will not satisfy the minimum horizontal separation requirements.

   c. Where sanitary sewer alignments cross alignments of other utilities, the angle between horizontal alignments at the crossing shall not be less than 45^0.

3. Depth of Sewers

   a. The minimum depth of cover over the top of the gravity sanitary sewer pipe shall be 4' as measured from the proposed ground elevation.

   b. Gravity sanitary sewers shall be a minimum of 10' deep when fronting residential parcels to be directly connected to the sewer. Deep setbacks or unusual topographic conditions may require more depth.

   c. A minimum vertical separation of 18" shall be provided between sanitary sewers and water mains. In addition, a minimum vertical separation of 12" shall be provided between sanitary sewers and other underground utilities unless otherwise approved by the City and/or the agency having jurisdiction over the other utility.

   d. The maximum depth to invert of any sanitary sewer shall not exceed the depth recommended by the pipe manufacturer for each size and class of pipe. The applicant's design engineer shall provide the manufacturer's installation instructions/recommendations with the plan submittal for review by the City.

4. Manholes

   a. Manholes shall be installed at intervals not to exceed 300', or at the following locations:

      i. The upstream terminus of a gravity sanitary sewer run, including transition between a gravity building sewer and a low-pressure sanitary sewer pipe. Wherever possible, dead-end gravity sanitary sewer alignments shall be avoided. Gravity sanitary sewer alignments shall be extended to common terminus locations and high-point manholes shall be installed at the common terminus locations.

      ii. All changes in pipe grade.

      iii. All changes in pipe size.

      iv. All changes in horizontal alignment.

      v. All gravity sanitary sewer junctions.

      vi. All monitoring locations.

   b. Manholes shall be located such that the casting will not be in street or parking lot pavements, sidewalks or driveways.

   c. Manholes for sanitary sewers 21" and smaller shall have a minimum inside diameter of 48". Manholes for sanitary sewers larger than 21" shall have a minimum inside diameter of 60". Larger diameter manholes may be required depending on such factors such as the number of sanitary sewers at a junction or significant changes in horizontal alignment. Manholes for transitions between gravity building sewers and low-pressure sanitary sewer pipe shall have a minimum inside diameter of 24".

   d. Internal drop connections will be required where the invert of the outlet gravity sanitary sewer is 18" or more below the inlet pipe invert.

   e. The 0.8 depth flow line of gravity sanitary sewers shall be matched at structures when changing sizes of gravity sanitary sewers.

   f. An allowance of 0.1' in grade shall be made for loss of head through a manhole where gravity sanitary sewer horizontal alignment is deflected 30^0 or more.

5. Building Sewers

    a. General

        i. Except as permitted by the City Sewer Ordinances, each individual residence or building connected to the City wastewater collection system shall have an independent building sewer.

        ii. For each parcel along the route of a proposed gravity sanitary sewer, a building sewer shall be constructed from the gravity sewer to the public right-of-way or easement line. In particular, this applies to any parcels in the sanitary sewer service design area that are zoned for no more than one single-family residence or parcels that have an existing residence or building when the gravity sanitary sewer is installed. Installation of building sewers may not be required to larger vacant parcels that may be developed in the future.

    b. Building sewers shall be aligned such that the building sewer pipe is perpendicular to the centerline of the public road right-of-way or easement.

    c. Building sewers may be connected directly to an existing manhole when the manhole is located in the right-of-way or easement between the extensions of the side property lines of the parcel. Internal drop connections, as specified elsewhere, may be required.

    d. The minimum grade for building sewers shall be 1% for 6" diameter pipe and 2% for a 4" diameter pipe.

    e. Connections other than sanitary building sewers will not be permitted. Downspouts, weep tile, footing drains, sump pump discharges, or any other conduit that collects storm or groundwater shall not be discharged into the building sewer.

    f. Private building sewers of excessive length, although not a public sewer, may require inspection and testing. Each site will be considered individually by the City.

    g. Cleanouts shall be provided within 5' of the foundation walls, at all bends, at intervals not greater than 90', and at the location where the building sewer enters the public road right-of-way or the sanitary sewer easement.

    h. The minimum allowable horizontal separations between building sewers and other facilities are as follows:

        i. Water services – 3'

        ii. All other utilities and structures – 10'

6. Inverted Siphons

    a. In general, sanitary sewer siphons will only be accepted where no other feasible alternative exists and where there will be sufficient flow in the sewer so that maintenance will be held to a minimum.

b. The minimum size for inverted siphons shall be 6” in diameter.

c. A minimum of two pipes shall be provided for each inverted siphon. Inverted siphons shall be designed to have a minimum velocity of three feet per second. Design calculations, including plan and profile drawings, shall be submitted for review and approval.

7. Pump/Lift Stations

a. Pump stations and pressure sanitary sewers will only be allowed when no practical gravity sanitary sewer alternative exists.

b. A minimum of two pumps shall be provided. Pump stations shall be designed to pump the anticipated peak hour flow with the largest pump out of service.

c. Pump stations shall be protected from physical damage during a 100-year flood and remain operable and accessible during a 25-year flood.

d. Pump station structures and equipment shall be protected from vehicular traffic. Provisions for maintenance vehicles shall be provided, including pavement with sufficient space to park and maneuver, as well as a curb cut to allow ingress/egress from the adjacent roadway.

e. Sketches of the typical pump station layout and sections, including some of the standard equipment requirements, are provided in the Digital Appendix. Pump stations must include valves and risers to accommodate bypass of the station under various conditions and drainage from the valve vault to the wet well.

f. Electrical instrumentation and control devices, including adequate alarms and backup power, will be required.

g. Wastewater pumps shall meet the following requirements:

i. Pumps must be capable of passing 3” or larger spheres.

ii. Pump suction and discharge opening must be at least 4” in diameter.

iii. Pumps shall operate under a positive suction head.

iv. Pump “off” level shall be above the pump impeller.

v. Pumps must be equipped with individual intakes.

vi. Pump motors shall be three-phase electric.

vii. Shut off valves shall be provided on the discharge line of each pump.

viii. Check valves shall be provided between the pump discharge and the shut off valve on the discharge line.

8. Pressure Sanitary Sewers

   a. Pressure sanitary sewer pipe shall have a minimum diameter of 4".

   b. Pressure sanitary sewers shall be designed to maintain a minimum velocity of 2 feet per second.

   c. Valves and appurtenances shall be provided in the following locations:

      i. Isolation valves shall be provided per the spacing requirements as specified in the Water Supply System chapter of these standards.

      ii. Air/vacuum relief valves shall be provided at all high points.

      iii. Clean outs shall be provided at all low points.

   d. Pressure sanitary sewers shall be designed to discharge to gravity sanitary sewers at manholes. The pressure sanitary sewer shall enter the receiving manhole at a point of no less than 6" above the invert of the outlet gravity sanitary sewer invert and no more than 2' above the flow line of the gravity sanitary sewer.

   e. Pressure sanitary sewer pipe shall be designed to withstand internal pressures and external trench loads, as well as live loads. Design computations shall be submitted by the applicant's design engineer to the City for review and approval.

   f. Low pressure sanitary sewer systems which utilize individual grinder pump stations at each separate user will not be accepted as part of the City wastewater collection system. Such systems, if deemed appropriate by the City, will be private. The operation and maintenance of both the grinder pump station and low-pressure sanitary sewer pipe will remain the responsibility of the applicant or property owner.

C. Materials

1. Sanitary Sewer Pipe

   a. Gravity sanitary sewer pipe shall be one of the following:

      i. For pipes 4" diameter to 15" diameter, solid wall polyvinyl chloride (PVC) conforming to the requirements of ASTM D3034, latest revision. Solid wall PVC pipe shall have a sidewall dimension ration (SDR) no greater than 26.

      ii. Reinforced concrete pipe and inverted siphons conforming to the requirements of ASTM C76, latest revision.

   b. Pressure sanitary sewer pipe shall be one of the following:

      i. Ductile iron conforming to the material requirements prescribed in Item IV.C.1, Water Supply System, Materials, Water Transmission and Distribution Mains.

ii. Solid wall PVC conforming to the requirements of ASTM D3034, latest revision, with an SDR no greater than 21.

c. If other materials are proposed for use, the applicant shall furnish the necessary design data for the proposed depth and operating conditions. Use of materials other than those specified herein will not be allowed unless approved by the City.

2. Pipe Joints

a. Pipe joints for gravity sanitary sewer shall conform to the following requirements depending on the type of pipe used:

i. Joints for solid wall PVC pipe shall be push-on type unless solvent weld joints are approved by the City. Push-on type joints shall conform to ASTM D3212, latest revision. Solvent weld joints, where approved by the City, shall conform to ASTM D2855, latest revision.

ii. Modified grooved tongue joints for reinforced concrete pipe shall have a rubber gasket snapped into a groove cast in to the tongue, and shall only be permitted for inverted siphons. Rubber gasket joints for reinforced concrete pipe shall be in accordance with ASTM C443, latest revision.

b. Joints and fittings for pressure sanitary sewer pipe shall be equal to the City requirements for pressure pipe as specified in Chapter IV, Water Supply System.

3. Manholes and Vaults

a. Manholes and vaults shall be constructed of precast reinforced concrete sections, unless otherwise approved by the City.

b. Precast reinforced concrete manhole sections shall conform to requirements of ASTM C478, latest revision.

c. Precast manhole joints shall be modified grooved tongue with rubber gasket joints as described in Item IV.C.5.h.

d. Manhole steps, where required by the City, shall be reinforced polypropylene plastic, PS2-PFS, manufactured by M.A. Industries, Inc., or approved equal.

e. Cover and frame for new manholes shall be East Jordan Iron Works #1040 with Type “A” cover or approved equal. Covers shall be cast with the words “SANITARY SEWER” in raised letters spaced in from the periphery of the cover. New cover and frame for existing manholes shall match the existing cover and frame.

f. All new sanitary manholes shall have an infiltration fabric placed from the top of the frame casting base over the adjustment rings and over at least half of the transition cone section of the manhole chimney. The material shall be Infra-Shield or approved equal. Existing sanitary manholes located within the limits of a project that have the cone section excavated shall have the infiltration fabric installed. Existing manholes

that are not excavated shall have the chimney coated internally with a product approved by the City.

g. Rings for grade adjustment of covers and frames shall be injection molded high density polyethylene adjustment rings as manufactured by Ladtech, Inc., or approved equal. Use of other materials, such as precast concrete rings or brick and mortar, will not be allowed unless otherwise approved by the City.

h. All adjustment for matching road grade shall be made utilizing a molded indexed slope ring.

i. Each adjustment ring shall be sealed with a 3/16" to ¼" bead of butyl rubber sealant per the manufacturer's instructions. Sealant shall meet ASTM C-990, latest revision.

j. All castings and adjustment rings shall be securely fastened to the cone of the structure with four 3/8" threaded rods. The rods shall be galvanized or stainless steel anchored to the structure with Redhead concrete anchors or equal. Stainless steel or galvanized nuts and washers shall be used to attach the casting.

k. Manhole Drops

i. Manhole drop connections shall be interior drops using the drop bowl as produced by Reliner-Duran Inc. or approved equal.

ii. Drop bowl model "A-4" shall be used for all lines up through full 6" inlets. Drop bowl model "A-6" shall be used for all 8" inlets. Drop bowl model "B-8" shall be used for all 10" inlets. Lines larger than 10" shall be as directed by the City.

iii. The force line hood shall be attached on models "A-4" and "A-6" when the incoming line is from a force main or the slope of the incoming gravity sanitary sewer is 3% or greater.

iv. The drop pipe shall be secured to the manhole wall with Reliner-Duran, Inc. stainless steel adjustable clamping brackets or approved equal.

4. Building Sewers

a. Building sewers shall be constructed of solid wall PVC pipe conforming to ASTM D2751, latest revision, minimum schedule 40 or solid wall PVC conforming to the requirements of ASTM D3034, latest revision, with an SDR no greater than 26.

b. Building sewers larger than 6" in diameter shall be constructed of materials permitted for gravity sanitary sewers under the same conditions of depth.

c. Joints in building sewers, including fittings, shall be solvent welded conforming to the requirements of item V.C.2.a.i.

d. Cleanouts, including bends, wye fittings, and caps, shall be the same material as the building sewer. Caps shall be secured to the riser section of the cleanout via threaded connection.

e. Connection of new building sewers to existing gravity sanitary sewers shall be accomplished using a service saddle. Service saddles shall be a flexible tap saddle in tee configuration as manufactured by Fernco, Inc. or approved equal.

5. Pump Stations and Pressure Sanitary Sewers

a. Unless otherwise approved by the City, pumps shall be of a submersible type. Pumps shall be manufactured by ITT Flygt or approved equal.

b. Isolation valves on pressure sanitary sewers shall be plug valves:

i. Plug valves shall be non-lubricated, eccentric type with nitrile butadiene (hycar) or Buna-N resilient faced plugs. End connections shall generally be flanged or grooved for inside valves and mechanical joint for exterior ground-buried valves. Port area shall be equal to at least 80% of the nominal size pipe area. Valve bodies shall be suitably marked to indicate whether the valve is open or closed.

ii. The seating surface of the valve body shall be welded in stainless steel or nickel. Bearings at the top and bottom supporting the rotating element shall be self-lubricating, corrosion-resistant type, suitable for sewage plant service. The valve shall be of the bolted bonnet design. Packing shall be adjustable and replaceable without disassembling of the valve. The valve body shall be cast or ductile iron marked to show seat side of valve. A grit seal shall be provided for the bottom of the valve shaft.

iii. Plug valves shall be of adequate design to operate with a pressure of 50 psi on both sides or on either side of the valve without leakage.

D. Construction Methods

1. General

a. Excavation

i. Excavation, bedding, and backfill operations shall be accomplished in accordance with the requirements outlined in Chapter VIII, Grading and Earthwork, except as modified herein.

ii. Pipes shall be laid on a compacted granular material placed on the bottom of the trench to a depth of not less than 3” for 24” and smaller pipe and not less than 4” for pipe larger than 24”. Concrete encasement or concrete cradle shall be used as directed by the City.

iii. PVC pipe shall be laid on a compacted granular material placed on the bottom of the trench to a depth of not less than 4” conforming to Class B bedding as

shown on the plans. Where shown on the plans, or where the pipe passes under a road with less than 4' of cover, the pipes shall be encased.

iv. For all pipes, compacted granular material shall be placed at the sides of the pipe and cover not less than 12" above the crown of the pipe.

v. "Granular Material" shall be class 2NS sand, pea gravel or crushed stone, conforming to ASTM C33 Size No. 67 placed in not more than 6" layers and compacted to not less than 95% standard density for PVC and 90% standard density for reinforced concrete.

vi. Pea gravel or crushed stone used for bedding shall be separated from the sand backfill with a non-woven geotextile fabric. The fabric shall be Amoco 4551, or approved equal.

b. Existing Wastewater System

i. Wastewater system improvements shall be constructed without interruption of service in the existing system. Temporary provisions to maintain service, such as bypass pumping, shall be the responsibility of the proprietor unless otherwise approved by the City.

ii. The condition of the existing wastewater system will be observed by the City prior to the commencement of any improvements to the existing system or adjacent to the existing system. Any damage or adverse impact to the existing wastewater system resulting from the operations or action of the proprietor or their designated representative shall be remedied by the proprietor. Damage or adverse impacts include, but are not necessarily limited to, introduction of debris to the system and improper adjustment of manhole castings.

2. Submittals

a. Certifications

i. All pipe, fittings, and appurtenances delivered to the job shall be accompanied by certification papers showing that the materials have been manufactured and tested in accordance with all applicable standards.

b. Shop Drawings

i. Shop drawings may be required for certain materials, including, but not necessarily limited to, pump stations and appurtenances prior to fabrication and manufacture.

3. Delivery, Handling and Storage

a. Wastewater system materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations and as specified by the City.

b. Upon delivery to the project site, all materials will be inspected by the City or its designated representative. Rejected materials shall be immediately removed from the project site by the proprietor.

4. Construction Sequence

   a. Unless otherwise authorized by the City, construction of wastewater system improvements shall begin at the downstream end of the system and proceed upstream.

5. Installation

   a. GPS
      i. GPS data shall be collected for all bends, tees, wyes, cleanouts, manholes, and vaults.
      ii. The data shall be provided to the City and City Engineer for records.

   b. Sanitary Sewer Pipe

      i. General

         1. All pipe shall be laid true to the required lines and grades. All trenches shall be kept dry when pipe laying is in progress and all pipe fittings shall be uniformly supported on properly trimmed bedding with holes at each joint to receive bells. All pipe shall be laid with bells uphill.

         2. The grade as shown on the profiles is that of the pipe invert and that to which the work must conform. The grade shall be kept by levels, laser or other tools which shall be furnished by the proprietor. Each pipe shall be laid accurately to the line and grade as shown on the plans and in such a manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the invert. The interior of the sanitary sewer pipe shall, as the work progresses, be cleaned of all dirt, cement, debris and other superfluous materials. Bulkheads shall be used to keep foreign materials out of the open end of the sanitary sewer pipe when work is not in progress.

         3. All pipe and fittings shall be carefully lowered and moved into position in the trench or vault in a controlled manner such as will prevent damage to the pipe and any coatings or linings. An excessive amount of scratching on the surface of the PVC pipe will be considered cause for rejection.

         4. The trench shall be backfilled closely behind the pipe laying. Unless otherwise directed or permitted by the City, the backfilling shall follow and be completed to the top of the trench within two pipe lengths behind the pipe laying.

         5. All cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to new or existing lines. A fine tooth saw, tubing cutter or similar tool may be used to cut PVC

pipe. Cuts must be square. Ragged edges shall be removed with a cutting tool or file.

6. After cutting bell and spigot or socket pipe, a stop mark shall be made with a pencil or crayon using dimensions shown on the pipe manufacturer's instructions or by using another pipe in the field as a guide.

7. Breaks in pipe or joints shall be repaired by the proprietor to the satisfaction of the City.

ii. Gravity Sanitary Sewer

1. Solid wall PVC pipe, shall be installed in accordance with the requirements of ASTM D2321, latest revision.

2. Reinforced concrete pipe shall be installed in accordance with the requirements of ASTM C76, latest revision.

iii. Pressure Sanitary Sewer

1. Ductile iron pipe and appurtenances shall be installed as prescribed in item IV.D.5.a, Water Supply System, Construction Methods, Installation, Water Transmission and Distribution Mains.

2. Plastic pressure sanitary sewer pipe shall be installed in accordance with the requirements of ASTM D2274, latest revision.

c. All joints shall be made-up in accordance with the manufacturer's instructions using materials and equipment especially prepared for the type of joint to be used.

d. Manholes and Vaults

i. Precast base sections shall be placed on a well-graded granular bedding course conforming to the requirements for sewer bedding, but not less than 6" in thickness and extending to the limits of the excavation. The bedding course shall be firmly tamped and made smooth and level to ensure uniform contact and support of the precast element.

ii. Manhole and Vault Sections

1. All lift holes and all joints between precast elements in manholes shall be thoroughly wetted and then completely filled with mortar and smoothed to ensure all holes and joints are watertight.

2. Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the manhole steps, if required by the City. The complete manhole shall be rigid, true to dimensions, and watertight.

3. Epoxy joints of polymer concrete manholes shall be inspected for damage and cleaned of all debris. Apply compatible epoxy material for bonding in accordance with manufacturer's instructions.

iii. Placing of Castings, Grade Rings, and Top Sections

1. Castings placed on concrete surface shall be set in full mortar beds. The mortar shall be mixed in proportion of 1 part Portland cement to 2 parts sand, by volume, based on dry materials. Casting shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary unless otherwise specified by the City.

2. Where castings are located in paved surfaces or areas which have been brought to grade, not more than 15" shall be provided between the top of the cone or slab and the underside of the casting or adjustment of the casting to street grade.

3. Where castings are located in unpaved traffic bearing areas, provide not more than 12" of adjusting rings between the top of the cone or slab and the underside of the casting for adjustment of the casting to finished grade. Set the top of casting 5" below finished grade, unless otherwise directed by the City.

4. Where castings are located in cultivated agricultural areas, the top of the manhole casing shall be set at least 6" higher than the finished grade, and in non-cultivated areas, set the casting flush with the finished grade, unless otherwise directed by the City.

5. Point up and make watertight adjusting rings used to set the casting to grade.

6. All channels shall be constructed to the full flow depth of the pipe.

e. Pumps and Appurtenances

i. Pumps and appurtenances, as well as other wastewater system infrastructure, shall be installed in accordance with all applicable ASTM standards, manufacturer's recommendations, and as directed by the City.

f. Pressure Sanitary Sewer

i. Pressure sanitary sewer shall be tested in accordance with the requirement for hydrostatic testing as prescribed for water supply system improvement in Chapter IV.

6. Testing

   a. General

      i. All sanitary sewers shall be subjected to infiltration, exfiltration, or low pressure air tests, or a combination thereof prior to final acceptance by the City. In addition, all PVC and ABS plastic sewers shall be subjected to deflection testing by means of a nine-point deflection test mandrel.

      ii. The City shall be present for all testing operations. If testing is to be done by the proprietor, only properly trained personnel shall be allowed to perform the testing work. If testing is to be done by municipal agency work forces, then the proprietor shall be responsible for coordinating with the inspector in order to schedule the testing.

      iii. In the event that the sanitary sewer pipe fails any of the required tests, the proprietor shall be responsible for repairing the pipe and repeating the test until acceptable results are achieved.

      iv. The method of testing and measurement shall be approved by the City. The proprietor shall provide all necessary equipment and labor for performing the tests.

   b. Infiltration Test

      i. All sanitary sewers that are over 24" in diameter shall be subjected to an infiltration test. Also, all sanitary sewers that are 24" in diameter and smaller and where the groundwater level is more than 7' above the top of the sewer shall be subjected to an infiltration test.

      ii. The infiltration rate for all sanitary sewers shall not exceed a maximum of 200 gal/in diameter per mile of sewer per 24 hours.

   c. Low Pressure Air Test

      i. All sanitary sewers that are 24" in diameter or smaller and where the groundwater level is 7' or less above the top of the sewer shall be subjected to a low pressure air test.

      ii. The procedure for air testing sanitary sewers shall be as follows:

         1. The sanitary sewer line shall be tested in increments between manholes. The line shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide an airtight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be connected to the orifice. The supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3½" and a range

of 0 – 10 psig. The gauge shall have minimum divisions of 0-10 psig and accuracy of plus or minus (+/-) 0.04 psig.

2. The sanitary sewer shall be pressurized to 4 psig greater than the greatest back pressure caused by the groundwater over the top of the sanitary sewer pipe. At least 2 minutes shall be allowed for the air pressure to stabilize between 3½ and 4 psig. If necessary, air shall be added to the sewer to maintain a pressure of 3½ psig or greater.

3. After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sanitary sewer. The sanitary sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3½ psig, or such other pressure as is necessary to compensate for the groundwater level.

4. The time required for air pressure to decrease 1.0 psig during the test shall not be less than the time shown in the following Air Test Tables. The proprietor shall use the appropriate test table based on the sanitary sewer pipe material.

Table SA-1

Air Test Table for Vitrified Clay and Concrete Pipe

Specification Time (min:sec) Required for Pressure Drop from 3-1/2 to 2-1/2 PSIG When Testing One Pipe Diameter Only															
Length of Line, Feet	Pipe Diameter, Inches														
	4	6	8	10	12	15	18	21	24	27	30	33	36	39	42
25	0:04	0:10	0:18	0:22	0:27	0:32	0:36	0:45	0:54	1:03	1:12	1:21	1:30	1:39	1:50
50	0:09	0:21	0:36	0:45	0:54	1:03	1:12	1:30	1:48	2:06	2:24	2:42	3:00	3:18	3:39
75	0:14	0:32	0:54	1:08	1:21	1:34	1:48	2:15	2:42	3:09	3:36	4:03	4:30	4:57	5:29
100	0:18	0:42	1:12	1:30	1:48	2:06	2:24	3:00	3:36	4:12	4:48	5:24	6:00	6:36	7:18
125	0:22	0:52	1:30	1:52	2:15	2:38	3:00	3:45	4:30	5:15	6:00	6:45	7:30	8:15	9:08
150	0:27	1:03	1:48	2:15	2:42	3:09	3:36	4:30	5:24	6:18	7:12	8:06	9:00	9:54	10:57
175	0:32	1:14	2:06	2:38	3:09	3:40	4:12	5:15	6:18	7:21	8:24	9:27	10:30	11:33	12:47
200	0:36	1:24	2:24	3:00	3:36	4:12	4:48	6:00	7:12	8:24	9:36	10:48	12:00	13:12	14:36
225	0:40	1:34	2:42	3:22	4:03	4:44	5:24	6:45	8:06	9:27	10:48	12:09	13:30	14:51	16:26
250	0:45	1:45	3:00	3:45	4:30	5:15	6:00	7:30	9:00	10:30	12:00	13:30	15:00	16:30	18:16
275	0:50	1:56	3:18	4:08	4:57	5:46	6:36	8:15	9:54	11:33	13:12	14:51	16:30	18:09	20:06
300	0:54	2:06	3:36	4:30	5:24	6:18	7:12	9:00	10:48	12:36	14:24	16:12	18:00	19:48	21:54
350	1:03	2:27	4:12	5:15	6:18	7:21	8:24	10:30	12:36	14:42	16:48	18:54	21:00	23:06	25:33
400	1:12	2:48	4:48	6:00	7:12	8:24	9:36	12:00	14:24	16:48	19:12	21:36	24:00	26:24	29:12
450	1:21	3:09	5:24	6:45	8:06	9:27	10:48	13:30	16:12	18:54	21:36	24:18	27:00	29:42	32:51
500	1:30	3:30	6:00	7:30	9:00	10:30	12:00	15:00	18:00	21:00	24:00	27:00	30:00	33:00	36:30

Note: Table SA-1 is taken from the National Clay Pipe Institute (NCPI) tables which are based upon ASTM C828 “Test Method for Low Pressure Air Test for Vitrified Clay Pipe Lines” and ASTM C924 “Standard Practice for Testing Concrete Pipe Sewer Lines by Low Pressure Air Test Method.”

Table SA-2

Air Test Table For PVC and ABS Pipe

Minimum Specified Time Required for a 1.0 PSIG Pressure Drop

For Size and Length of Pipe Indicated for Q=0.0015 *

Pipe Dia. (in)	Minimum Time, (min:sec)	Length for Minimum Time, ft.	Time for Longer Length, se conds	Specified Time for Length (L) Shown, (min:sec)							
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:43	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	203:46

Note: Table SA-2 is taken from ASTM F1417 “Standard Test Method for Installation and Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air Test”. ASTM F1417 conforms to Uni-Bell “Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe” (UNI-B-6-98).

*Q is the allowable leakage rate in cubic feet/minute/square foot of inside surface area of pipe.

d. Exfiltration Test

i. Exfiltration or leakage from the sanitary sewer line can be measured by recording the water level drop over a given period of time in a standpipe placed and connected in the upstream manhole. The measured drop in the time period can be converted by calculations to the leakage rate in terms of gallons per inch of pipe diameter per mile per day.

ii. Exfiltration tests may be substituted for low pressure air tests where approved by the City. Exfiltration tests will not be allowed where the external water pressure exceeds 4’.

iii. For the purpose of exfiltration testing, the internal water level shall be equal to the external water level plus 4’ as measured from the top of the highest pipe in the system being tested. This could be either a house lead or a lateral. However, the maximum total height of water above the invert of the pipe at the lower end shall not exceed 16’. A prospective test that would exceed this 16’

limit should not be taken. The line under construction can be broken down into smaller sections such that the maximum head of 16' will not be exceeded.

iv. The maximum exfiltration rate shall be the same as that permitted for the infiltration test. The exfiltration test procedure is summarized as follows:

1. All service laterals, stubs, and fittings into the sewer line(s) being tested shall be properly capped or plugged, and carefully braced to resist the thrust actions developed by the internal water pressure. In preparing the blocking of plugs or end caps, it is extremely important to recognize that the 5' to 10' of head in the standpipe will exert considerable thrust against the plugs or caps.

2. A plug is inserted and tightened in the inlet pipe of the downstream manhole to which the water supply connection is made for filling the pipe.

3. The upper manhole is plugged and securely tightened for connection to the standpipe. The standpipe is then placed in this manhole and connected to the tapped plug. The standpipe must be capable of handling from 5' to 10' of water head to determine the tightness and soundness of the sewer line, as specified and directed by the City.

4. Water is introduced into the line at the downstream manhole until the standpipe in the upstream manhole has been completely filled. By filling the line from the lowest level, the air in the line is easily pushed ahead and finally dispelled through the standpipe at the upper end of the test section. Care should be taken to minimize entrapped air that will give distorted test results. The rate of drop in the standpipe may be quite rapid until the air has been expelled.

5. After filling with water, the line must be allowed to stand for at least four (4) hours before beginning the test. During this time some water absorption into the manhole structures and sewer pipe will take place. After the water absorption has stabilized, the water level in the standpipe is checked and water added if necessary.

6. The test is now ready to begin. The drop in the standpipe is measured and recorded over a 15-minute period. To verify the first results, a second 15-minute test is suggested. This will also verify whether a stable condition exists in the line.

7. The measured drops in the standpipe are converted to leakage in terms of gallons per inch diameter per mile per day.

8. Another commonly used method of conducting water exfiltration testing is to utilize the manhole in lieu of a standpipe. The test procedure is exactly as outlined for using the standpipe. However, since the manhole is larger in diameter than the standpipe, this method normally requires a minimum two (2) hour test period in order to be able to record a

measurable water level drop. Manhole leakage must also be considered in the leakage rate and test results.

v. Caution should be taken when conducting exfiltration tests on sanitary sewer lines laid on steep grades. Consideration must be given to the downstream portion of the system to prevent excessive pressures in these lower lines. For these installations and where the upstream manholes are very deep, it is not advisable to fill the standpipe and manhole to the top when performing the test.

e. Deflection Test for Plastic Pipe

i. The allowable maximum deflection shall be 5% of internal pipe diameter. A deflection test gauge (Go, No-Go Gauge) as manufactured by Hurco Industries, Cherne Industries, or approved equal, shall be used to verify that the maximum allowable deflection standard is met. The test gauge must have a minimum of nine (9) points. Proving rings must be provided to verify gauge diameter. The gauge shall be pulled through manually; force will not be allowed. Pipe with deflections greater than 5% will be considered unacceptable and shall be re-laid by the proprietor.

f. Videotaping

i. As a means of insuring that the pipe laying was properly done and that all joints are in the “home” position, the applicant shall be responsible for the videotaping of all of the pipe laid that is 36” in diameter and smaller. This videotaping shall be done no sooner than 30 days after sewer installation is complete. A minimum of 24 hours’ notice shall be provided to the City prior to videotaping so that a representative may be present. A satisfactory review of the videotape by the City shall be a condition for sewer acceptance by the City. Typical items to be reviewed on the videotape will include pipe deflection, pipe settlement, lead connections, joints and pipe cleanliness. If the videotape review reveals unsatisfactory conditions, the deficiencies shall be corrected and the affected pipe sections shall be re-videotaped for review by the City.

VI. STORMWATER MANAGEMENT

A. General

1. Stormwater management systems shall be designed in accordance with the Oakland County WRC procedures and engineering practices and as prescribed herein for City-owned storm sewer.

2. Where possible, the applicant is strongly encouraged to propose low-impact stormwater management designs that limit the amount of runoff generated on site.

3. Where an approved point of discharge is not available on the site, the applicant shall make such offsite drainage improvements as are necessary to provide positive drainage to an approved outlet, as determined by the City Engineer and/or the Oakland County WRC. Such improvements shall be located in an easement secured by the applicant. The easement form and width of the easement shall be subject to City approval.

4. Soil borings in the location of any proposed stormwater storage facility are required. Soil borings shall include groundwater surface elevation information. Where infiltration is proposed, infiltration rates shall be calculated. For facilities proposing basements, soil borings must be performed in a grid pattern within the buildable areas to show the groundwater characteristics of the site.

5. Plan and profile views shall be provided for all proposed stormwater management system improvements. The plan and profile views shall be presented on the same plan sheet and shall be vertically oriented.

    a. Design calculations for all components of stormwater management systems, including, but not necessarily limited to, storm sewers, channels and detention facilities, shall be provided on the plans.

    b. A drainage area map shall be included on the plans. The map shall define the areas tributary to catch basins and inlets (including upstream and offsite areas). The design calculations shall include the determination of the weighted runoff coefficients for the areas tributary to each specific inlet and outlet. The design calculations shall also include justification for the initial time of concentration used for the storm sewer design calculations.

    c. The following information must be shown in the plan view of the proposed storm sewer system improvements:

        i. Size, material, and type of pipe.

        ii. Length between structures.

        iii. Slope of sewer between structures.

        iv. Where required, a dedicated stormwater easement must be shown on the plans. The easement width shall be in accordance with the following:

1. 12’ for open drainage along rear and side property lines.
2. A minimum of 20’ for enclosed storm drains.
3. A minimum of 30’ for open swales (cross lot drainage).
4. Top of casing and all invert elevations at each structure.
5. Progressive number system on structures.

d. The following information must be shown in the profile view of the proposed storm sewer system improvements:

   i. Existing and proposed ground elevations.
   ii. Size, material, and type of pipe.
   iii. Length between structures.
   iv. Slope of sewer between structures.
   v. Hydraulic gradient between structures.
   vi. Top of casting and all invert elevations at each structure.
   vii. All utility crossings.
   viii. Special backfill areas, (i.e. sand).
   ix. Progressive numbering system on structures.
   x. Adjacent existing or proposed utilities plotted where parallel.

e. Where public storm sewer construction is proposed, the City of Farmington standard storm sewer detail sheets must accompany the plans. The standard details are included in the Digital Appendix.

B. Design Criteria

Components of the stormwater management systems shall be designed in accordance with the requirements of the City and/or Oakland County WRC, as noted previously. The City design criteria shall apply to all stormwater management system components, regardless of whether the facilities will be publicly dedicated or privately maintained at the completion of the project.

1. Stormwater discharge rates shall be determined as prescribed in Item 1 of Part A of this section.

2. Surface runoff shall be determined as outlined by the Oakland County WRC.

3. Stormwater conveyance systems shall be designed per the requirements prescribed by the Oakland County WRC. The following are acceptable forms of stormwater conveyance:

    a. Natural streams and channels.

    b. Vegetated swales and open ditches.

    c. Storm sewers. Enclosed storm sewers are generally comprised of the following elements:

        i. Pipe.

        ii. Manholes.

        iii. Catch Basins.

        iv. Inlets.

        v. Sump pump leads shall be connected into an enclosed system and shall be tapped directly into storm sewer structures or cleanouts at or above the hydraulic grade line of the 10-year storm. Sump pump leads shall not be discharged directly to open surfaces.

    d. Culverts.

4. Detention/Retention facilities shall be designed per Oakland County WRC guidelines.

5. Underground detention/retention facilities shall include all required bedding, cleanouts, and monitoring manholes and can only count up to 30% of void volume for storage or as determined to be acceptable by the City Engineer.

6. The use of low impact design (LID) and/or Best Management Practices (BMPs) for stormwater management is encouraged within the City of Farmington. However, the use of these design techniques must be in conformance with the Low Impact Design Manual of Michigan and must also be in compliance with requirements of the of the Oakland County Water Resources Commissioner's Office. Examples of low impact design include:

    a. Bioretention (Rain Garden)

    b. Detention Basin

    c. Infiltration Basin/Trench

    d. Bioswale

    e. Porous and Pervious Pavement

C. Materials

1. Vegetative cover for natural streams and channels, open ditches and swales, as well as detention/retention facilities shall be in accordance with the requirements of the Oakland County WRC.

2. Sewer Pipe

    a. Storm sewer pipe shall conform to the current American Society for Testing Materials "Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe", ASTM C-76 for circular pipe, or ASTM C-507 for horizontal elliptical pipe, latest revision.

    b. If other materials are proposed for use, the applicant shall furnish the load carrying design analysis for the pipe for the proposed depth conditions.

3. Pipe Joints

    a. Pipe joints shall conform to the following requirements:

        i. Modified Grooved Tongue (M.G.T.) pipe shall have a rubber gasket snapped into a groove cast into the tongue.

        ii. The modified groove or bell end of the pipe shall be made smooth and shall have not over a 3.5% slope for sizes 10" to 24" or a 2% slope for sizes 27" to 108" tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer.

        iii. Rubber gasket joints shall be in accordance with the Specification for "Joints for Concrete Pipe and Manholes, using Rubber Gaskets," ASTM Designation: C-443, latest revision.

        iv. Rubber gasket joints shall be lubricated and coupled in accordance with the pipe manufacturer's printed instructions.

4. Manholes

    a. Manholes shall be precast reinforced concrete sections in accordance with the City of Farmington Standard Details as seen in the Digital Appendix.

    b. Precast reinforced concrete manhole sections shall conform to the requirements of the American Society for Testing and Materials, "Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, latest revision.

    c. Wall thickness shall depend on depth and shall be subject to the approval of the City Engineer.

    d. Pre-cast or HDPE grade adjustment rings are encouraged under paved areas.

    e. Brick for casing adjustment or concrete block for manhole, inlet, and catch basin construction shall conform to the requirements of the Michigan Department of

Transportation "Standard Specifications for Construction," latest revision. Wall thicknesses shall depend on depth and shall be subject to the approval of the City Engineer.

f. Pre-cast manhole joints shall be as described in Section VI.C.3.a.iii.

g. A minimum of three (3) to a maximum of six (6) adjustment courses shall be placed above the top of the cone section on all precast or block manholes.

h. Manhole covers and frames shall be East Jordan Iron Works #1040 with Type "B" cover, or approved equal. All storm structures receiving runoff shall include raised lettering reading "Dump No Waste, Drains to Waterways" and a fish logo.

i. The entire outside surface of all concrete block and brick masonry portion of drainage structures shall be plaster coated with ½" thick mortar.

j. All manholes on storm sewers 18" in diameter and smaller shall have 2' deep sumps unless otherwise called for on the plans.

5. Catch Basins

a. Catch basins shall be constructed of brick, precast manhole blocks, or precast reinforced concrete manhole sections, as described in Part 4 of this section, in accordance with the City of Farmington Standard Details.

b. Pavement catch basin and inlet frames and grates shall be accordance with the requirements of the City.

c. Lawn catch basin frames and grates shall be selected at the discretion of the applicant's engineer, but shall be capable of carrying the anticipated traffic loads, and shall have sufficient opening area to receive the design stormwater runoff. Where possible, catch basins shall be placed out of the expected wheel paths of vehicles. Where catch basins are placed within areas of travel, a concrete apron shall be provided.

D. Construction Methods

1. Construction Progress

a. Unless otherwise permitted by the City Engineer and/or the Oakland County WRC, construction of storm sewers shall begin at the outlet end of the sewer and proceed upgrade.

2. Certification and Inspection

a. All pipe and fittings delivered to the job shall be accompanied by certification papers showing that pipe and fittings have been tested in accordance with the applicable specifications and that the pipe and fittings meet the specifications for this project. All pipe and fittings will be inspected upon delivery to the job site. No cracked, broken or

damaged pipe or fitting will be allowed in this work. Rejected pipe and fittings will be immediately removed from the job site.

b. No pipe or fittings known to be defective shall be laid in the work. Any piece found to be defective after it has been laid shall be removed and replaced with a sound piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut shall be square and ground smooth. Cut surfaces of ductile iron pipe shall be painted with two coats of approved asphaltum metal protective paint where required by the City.

c. Full time inspection is required by the City Engineer for all underground storm sewer infrastructure.

3. Excavation

   a. Excavation, bedding, and backfill for open cut pipe installations and structures shall be accomplished in accordance with requirements in Section IX: Grading and Earthwork of these standards.

4. Laying Pipe

   a. Handling Pipe and Fittings

      i. All pipe and castings shall be unloaded and distributed along the line of work in such manner and with such care as will effectually avoid damage to any pipe or fitting. Dropping pipe or fittings directly from the truck will not be permitted. Care must also be taken to prevent abrasion of the pipe coating. Wherever the coating may have been rubbed off, the part shall be recoated as may be required by the nature of the pipe coating.

   b. Placement of Pipe

      i. Each pipe shall be inspected for defects prior to being lowered into the trench. The inside of the pipe and the outside of the spigot shall be cleaned of any dirt or foreign matter.

      ii. Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in the direction of the flow. Pipes shall be laid on minimum 4" MDOT Class II natural sand cushion. A 6" MDOT Class II natural sand cushion shall be provided if called for on the plan details. All plastic pipe bedding shall be clean course aggregate 6A, 6AA, or peastone. If the subgrade has been disturbed so that refilling is necessary to bring the pipe to grade, such refilling shall be done with MDOT 6A coarse aggregate thoroughly tamped in place. Bell holes shall be excavated so that the full length of the pipe barrel will bear uniformly on the sand cushion.

      iii. Pipe shall be centered in bells or grooves and pushed tight together to form a smooth and continuous invert. After laying pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be re-laid properly.

c. Line and Grade

    i. Pipe shall be carefully laid to line and grade and shall have bearing over its entire length except at joints where the joint hole shall be of such size as to give adequate room for working. Pipes shall be laid with a minimum cover (2.5') as shown on the standard details. When a pipe laser is not used, elevations will be taken and recorded at each pipe bell, and a transit, plumb bob or other line of site device will be used to maintain line.

d. Excavation Below Bottom of Pipe

    i. As a result of construction procedures or where excavation has not uncovered a stable foundation subgrade at a depth of 6" below the bottom of the proposed pipe, excavation shall continue downward below the bottom of the proposed pipe to reach a stable foundation soil. The space resulting from such excavation and the pipe bedding shall be filled and constructed with MDOT 6A coarse aggregate and bedding as specified in Section IX: Grading and Earthwork of these standards.

e. Laying and Bedding of Pipe

    i. Pipe installation shall be made in accordance with the published installation guild of the pipe manufacturer, except as otherwise specified herein. Whenever instructions given by the manufacturer are at variance with the provisions specified herein, the laying standards provided herein shall govern.

    ii. Proper tools, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gauges, etc. shall be provided at the site of the work for the installation of the pipe.

    iii. Immediately before laying each section of pipe or fitting, it shall be thoroughly cleaned of all debris, dirt or other accumulated foreign material. It shall be inspected for damage to the coating or pipe material and repairs shall be made where required. If deemed irreparable by the City Engineer, then it shall be removed from the job site. Care shall be taken to keep the interior of previously laid pipe clean and free from dirt and other foreign material. Bulkheads or other means shall be used at the open end of the previously laid pipe for this purpose.

    iv. After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe, the pipe shoved into the proper position in the collar or bell and brought into true alignment. The pipe shall then be secured with MDOT Class II natural sand, or clean coarse aggregate 6A, 6AA, or peastone for plastic pipe that is carefully tamped under and on each side of the pipe.

f. Concrete Cradle for Pipe

i. Where required, pipe shall be installed with a cradle of MDOT Grade S3 concrete.

ii. Each pipe shall rest on a 6” minimum thickness bed of dry mix concrete that is shaped to fit the bottom of the pipe. The dry mix concrete shall be MDOT Grade S3.

iii. After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be filled to a level equal to a point one (1) foot above the top of the pipe with MDOT Grade S3. The concrete shall have a 5” slump and be mechanically vibrated to ensure complete filling of the annular space between the excavated face of the original ground and the outside face of the pipe.

g. Pipe Placed in Casings

i. Pipes will be placed in casing pipe in the locations shown on the drawings. Under this work, the contractor will place the carrier pipe, fill the annular space between the casing and the carrier pipe, place bulkheads, and complete all backfilling.

ii. For road crossings, all void spaces between the casing pipe and the carrier pipe will be filled with sand meeting the requirements of MDOT 2NS natural sand. Sand will be placed by flushing or other methods approved by the City Engineer. The contractor will furnish the City Engineer with information on the quantity of sand placed.

iii. The annular space at the ends of the casing pipe will be bulkheaded with a minimum of 12” thick solid masonry with a ½” fiberboard cushion between the masonry and carrier pipe.

iv. All necessary skidding materials required to protect the carrier pipe will be furnished by the contractor.

h. Jointing

i. Where pipe is laid in wet trenches, trenches with running sand, or in trench conditions where manual means will not allow pushing the pipe home, mechanical means shall be utilized for pulling the pipe home and holding the pipe joints tight until the completion of the line. Mechanical means shall consist of a cable placed inside the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position.

ii. All joints on elliptical concrete pipe (42” equivalent diameter and larger) shall be cement mortar pointed on the inside.

i. Gravity Pipe

    i. Where pipe is laid in wet trenches, trenches with running sand, or in trench conditions where manual means will not allow pushing the pipe home, the applicant shall provide and use mechanical means for pulling the pipe home and holding the pipe joints tight until completion of the line. Mechanical means shall consist of a cable placed inside the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position.

j. Pressure Pipe

    i. Refer to Section IV: Water Supply System of this document for acceptable construction methods and approved materials for joints and joint restraint for ductile iron pressure pipe.

k. Backfill

    i. Backfill shall be placed in accordance with Section IX: Grading and Earthwork of these standards.

5. Structures and Appurtenances

a. Construction methods for drainage structures shall conform to Section 403.03 of the current Michigan Department of Transportation Standard Specifications for Construction, except as herein provided.

b. All precast sections shall bear the stamp of an approved laboratory as having been tested and delivered from tested stock of the manufacturer.

c. Precast sections shall be constructed so that no more than 50% of the circumference, measured on the inside face, is deleted on any horizontal plane for sewer pipe openings. There shall be no less than 12” of residual concrete measured on any horizontal plane between pipe openings.

d. Excavation shall be carried to the depth required to permit the construction of the base in accordance with the requirements of the City of Farmington Standard Details. The excavation shall be sufficiently wide enough to allow for shoring, bracing, or formwork, should any or all be necessary. Also, the excavation shall allow for accessibility in plastering the exterior of all brick masonry. The bottom of the excavation shall be trimmed to a uniform horizontal bed to receive the concrete base. The excavated section shall be completely dewatered before any concrete is placed therein. The standard details are included in the Digital Appendix.

e. With the exception of drainage structures having sumps, the bottom of structures shall be channeled to provide for smooth flow through the manhole. Channels shall be formed using MDOT Grade S3 concrete.

f. Connections to manholes shall be properly supported and braced.

6. Stubs, Connections, and Bulkheads

    a. Existing sewers shall be connected in where called for on the plans. Bulkheads shall be placed or removed where called for on the plans.

    b. Unless otherwise noted on the plans, stubs shall consist of one length of sewer pipe with a watertight stopper bulkhead or, where approved by the City Engineer, a brick and mortar bulkhead. Pipe stubs shall be of the same material as the sewer to which they connect to unless otherwise specified.

7. Cleaning

    a. All sewers shall be thoroughly cleaned before final acceptance.

8. Testing

    a. General

        i. The applicant shall be responsible for providing all necessary equipment and labor for performing the tests.

    b. Deflection Test for Plastic Pipe

        i. The allowable maximum deflection shall be 5% of the internal pipe diameter. A Deflection Test Gauge (Go, No-Go) as manufactured by Hurco Technologies, Cherne Industries, or approved equal shall be used to verify that the maximum allowable deflection standard is met. Pipe with deflections greater than 5% will be considered unacceptable and shall be replaced.

    c. Digital Recording (Public Storm Sewers)

        i. As a means of insuring that pipe laying was properly performed and that all joints are in a “home” position, the applicant shall provide for digital recording of 10% of the pipe footage laid (pipe 36” diameter and smaller), with no less than one manhole run being televised on each project. The City Engineer shall review and approve which pipe runs are to be recorded. The recording shall be done no sooner than thirty (30) days after the sewer installation is complete. The applicant shall provide 24 hours’ notice to the City Engineer prior to recording so that a representative may be present. A small amount of water must be poured into the pipe before recording to ensure identification of low spots. A satisfactory review of the DVD by the City Engineer shall be a condition for the sewer acceptance by the City of Farmington. Typical items to be reviewed on the DVD will include pipe deflection, pipe settlement, connections, joints and pipe cleanliness. If the DVD review reveals unsatisfactory conditions, all deficiencies shall be corrected and the affected pipe sections re-televised for review by the City Engineer.

9. Maintenance Agreement

    a. Purpose

        i. The purpose of the maintenance agreement is to provide the means and assurance that maintenance of the stormwater management and facilities shall be undertaken on an on-going basis.

    b. Required

        i. A maintenance agreement shall be submitted to the City Engineer for all new development or redevelopment subject to the site plan review requirements and Zoning Ordinance.

        ii. Maintenance agreements shall be approved by the City Engineer prior to construction.

    c. Provisions

        i. The maintenance agreement shall include a plan for routine, emergency, and long-term maintenance of all stormwater facilities with a detailed annual estimated budget for the initial three (3) years.

        ii. The maintenance agreement shall be binding on all subsequent owners of land served by the stormwater management and facilities, and shall be recorded in the office of the Oakland County Register of Deeds.

VII. PAVING IMPROVEMENTS

A. General

1. All roads proposed for construction in the City of Farmington shall be public roads under the jurisdiction of the City of Farmington unless otherwise permitted by City ordinance. Plans for such roads and/or accompanying sidewalks/bike paths shall be prepared in accordance with the current MDOT Standard Specifications for Construction, the Americans with Disabilities Act (ADA), and the American Association of State Highway and Transportation Officials (AASHTO) guidelines, latest respective revisions. In addition to any submittals for City approval, plans shall also be submitted to the City of Farmington for review of the proposed road improvements in relation to other existing and proposed facilities.

2. Paving improvements for parking lots, internal roads and pedestrian facilities on private sites shall be designed in accordance with the requirements prescribed herein.

3. Concrete curb and gutter will be required for all private roadway construction and parking lot construction with the following exceptions:

    a. Large lots of one acre or more for residential detached housing.

    b. Industrial storage yards not used for regular road vehicle parking.

    c. Bituminous curb may be substituted for concrete curb and gutter only under certain circumstances where allowed by the City of Farmington Department of Public Services (DPS).

    d. The use of Low Impact Design and/or Best Management practices as stated in Technical Section VI Stormwater Management (Page VI-3).

4. Underground storm sewers, including edge drains for parking lots and roads, shall be designed and installed with all paving improvements which required concrete curb and gutter or asphalt curb. Where pavements are to be constructed over clay soils, or other poorly drained soils, and a granular sub-base is used, an approved sub-drainage system shall be installed.

5. Plan and profile views shall be provided for all proposed paving improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically aligned. If possible, stormwater management improvements shall be shown on the same plan sheet as the paving improvements.

    a. The plans shall include typical cross section(s), showing dimensions, materials, type and thickness of the proposed paving improvements.

    b. The following information shall be shown in the plan view of the proposed paving improvements:

        i. Existing right-of-way or road easement, as well as the proposed right-of way or road easement. A minimum of a 12-foot wide easement for private

franchise utilities shall be provided adjacent to each side of the proposed right-of-way or road easement.

ii. Centerline alignment, including curve data, stationing, edge of pavement and/or curb. Centerline and stationing are not required for parking lots.

iii. Location of existing and proposed topographic features, including utilities.

iv. Location of existing and proposed traffic control devices.

v. Location of existing and proposed streetlight poles.

vi. Location of all proposed pedestrian facilities. Bike paths may be required by the City in lieu of sidewalks.

c. The following information shall be shown in the profile view of the proposed paving improvements. Profiles are not required for proposed parking lots.

i. Existing and proposed ground at the centerline (for rural roads) or top of curb (for urban roads).

ii. Percent of grade and vertical curve data.

B. Design Criteria

1. Cross Sections

a. Dimensional widths and thickness of materials and associated road features shall be designed in accordance with the typical road cross sections as prescribed by the City standards. For public roads, the cross section requirements will be based on the functional class of the road as designated by the City.

b. For parking lots and internal roads at non-residential sites, the cross section requirements will be based on the functional class of the public road serving the property. The minimum width for an internal drive shall be 12’ for single lane and 22’ for two-lanes per Ordinance Article 14 Section 35-173.

c. Driveways will be defined as the paved area adjacent to a public or internal road serving no more than one residence, commercial, or industrial establishment.

i. Single family residential driveways shall be designed according to the following criteria:

1. Concrete driveways shall be a minimum of 6” thick between the back of curb or edge of pavement and the right-of-way or easement line. Concrete driveways outside of the right-of-way or easement shall be a minimum of 4” thick. All sidewalks within four feet of the back of curb shall be 6” thick.

2. Bituminous pavement driveways shall be a minimum of 3" thick over an aggregate base course having a minimum thickness of 6".

3. Aggregate surface course driveways will only be permitted where the adjacent public or internal road does not have a paved surface. The aggregate surface course shall be a minimum of 4" thick outside of the right-of-way or easement.

ii. Driveways to serve multi-family residences, commercial, or industrial establishments shall be designed with the same cross section as the corresponding parking lot or internal road.

iii. Driveways within subdivisions must be paved if it is a platted subdivision or a site condominium. If it is a non-platted subdivision, the paving of the driveways will be determined by the City Planner on a case-by-case basis.

d. Pedestrian facilities, including accessible routes, as required by the American's with Disabilities Act (ADA), shall be designed in accordance with the requirements prescribed by the ADA, City, AASHTO, and the current MDOT R-28 series.

2. Horizontal Alignment

a. Horizontal alignment of pavement and associated road features shall be designed in accordance with the requirements prescribed by the City.

b. Internal roads shall be designed to accommodate the typical vehicles anticipated to use the site, including, but not necessarily being limited to, delivery vans and trucks, fire department traffic, trash collection vehicles and school buses.

c. Parking lots and off-street loading and unloading areas shall be designed in accordance with the requirements prescribed by City Ordinance and/or as determined by the City Engineer and Planner.

d. Driveways

i. Single family residential driveways shall be a minimum of 9' wide.

ii. Driveways to serve multi-family residences, commercial, or industrial establishments shall be a minimum of 24' wide. Vehicular turn movements shall be provided to ensure the proposed driveway width suits the type of vehicles accessing the site.

iii. Offset parking areas adjacent to driveways shall be configured with a 25' radius as shown in the standard details.

e. Pedestrian facilities shall generally be located inside the right-of-way. Facilities located outside public right-of-way shall be located within a dedicated easement. Pedestrian facilities will be located within the right-of-way with the permission of the City and/or RCOC. The horizontal alignment of pedestrian facilities shall be as close to parallel as practical to the right-of-way or easement.

i. Concrete sidewalk shall be a minimum of 5’ wide.

ii. Bituminous pavement bike paths shall be a minimum of 8’ wide.

iii. Surfaces other than concrete (standard trowel finish) for pedestrian facilities shall be reviewed and approved by the City Engineer. The property owner and/or developer shall sign an agreement with the City stating any improvements within the easement or Right-of-Way for road, utility, or maintenance purposes, will be replaced with standard 4” or 6” concrete.

iv. The City may change material, widths, alignments within Right-of-Way of pedestrian facilities as part of a City program at any time.

3. Vertical Alignment

   a. The vertical alignment of all public roads, internal roads, and parking lots shall be designed in accordance with the requirements prescribed by the City.

   b. The vertical alignment of driveways shall be designed in accordance with the requirements prescribed by the City.

   c. Pedestrian facilities shall be designed to meet the requirements of the American’s with Disabilities Act (ADA), as amended.

4. Materials

   a. Subgrade

      i. Subgrade material shall consist of loam, clay, sand, gravel, or other similar material.

      ii. The finished subgrade surface shall be free of all topsoil, stones, stumps, organic matter, muck, peat, and frost heave material.

      iii. Subgrade material shall be proof-rolled prior to acceptance and placement of the aggregate base course.

   b. Under-drainage

      i. Underdrain pipe shall be smooth plastic pipe or corrugated plastic tubing meeting the MDOT requirements.

      ii. Underdrain outlets shall be constructed of polyvinyl chloride (PVC) plastic pipe or corrugated steel pipe conforming to MDOT requirements.

      iii. Subbase materials shall conform to the requirements of MDOT Class II granular material compacted in place.

   c. Aggregate Base Course

i. Dense graded aggregate conforming to the requirements for MDOT Specifications 21A, 21AA, or 22A, compacted in place.

ii. The use of slag material will not be permitted.

iii. The use of stabilized base course will be permitted. The type, thickness, and mix must conform to the MDOT requirements and must be approved by the City Engineer.

iv. Bituminous pavement materials shall be accordance with the MDOT requirements as specified on the typical cross sections.

v. Concrete pavement materials shall be in accordance with the MDOT requirements as specified on the typical cross sections.

C. Construction Methods

1. Construction methods shall be in accordance with the plan details and the current MDOT Standard Specifications for Construction.

2. Pavement Cuts

   a. Where a trench must be cut through pavement, driveway, or sidewalk, particular care shall be taken to avoid unnecessary damage to adjoining areas of the pavement, driveway, or sidewalk.

   b. All cuts through existing surfaces shall be made full-depth with a concrete saw. Cuts in concrete pavement shall be made parallel with longitudinal and transverse construction or contraction joints.

   c. Saw cuts in concrete pavement shall not be nearer than 5’ to a transverse joint, to the centerline of pavement, or to the edge of the pavement or curb. No existing or replacement pavement shall be less than 5’ to a joint or centerline of pavement, or to edge of pavement, surfacing or curb; removal and replacement shall be extended to said joint, centerline, edge of pavement, surfacing, or curb. These same requirements shall apply to the saw cutting and replacement of concrete driveways.

   d. If a square or block of sidewalk is cut, broken, or cracked, the entire square or block shall be removed and replaced.

3. Pavement Replacement, Temporary

   a. All pavements removed in crossing and/or paralleling paved streets, alleys, drives, and parking areas shall be temporarily replaced immediately following the completion of backfill operations. Temporary pavements for streets and alleys shall conform to the City specifications for underground construction. Temporary pavement for driveways, including approaches and parking areas, shall consist of a minimum of 3” of compacted cold patch asphalt over a minimum of 7” of compacted MDOT 22A aggregate base. All temporary pavements, including those constructed for streets, alleys, driveways, and

parking areas, shall be maintained in good condition until the final pavement replacement is made.

4. Testing

    a. Density reports on private developments are required to be provided to the City Engineer for sub-base, base, and paving course construction.

5. Inspection

    a. The City Engineer shall be contacted prior to the preparation and placement of any of the following materials for roadways and pedestrian facilities:

        i. Sub-base and underdrain.

        ii. Aggregate base course.

        iii. Paving course.

        iv. Pedestrian facility/sidewalk forms and concrete pour.

VIII. GRADING AND EARTHWORK

A. General

1. All proposed developments should be graded such that stormwater runoff will be intercepted within the boundaries of the site and conducted through a storm sewer system to an approved point of discharge.

2. Easements for surface drainage shall be dedicated and recorded.

3. For perimeter lots, the drainage easement width shall be 20' minimum, and for abutting lots with a common rear yard lot line, the easement width shall be at least 10' on each lot.

4. The following information must be shown in the plan view of the proposed grading:

    a. Grading plans shall be drawn to a scale of 1"= 50' or larger.

    b. The grading plans shall show the existing elevation topography either by contour method or grade point grid method.

    c. High and low street grade points, slope direction (by arrow), and the location of all catch basins, inlets, and drainage ditches shall be shown on the grading plan.

    d. For subdivisions, a detail of the typical lot drainage pattern shall be shown on the grading plan with all grade control points identified. All grade point elevations shall be shown for each lot. These will include the finish floor (F.F.) or the foundation grade (F.G.) elevations, high point (grade break), drainage arrows, and additional spot elevations to clarify site grading.

5. Plot plans shall be provided in accordance with the requirements prescribed in Appendix A-2.

6. A preconstruction meeting must be held and all applicable requirements fulfilled prior to any grading, earthwork, clearing, or grubbing occurring on site unless specific approval is granted from the City Engineer. Earth change in excess of 1.0 acre require a soil erosion and sedimentation control permit.

B. Design Criteria

1. General

    a. Grading plans shall take into account the desirable natural features and the character of the land, which must be preserved where possible.

    b. No filling will be allowed in any areas of land which lie either wholly or partially within the flood plain of a river, stream, creek, or lake. Only a variance in the form of a permit from the Michigan Department of Environmental Quality (MDEQ) may override this restriction.

c. Filling and grading shall not create a barrier causing entrapment of water on the adjacent lands of others.

d. Retaining walls are discouraged. Any wall separating a grade differential exceeding 18-inches will require a special detail on the plan and will require the review of a structural engineer.

2. Drainage Pattern

a. Generally, all single-family lots shall be graded for front-to-rear drainage.

b. Rear-to-front drainage will be allowed by the City Engineer only where, due to existing topography, front-to-rear drainage would be very difficult to achieve and would not be feasible.

c. Other drainage patterns may be used. All non-conforming lots with drainage patterns other than those discussed above shall be noted in the grading plan. Each alternate drainage patterns will be reviewed on a case-by-case basis.

d. Large acreage parcels, outside of approved subdivisions/site condominiums, will be reviewed on an individual basis.

3. Slopes

a. All areas within 10' of buildings shall slope away from the building at a minimum slope of 5%. The minimum slope for any other part of the site shall be 1%.

b. A maximum slope of 4' horizontal to 1' vertical (4:1) shall not be exceeded for terracing. The toe (top) of the slope shall be located outside of the rear and/or side lot line drainage easements.

c. Swales

i. Each single-family lot shall be graded to drain away from the house to swales constructed along the lot lines.

ii. Swales shall discharge to a catch basin, roadway gutter, or other approved drainage course.

iii. The longitudinal slope along a rear or side yard drainage swale shall not be less than 1.5% or more than 6.0%.

iv. Plans may not include any structures, landscaping, or other permanent objects within swales.

v. Bio-swales or Vegetated Swales proposed to promote groundwater infiltration are acceptable, but must be designed in accordance with the current Low Impact Development Manual for Michigan (LID Manual for Michigan) and in conformance with the Oakland County Water Resources Commissioner's (WRC) Office.

d. Maximum distance from a high point to a drain outlet shall not exceed 250' or two lots, whichever is the lesser.

e. In general, for streets with ditches and no curbs, the elevation of the front lot line shall be at least 6" above the centerline of the road.

f. Driveway slope gradients shall not exceed 8%.

g. Longitudinal sidewalk slopes shall not exceed 5%. All pedestrian facilities shall meet the requirements of ADA.

C. Materials

1. Materials used in earth excavations and/or embankment construction shall be in accordance with the plans and the current MDOT Standard Specifications for Construction.

2. Material placed in future building sites, roadways, or other areas that may support structures shall be free of trees, stumps, topsoil, or any other surplus or unsuitable materials.

D. Construction Methods

1. Methods of Excavation in Earth

   a. All excavation shall be by open cut from the surface, except in special cases where boring/jacking under pavement or structures may be required, or where boring/jacking under the root system will be required for tree root protection. All excavation shall be made in such a manner and dimensions as well give ample room for:

      i. Building the structures.

      ii. Bracing, sheeting and supporting the sides of the excavation.

      iii. Pumping and drainage of groundwater and sewage which may be encountered.

      iv. Removal of all materials excavated. Special care shall be taken so that the soil below the bottom of structures to be built shall be left undisturbed to provide a firm bed will be provided for construction. Any voids shall be backfilled with suitable granular material and shall be properly compacted.

2. Trench Excavation

   a. General

      i. Excavation shall be of sufficient width and depth to provide adequate room for construction and installation of the work to the lines, grades and dimensions called for on the plans. The width of the trench from the invert to a height of

12” above the top of the pipe barrel shall be as indicated on the City of Farmington Standard Details included in the Digital Appendix.

ii. If the maximum trench width as specified above is exceeded, unless otherwise shown on the drawings, concrete cradling, or other bedding as is approved by the City Engineer shall be installed to support the added load of the backfill.

iii. Where trench excavation is in granular material, the last 6” of trench depth shall be carefully excavated and trimmed by hand to the exact elevation and contour of pipe. Where trench excavation is in rock or clay soil, the trench bottom shall be undercut a minimum of 4” below the final bedding material elevation of pipe. The bedding material as hereinafter specified shall be placed and compacted to the underside of the pipe.

iv. Excavation for structures shall be made to the outside lines and surfaces of such structures wherever it is practical to build directly against the sides and bottoms of excavations. In such cases, care shall be taken not to disturb the original foundation or backing. Final trimming shall be done by hand just before the construction of the structure. If excess excavation is made, or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be refilled with bedding, as specified hereinafter, and solidly machine tamped into place to 95% of maximum unit weight before the construction work proceeds.

v. Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for form construction and other construction methods to be followed, wherever necessary.

b. Bedding

i. Where the subgrade below the bottom of the pipe is disturbed during the construction, the space shall be refilled with sand or pea gravel bedding material solidly tamped to form a firm foundation for the pipe. Sand or pea gravel bedding material shall be extended to 1’ above the pipe, except that the bedding shall be exclusively pea gravel to the springline for pipe 36” and greater in diameter.

c. Amount of Trench Opening

i. Not more than 50’ of trench shall be open at one time in advance of the pipe unless permitted by the City Engineer. The length of street that may be occupied by the construction work at any one time shall be subject to the direction of the City Engineer and will be based on requirements of the use of the street by the public. No more than 600’ of street length shall be occupied at one time, and vehicle traffic through the street shall not be entirely stopped without permission of the City Engineer.

ii. After placement of the utility line, the trench shall be promptly backfilled in order to minimize the length of open trench and to avoid any unsafe conditions.

3. Stone Refill

    a. In locations where soil at the bottom of the trench is unstable, the trench shall be excavated (undercut) below the trench bottom and refilled with MDOT 6A crushed aggregate.

4. Excavation and Trench Dewatering

    a. Any excavation or trench shall be maintained free of water during construction of any structures and/or pipelines.

    b. Adequate precautions shall be taken to control the discharge of dewatering pumps so as to prevent soil erosion or sedimentation of drainage ditches, structures, storm sewers, culverts, natural drainage courses, ponds, lakes, or wetlands. If groundwater is discharged to a County Drain or City storm sewer, a permit may be required by the Oakland County Water Resources Commissioner's Office and/or the City, respectively.

    c. Discharge from any dewatering operations shall have a suitable outlet and shall cause no damage to adjacent dwellings or property. Water and discharge hoses shall be placed and/or controlled so as to prevent a hazard to pedestrians or motor vehicles passing in the vicinity of the construction site.

    d. Electric pumps shall have suitable power supply appurtenances meeting NEC requirements and shall be properly fused and grounded to prevent electrical shock hazards to on-site personnel.

    e. Internal combustion engine driven pumps, if operated 24 hours per day, shall have adequate exhaust silencers in good repair to muffle engine noise to an acceptable level for the area where located.

5. Diverting Existing Sewers

    a. Where existing sewers or drains are encountered during construction operations, adequate provision shall be made for diverting flow in the existing sewers so that the excavation will be kept dry during the progress of the construction work. Upon completion of the construction work, the existing sewers shall be restored or otherwise provided with an adequate outlet as approved or directed by the City Engineer.

6. Sheeting, Bracing and Shoring

    a. Sheeting, bracing and shoring shall be provided where required to properly support the surfaces of excavations and protect the construction work, adjacent work, and workers. In removing the sheeting and bracing after the construction has been completed, special care shall be taken to prevent any caving of the sides of the excavation and injury to the completed work or the adjacent property.

7. Crossing Existing Structures/Pipes

    a. During construction, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits, and other underground structures. Every effort shall be made to prevent damage to such structures. Wherever such structures are disturbed or broken, they shall be restored to good condition. Specified granular backfill shall be placed as described in Item 9, Backfilling. MDOT Grade 30S concrete can be utilized where approved by the City Engineer. Either granular backfill or concrete shall be brought to the spring line of the higher utility.

8. Tunneling Trees

    a. Trees 8" in diameter or less will require a minimum tunnel length of 8'. Trees over 8" in diameter, measured 4' above the ground surface, will require a minimum tunnel length equal to one foot for each inch of tree diameter.

    b. Trees shall be tunneled whenever any portion of an excavation approaches within a distance equal to one-half the required tunnel length except as otherwise noted on the plans.

    c. Tunneling under trees may be accomplished by one of the following methods:

        i. Boring and jacking casing pipe along with placement of a carrier pipe.

        ii. Boring and jacking sewer pipe or water main without a casing pipe.

        iii. Jacking sewer pipe or water main without boring and without a casing pipe.

9. Backfilling

    a. General

        i. Backfilling shall include all work required as hereinafter specified. The placement of various pipe, including bedding and building of structures, shall be completed prior to backfilling.

        ii. Trenches and/or other excavations shall be backfilled with suitable excavated material (not including gray or blue clay) replaced into the trench or excavation and compacted to not less than 95% of maximum unit weight as determined at existing moisture content during backfilling. Compaction shall be provided by means of suitable mechanical compaction equipment.

        iii. If the moisture content of cohesive backfill material exceeds the optimum moisture content for maximum density by more than 3%, the material shall be dried to meet the foregoing moisture content limitation or MDOT Class II Granular Material shall be provided. No sloppy or wet backfill will be allowed.

        iv. Maximum unit weight will be determined by current methods of Test for Compaction and Density of Soil, AASHTO Designation T-180 or by the Cone Density Method developed by MDOT, as the material may require.

v. Compaction tests shall be conducted at all locations requiring granular backfill. Such tests shall be the responsibility of the applicant.

vi. Any depression resulting from settlement of any backfill shall be brought to the proper grade and surface and made to match the adjacent surface.

b. Compaction

i. Backfill material shall be placed in layers not to exceed 12" in thickness unless approved by the City Engineer.

ii. Specified compaction shall be obtained with the use of a bulldozer, sheepsfoot roller, mechanical tamper, or other similar and effective equipment. Specified compaction means not less than 95% (not average 95%) of maximum unit weight when tested in accordance with current MDOT specifications.

iii. If excavated material is not suitable to obtain 95% minimum compaction, unsuitable materials shall be removed, granular materials shall be added, or both, to obtain 95% minimum compaction as specified.

c. Backfilling Trenches

i. Bedding

1. The type of bedding required is shown on the detail drawings.

2. Bedding shall be worked under the haunches of the pipe to provide firm continuous support.

3. Bedding placed on the sides of and above the pipe shall be compacted by machine tamping to not less than 95% of maximum unit weight in layers not exceeding 12" in depth.

ii. Trench or Excavated Area

1. All trenches in paved streets, shoulders, traveled roadways, parking areas and driveways shall be backfilled with suitable excavated backfill or granular backfill, as shown on the drawings, from 1' above the top of pipe up to the required subgrade elevation which will allow for placement of the required gravel base and/or pavement surface. The approved excavated backfill or granular backfill shall be placed and thoroughly and uniformly compacted by machine tamping to the specified compaction. With the approval of the City Engineer, water jetting may be accepted, in lieu of tamping, for granular backfill only.

2. Specified compaction shall be required of the entire trench when the edge of trench is within 3' of edge of pavement. On road crossings, specified compaction shall extend 10' beyond the edge of pavement for

paved roadways with gravel shoulders or shall extend 3' beyond the back of curb for roadways with curb.

3. Trenches under concrete sidewalks and bike paths shall be backfilled from 1' above top of pipe to a level of 4" below finished grade of sidewalk with approved suitable excavated backfill or granular backfill and compacted 95% maximum density.

4. Trenches not in paved streets, shoulders, traveled roadways, parking areas, driveways, or under sidewalks, shall be backfilled from 1' above the top of the pipe to the ground surface with suitable, excavated backfill and shall require compaction equal to adjacent undisturbed earth.

5. Wherever gas mains, water mains, sewers, or other utilities are located in the trench area, granular backfill shall be used for backfill from the bottom of the trench up to the spring line of the pipes. Granular backfill shall be placed across the full trench width and extend far enough to either side of the existing pipe to allow for the specified compaction so as to thoroughly support the pipe within the trench area.

d. Backfilling Around Structures

   i. As soon as practical after concrete structures have set, forms and debris shall be removed and the surface of the concrete pointed. After the structure has been inspected and approved, the excavated area around the structure shall be backfilled up to specified subgrade with granular material or suitable excavated material as called for on the drawings for the adjacent trench. The fill shall be thoroughly compacted by machine tamping. No large boulders or masonry shall be placed in the backfill. No backfill will be placed against manhole walls within 48 hours after the plaster coat has been applied to the outside of the walls nor shall backfill be placed about concrete structures until concrete has attained at least 75% of its design strength and approval from the City has been obtained.

10. Disposal of Excavated Material

a. After all suitable excavated material has been used on site, all excess material shall be removed and disposed of property.

b. All other excavated materials that are unsuitable for use as fill or backfill shall be disposed of properly. Unsuitable materials may include, but are not limited to, broken concrete, asphalt, rock, stone, and other related debris. The applicant shall be required to obtain proper disposal areas and permits.

c. Any agreements that the applicant makes with local residents, concerning the placement of fill on private property shall be the sole responsibility of the applicant. Copies of such agreements shall be provided to the City.

d. Placement of fill on private property may require that the property owner and/or the applicant obtain a grading permit or fill permit for the City.

11. Contractor Safety Requirements

a. All construction operations shall be performed in accordance with OSHA and MiOSHA requirements.

b. The excavation and trenching operations shall be conducted in a manner that will provide safe working conditions for all persons on the site who may be affected by the construction operations. All construction operations shall be conducted in a manner that will protect adjacent property from damage.

c. Trench sides shall be either cut back to the slope as required by soil and groundwater conditions which will provide stable sides, or supporting systems shall be installed that are capable of restraining the earth sides from movement. Design and installation of trench supporting systems shall be the responsibility of the applicant.

d. A qualified person who will be responsible for the safety of both the work and workmen, and who will make all the decisions relevant to the stability of trenches, the adequacy of any and all protective devices, proper operation of equipment, and all other matters related to safety, shall be employed at all times at the site of the work.

e. Excavated material, heavy equipment, backfill materials, sewer pipe, or other construction materials shall not be stored along or adjacent to the trench where they may impose too great a load on the earth and cause displacement or caving of the earth. A safe means of emergency exit shall be provided at all times from all trench excavations.

IX. SOIL EROSION AND SEDIMENTATION CONTROL

A. General

1. Soil erosion and sedimentation control measures shall be incorporated into the design and construction of all projects as specified by the Oakland County WRC Standards and/or the MDEQ. All projects shall be designed and constructed so as to minimize soil erosion and sedimentation impacts to the environment.

2. A permit must be obtained from either the WRC and/or the MDEQ.

3. All proposed temporary and permanent soil erosion and sedimentation control measures shall be shown on the plans. All soil erosion control measures shall be identified in accordance with the Michigan Unified Keying System.

4. Cleaning and maintenance schedule(s), listing annual budget and frequency of maintenance operations, shall be indicated on the plans.

B. Design Criteria

1. Temporary and permanent soil erosion and sedimentation control measures shall be designed in accordance with the requirements of the WRC and/or the MDEQ. At a minimum, the following shall be provided for all projects:

    a. Silt fence.

    b. Inlet filters.

    c. Gravel tracking mats at any point of ingress or egress to a construction site to a length not less than 50 feet and where possible to a length of 100 feet.

C. Materials

1. Temporary soil erosion and sedimentation control measures shall be fabricated of the materials specified in the latest edition of the Best Management Practice (BMP) guidelines published by the MDEQ and/or the WRC requirements.

2. Permanent soil erosion and sedimentation control measures shall be in accordance with the material requirements specified in other sections of above-mention standards.

3. The use of straw bales may only be permitted with written approval from the City and the WRC and otherwise will not be permitted in the City of Farmington.

D. Construction Methods

1. Soil erosion and sedimentation control measures shall be the first activity on site.

2. Temporary soil erosion and sedimentation control measures shall be installed and maintained as outlined in the latest edition of the BMP guidelines published by the MDEQ.

3. Permanent soil erosion and sedimentation control measures shall be constructed and maintained in accordance with the cleaning and maintenance schedule shown on the approved soil erosion and sedimentation control plan and as described in the required permit.

4. All lots within approved residential subdivision/site condominiums shall have the disturbed ground stabilized with sod, seed, or other acceptable permanent soil erosion control measures prior to the issuance of the final certificated of occupancy. Inclement weather exceptions will be made from November 15th through June 15th as determined by the WRC.

Appendix A

Review Checklists

Preliminary Site Plan Checklist
Plot Plan Checklist
Detailed Engineering Plan Checklist
SESC Plan Checklist
Record Plan Checklist
Structure Review Guidelines

CITY OF FARMINGTON
Checklist for Preliminary Site Plans

Note to Design Engineers:

The following checklist is intended to serve as a guide for designers to review prior to submitting plans to the City for review. While this checklist covers all major areas that will be reviewed by the City Engineer, this list is not all-inclusive and the City Engineer may comment on items not listed herein.

Topography

- ☐ A complete topographical survey is required for all proposed projects. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements shall also be shown on the plan view of the existing conditions.
- ☐ A minimum of two (2) benchmarks are required. All benchmarks shall be clearly indicated on the plans. All benchmark elevations shall be to North American Vertical Datum 1988 (NAVD '88).
- ☐ Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. On site, intermittent elevations and/or defined contours (minimum contour interval of 2 feet) are required to establish the existing site drainage.
- ☐ Existing features shall be located and shown within 100 feet of the project. Existing features to be shown shall include, but may not necessarily be limited to the following items:
  - ☐ Ditches.
  - ☐ Culverts.
  - ☐ Water supply system, stormwater management, and/or sanitary sewer facilities, including inverts and casting elevations at all structures.
  - ☐ Gas, telephone, electric, and cable television lines, including manholes and/or utility poles.
  - ☐ Pedestrian facilities.
  - ☐ Trees and other landmark vegetation.
  - ☐ All streams, lakes, and/or county drains with names shown.
  - ☐ Existing buildings and permanent structures.
- ☐ Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:
  - ☐ Right-of-way or easement line.
  - ☐ Ditch centerline.
  - ☐ Top of bank.
  - ☐ Edge of shoulder.

- ☐ Edge of pavement or top of curb.
- ☐ Crown or centerline.

Water Supply System

- ☐ Water infrastructure improvements specified in the City of Farmington Water Reliability Study (2014) may be required as part of the project. The applicant shall contact the City Engineer to determine if any improvements called for in the City Water Reliability Study will be necessary.
- ☐ The minimum size water main allowed for use in the distribution system shall be 8" diameter. Water mains shall be looped. Where dead ends are unavoidable, the following must be met: all mains must end with a gate valve followed by a hydrant. Maximum allowable dead-end main lengths are:
  - ☐ 40' for 6" diameter fire hydrant service pipe. If hydrant leads exceed 40', 8" diameter water main shall be used and reduced to 6" prior to attaching the hydrant.
  - ☐ 600' for 8" diameter water distribution mains (residential areas only).
- ☐ Show water service and size; no private services allowed from 6" hydrant lead or water mains larger than 16" or larger diameter.
- ☐ Where required, a minimum 15-foot wide easement must be shown on the plans. Where the water main is adjacent to and parallel to the right-of-way, a water main easement must be extended across the entire frontage of the property.
- ☐ A 10-foot horizontal separation must be maintained between the water main and the sanitary/storm sewers.
- ☐ Valve spacing:
  - ☐ Three (3) valves can be closed to isolate any section of water main, four (4) maximum.
  - ☐ No more than 800 feet of main out of service for 8" water mains, not more than ¼ mile of water main out of service for mains 12" and larger.
  - ☐ No more than two (2) hydrants out of service.
  - ☐ No more than 24 single-family units or 30 multiple-family units out of service.
- ☐ For major commercial and industrial developments, building services must be maintained from a looped system with valves located on either side of the building service.
- ☐ Fire hydrants shall be located to provide 250-foot radial coverage of all existing and proposed permanent structures.
- ☐ No parking within fifteen (15) feet of a hydrant.

Sanitary Sewer

- ☐ Sanitary sewer infrastructure improvements specified in the City of Farmington SRF Project Plan may be required as part of the project. The applicant shall contact the City Engineer to determine if any improvements called for in the City SRF Project Plan will be necessary.

- ☐ Preliminary design calculations shall be provided on the plans.
- ☐ Where required, a minimum 25-foot wide easement must be shown on the plans. For sanitary sewers proposed to be more than ten (10) feet deep, the minimum easement width shall be two times (2x) the proposed depth.
- ☐ Show building lead size and location as well as other proposed sewers.

Stormwater Management Systems

- ☐ Preliminary design calculations prepared in accordance with the standards and engineering practices of the Oakland County Water Resources Commissioner's Office (WRC) shall be provided on the plans.
- ☐ Restricted discharge rates and/or improvements to downstream drainage courses may be required as determined by the City. The applicant shall contact the City Engineer to determine what design criteria will apply to the proposed project.
- ☐ Proposed collection points, system layout, sizes, and outlets must be shown on the site plan. Preliminary invert elevations and top of casting elevations must also be shown.
- ☐ Where required, a minimum 12-foot wide easement must be shown on the plans. For storm sewers proposed to be more than 6 feet deep, the minimum easement width shall be two times the proposed depth.
- ☐ Alternative means of providing detention are discouraged, but will be considered on a "case- by-case" basis:
  - ☐ Oversized storm pipes.
  - ☐ Parking lot storage. When approved, the maximum depth of water stored in parking areas shall be 4".

Paving Improvements

- ☐ All roads must conform to these standards as specified herein.
- ☐ On-site Paving Requirements:
  - ☐ Pavement cross-section must be shown in accordance with City requirements.
  - ☐ Bituminous pavements shall have a minimum slope of 1.0% and a maximum slope of 6.0%.
  - ☐ Concrete pavements shall have a minimum slope of 0.5% and a maximum slope of 6.0%.
- ☐ Minimum drive widths and parking lot dimensions per City Standard Details.
- ☐ Sidewalks are required along the frontage of all existing and proposed roads. The following requirements shall be met for proposed sidewalks:
  - ☐ Sidewalks shall be located one (1) foot inside the ultimate right-of-way (ROW) line.
  - ☐ Barrier free ramps shall be noted.
  - ☐ All structures, hydrants, poles, etc., noted and moved or adjusted as necessary.
  - ☐ Bike paths may be required in lieu of sidewalks along the frontage of major roads.

Site Grading and Earthwork

- ☐ Sufficient proposed grades indicated to ensure that:
  - ☐ Drainage is adequately discharged offsite with proper detention.
  - ☐ No upstream drainage is restricted.
  - ☐ The site, in general, drains without standing water.
  - ☐ Elevation representing the finished grade (F.G.) and the first floor (F.F.) grade must be indicated. Each elevation shall be clearly labeled as either finished grade (F.G.) or first floor (F.F.) grade.
- ☐ Proposed grading shall meet abutting property line elevations. A maximum slope of 1 vertical to 4 horizontal (1:4) may be employed to meet existing grades at property lines.
- ☐ Easement(s) from adjacent property owner(s) will be required for any grading necessary on offsite property. All offsite easements required to complete the work shall be obtained prior to the start of construction.

CITY OF FARMINGTON
Checklist for Plot Plans

Note to Design Engineers:

The following checklist is intended to serve as a guide for designers to review prior to submitting plans to the City for review. While this checklist covers all major areas that will be reviewed by the City Engineer, this list is not all-inclusive and the City Engineer may comment on items not listed herein.

- ☐ The owner's name, address, and telephone number.
- ☐ The name, address, telephone, and fax numbers for the engineer/surveyor.
- ☐ The engineer/surveyor's signature and seal.
- ☐ A minimum of one (1) benchmark shall be provided on the plans. It is encouraged that the benchmark(s) be based upon NAVD '88, but not required. Assumed benchmarks are acceptable.
- ☐ The following dimensions must be shown on the plot plan:
  - ☐ Property lines (all sides) including the bearing.
  - ☐ All sides of the building footprint (including decks).
  - ☐ Driveways and sidewalks (label the material used for construction – i.e. concrete, asphalt, gravel). Driveway material shall match the existing road material (a gravel road shall have a gravel or asphalt drive, an asphalt road shall have an asphalt drive, a concrete road shall have a concrete or asphalt drive, etc.) in the ROW.
  - ☐ Water, sanitary, and storm service leads (sump pump discharges) including proposed material and size. Dimension the leads from the building corners; dimension the water shut-off valve from the building corners. Leads shall be proposed perpendicular to the existing main. Lead orientation shall be such as to minimize the amount of lead under public road pavement.
  - ☐ Any utility facilities on site (utility poles, catch basins, manholes, etc.) shall be dimensioned to property lines.
- ☐ The following elevations, referenced to the benchmark(s) provided, must be provided on the plot plans:
  - ☐ First floor (basement elevation where a basement is shown); garage floor, porch, and/or deck.
  - ☐ Lot corners and grade change points.
  - ☐ Ground elevation at the building corners.

- ☐ Groundwater elevation within proposed building envelope.
- ☐ Centerline of the driveways at no more than 25-foot intervals; culvert crossings; edge of road.
- ☐ Centerlines of swales and drainage ditches (at no more than 25' intervals) with the high points noted.
- ☐ Inverts of drainage culvert ends; sanitary sewer lead at the property line. Rims of manholes, catch basins, as well as gate wells/boxes, hydrants, and other utility structures (proposed and existing).
- ☐ Established street grades.
- ☐ Sidewalk grades at no more than 25' intervals.
- ☐ The proposed finished earth grades of the house and the finished earth grades of houses on adjacent lots must be shown. The grade shall decrease 0.5 feet in the first 10 feet (5%) from the dwelling per building requirements.
- ☐ All grades are to be in accordance with any subdivision or site condominium plans that have been previously approved for the property. If none are available, the preliminary plot plan will be reviewed using the existing and proposed elevations provided on the plot plan.

☐ Show and label undisturbed wooded areas, wetlands, flood plains, etc.

☐ Note any variances obtained for site with respect to standard setbacks, etc.

☐ Show all existing significant natural features, including, but not necessarily limited to, trees (in excess of 6" caliber) and wetlands, as well as existing utilities.

☐ Runoff shall not be shed onto neighboring parcels. Downspouts and sump pump discharges shall be directed away from neighboring parcels.

☐ Grading shall be such that stormwater runoff is not held in low areas leading to potential health hazards.

☐ If the site is utilizing a septic field, the grading shall be such that runoff is directed away from the septic tank and field.

☐ Rear yard and side yard drainage swales shall be clearly indicated with grades shown at sufficient locations to provide for positive drainage away from the building and other structures. Channelization of drainage to an approved outlet shall also be shown. Direction arrows shall be provided showing proposed and existing drainage directions.

☐ If construction is within 500 feet of a lake or stream, a SESC permit is required. In addition, if the disturbed area is to exceed one (1) acre, a SESC permit is required.

CITY OF FARMINGTON
Checklist for Detailed Engineering Plans

Note to Design Engineers:

The following checklist is intended to serve as a guide for designers to review prior to submitting plans to the City for review. While this checklist covers all major areas that will be reviewed by the City's Engineer, this list is not all-inclusive and the City Engineer may comment on items not listed herein.

General Requirements

- ☐ Submittal shall be on 24" x 36" white paper having blue or black lines with a minimum horizontal scale of 1" = 50' and vertical scale of 1" = 5'. Other acceptable scales are 1" - 20'; 1" = 30' and 1" = 40'.
- ☐ A general plan at a scale 1" = 100' or 1" = 200' shall be provided when the size of site prohibits a single plan sheet. Show street names, units, utilities, pavement, site dimensions, phase lines, lot lines, and lot numbers.
- ☐ A location map showing section number(s) and major thoroughfares in the project area shall be provided on the cover sheet of the plans.
- ☐ Lot number, parcel dimensions, and adjoining right-of-ways (ROW) shall be shown.
- ☐ City Standard Notes and Details must be attached to the plans. The Standard Notes and Details are included in the Digital Appendix.
- ☐ The plans must be signed and sealed by a professional engineer registered in the State of Michigan. All correspondence concerning the design of the site will be directed to the engineer whose seal appears on the plan.
- ☐ The name, address, and phone number of both the applicant and the design engineer must be shown on the plans.
- ☐ A legal description of property must be provided on the plans.
- ☐ Both existing and proposed utilities must be a minimum of 10' from existing or proposed buildings.
- ☐ A north arrow, scale, and MISS DIG notice must be shown on the plans.
- ☐ The storm sewer, sanitary sewer, and water main shall be shown on the same plan view. The landscaping plan shall be overlaid in light scale in for reference; plantings must not interfere with utilities.
- ☐ When more than three (3) plan sheets are in a set, a cover sheet with an index shall be provided and each plan sheet shall include a title block providing a summary of the information presented on that particular sheet.
- ☐ Adequate space must be provided to allow for turning movements of vehicles, including trucks and fire engines per AASHTO guidelines.

Topography

- ☐ A complete topographical survey is required for all proposed projects. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements shall also be shown on the plan view of the existing conditions.
- ☐ A minimum of two (2) benchmarks are required. All benchmark elevations shall be referenced to North American Vertical Datum of 1988 (NAVD '88). All benchmarks shall be clearly indicated on the plans.
- ☐ Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines.

Onsite, intermittent elevations, and/or defined contours (minimum contour interval of two (2) feet) are required to establish the existing site drainage.

- ☐ Existing features shall be located and shown within 100 feet of the project. Existing features to be shown shall include, but may not necessarily be limited to, the following items:
  - ☐ Ditches.
  - ☐ Culverts.
  - ☐ Water supply system, stormwater management, and/or sanitary sewer facilities, including inverts and casting elevations at all structures.
  - ☐ Gas, telephone, electric, and cable television lines, including manholes and/or utility poles.
  - ☐ Pedestrian facilities.
  - ☐ Trees and other landmark vegetation.
  - ☐ All streams, lakes, and/or county drains with names shown.
  - ☐ Existing buildings and permanent structures.

- ☐ Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:
  - ☐ Right-of-way or easement line.
  - ☐ Ditch centerline.
  - ☐ Top of bank.
  - ☐ Edge of shoulder.
  - ☐ Edge of pavement or top of curb.
  - ☐ Crown or centerline.

Water Supply System

- ☐ Water distribution system improvements shall be designed in accordance with the requirements of the Michigan Safe Drinking Water Act, Act 399 of the Public Acts of 1976, as amended; as well as the latest revisions of the standards prescribed by the American Water Works Association (AWWA), the Great Lakes Water Authority (GLWA), and as specified herein.
- ☐ Water infrastructure improvements specified in the City of Farmington Water Reliability Study may be required as part of the project. The applicant shall contact the City Engineer to determine if any improvements called for in the City of Farmington Water Reliability Study will be necessary.
- ☐ Plan and profile views shall be provided for all proposed water main, including all fire hydrant leads. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  - ☐ A water main quantity list shall be provided on the cover sheet of the detailed engineering plans. The quantity list shall be delineated by existing or proposed road right-of-way or easement.
  - ☐ The following information must be shown in the plan view of the proposed water supply system improvements:
    - ☐ Type, class, and size of pipe.

- ☐ Length between fittings and/or appurtenances.
- ☐ Water service locations and sizes.
- ☐ Where required, a dedicated water main easement must be shown on the plans. The easement width shall be the greater of the following: Twice the depth of bury plus the pipe diameter plus 2 feet (rounded to the next largest full foot), or 15 feet, whichever is greater. Where water main is adjacent to and parallel to the right-of-way, a water main easement must be extended across the entire frontage of the property.

☐ The following information must be shown in the profile view of the proposed water supply system improvements:

- ☐ Type, class, and size of pipe.
- ☐ Length between fittings and/or appurtenances.
- ☐ Top of casting elevation on valve wells and/or boxes, as well as the finished grade for fire hydrants.
- ☐ Crossing of all existing and proposed utilities, including leads.
- ☐ Granular backfill, trench details, special bedding, bores, and/or other special construction methods.
- ☐ Existing and proposed ground elevations.

☐ Where public water main construction is proposed, the City Standard Water Main Detail Sheets must accompany the plans. The Standard Details are included in the Digital Appendix.

☐ Water Main

☐ The minimum size water main allowed for use in the distribution system shall be 8” diameter. Other allowable sizes for use in the distribution system are 12” and 16”. A 12” water main may be considered as minimum for internal transmission on industrial sites, major streets, collector streets, and elsewhere as design dictates. Water mains larger than 16” in diameter are considered transmission mains.

☐ Water supply systems shall be designed to provide service from a double source of supply (“looped main”) or to provide service by a double source of supply in the future when adjacent properties are developed with the approval of the City Engineer.

☐ Terminal dead end water mains with domestic service connections are discouraged, and will not be permitted without the written approval of the City Engineer. Where terminal dead end water mains are permitted, a gate valve and fire hydrant shall be provided at the terminus of the main. The following are the maximum allowable lengths for terminal dead end water mains:

- ☐ 40 feet for 6” fire hydrant lead.
- ☐ 600 feet for 8” water distribution mains (residential areas only).
- ☐ 1,000 feet for 12” and larger water distribution mains.

☐ Water main shall be designed and constructed with a minimum 5½’ depth of cover over the top

of pipe as measured from the proposed final grade. A minimum 18" vertical clearance shall be maintained between water mains and other underground utilities. Where the vertical alignment of the water main must be deflected in order to achieve the required vertical clearance, the length of the deeper main shall be kept to a minimum and standard 45^0 bends shall be used to affect the necessary deflection.

- ☐ A minimum of ten (10) feet horizontal separation shall be maintained between water main and sanitary sewers and/or storm sewers. A minimum of 5 feet horizontal separation shall be provided between water mains and other underground utilities and/or structures.

☐ Valves

- ☐ Water supply system improvements shall be designed to include adequate valves to properly isolate sections of water main without adversely impacting significant portions of the system. Valves on water mains 16" and smaller shall be gate valves and valves on water mains larger than 16" shall be butterfly valves.
- ☐ The connection of proposed water mains to existing water mains shall be accomplished by means of a tapping sleeve and valve unless the connection can be made without interrupting service on the existing water main or if the existing water main is 16" diameter or larger.
- ☐ Valves shall be located so that:
  - ☐ Three (3) valves can be closed to isolate any section of water main, four (4) maximum.
  - ☐ No more than 800 feet of water main out of service for 8" water mains; not more than ¼ mile of water main out of service for mains 12" and larger.
  - ☐ No more than two (2) fire hydrants out of service.
  - ☐ No more than 24 single-family units or 30 multiple-family units out of service.
- ☐ Valves shall generally be located such that they will not be in street pavements, sidewalks, or driveways.
- ☐ All valves shall be installed in a three-piece, adjustable valve box with the following exceptions: Valves will be installed in gate wells where the valve will be located within existing or proposed pavement, or the valve is located on a water main larger than 16" in diameter, or the valve is part of a tapping valve connecting to a concrete water main requiring the use of a saddle sleeve.

☐ Fire Hydrants

- ☐ Generally, fire hydrants shall be spaced such that not more than 250' of fire hose would be required to reach the farthest corner of any proposed building. The spacing of hydrants around multiple, commercial or manufacturing establishments shall be considered on an individual basis and shall be determined by consultation with the City Engineer and the City Fire Marshal.

☐ Domestic Service Connections

- ☐ No service connections shall be permitted from 6" fire hydrant leads or transmission mains.

Sanitary Sewer

☐ Sanitary sewer infrastructure improvements specified by the City of Farmington shall be designed in

accordance with the requirements of Part 41 of Act 451 of the Public Acts of 1994, as amended; the most recent revision of the Recommended Standards for Sewage Works by the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (commonly known as the "Ten States Standards"); and as prescribed herein.

- ☐ Public sanitary sewers shall be provided where multiple lots or parcels will be served either presently or in the future. Public sanitary sewer system extensions will require the review and approval of the City Engineer, the City and the MDEQ. Public sanitary sewers are required when two or more connections are made to the same sewer. In most instances, including multiple unit developments, the sewer may have to be public even though the project has one owner. City approval will be required for private services serving more than one building. The extension of the sanitary sewers will generally be required across the entire frontage of the site.
- ☐ Sanitary sewer improvements specified in the City of Farmington SRF Project Plan may be required as part of the project. The applicant shall contact the City Engineer to determine if any improvements called for in the City SRF Project Plan will be necessary.
- ☐ Plan and profile views shall be provided for all proposed sanitary sewer system improvements, including force mains. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  - ☐ Sanitary sewer design flow computations, sanitary sewer district map and sanitary sewer quantity list shall be provided on the cover sheet of the detailed engineering plans. The design flow computations and sanitary sewer district map shall include both current and future service populations and areas. The quantity list shall be delineated by existing or proposed road right-of-way or easement.
  - ☐ The following information must be shown in the plan view of the proposed sanitary sewer system improvements:
    - ☐ Size, material, and type of pipe.
    - ☐ Length between structures.
    - ☐ Slope of sewer between structures.
    - ☐ Where required, a dedicated sanitary sewer easement must be shown on the plans. The sanitary sewer easement width shall be either twice the depth of the pipe plus the diameter of the pipe plus 2 feet (rounded up to the nearest whole foot), or 25', whichever is greater.
    - ☐ Top of casting and invert elevations at each structure.
    - ☐ Progressive numbering system on structures.
  - ☐ The following information must be shown in the profile view of the proposed sanitary sewer system improvements:
    - ☐ Existing and proposed ground elevations.
    - ☐ Length, type, class, size, and slope of pipe between structures.
    - ☐ Top of casting and all sewer inverts at all structures.
    - ☐ All utility crossings.
    - ☐ Special backfill areas, (i.e. sand).
    - ☐ Provisions for infiltration testing.

- ☐ Progressive numbering system on structures.
- ☐ Adjacent existing or proposed utilities plotted where parallel.

☐ Where public sewer construction is proposed, the City Standard Sanitary Sewer Detail Sheets must accompany the plans. The Standard Details are included in the Digital Appendix.

☐ Capacity Design

☐ Sewer design flow computations shall be submitted to the City Engineer for approval with a map delineating the area to be serviced. Major roads and natural features (rivers, lakes, streams) shall be included on the map. Present and future development phases with acreages and contributing offsite areas shall be shown with the number of lots included.

☐ For design purposes, population in the tributary area shall be based on a minimum of 3½ persons per single family residence, also referred to as a residential equivalent unit (REU). The basis of design calculations shall include a tabulation of the usage types and the conversion of the various uses into REUs. The adopted unit factors as included in the City of Farmington Code of Ordinances shall be used to convert different usage types to REUs.

☐ Sanitary sewers shall be designed on the basis of an average daily flow of 100 gallons per capita per day. The sanitary sewer capacity shall be designed on a peak design flow using the peaking factor as prescribed by the Ten States Standards.

☐ All sanitary sewers shall be designed to provide mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The maximum design velocity for sanitary sewers shall be 10.0 feet per second with the pipe flowing full.

☐ The minimum size for sanitary sewers shall be 10" diameter, with the terminal run of 10" sewer at a uniform grade of not less than 1.0% between structures. On all other 10" sanitary sewer runs, the minimum grade shall be 0.30% between structures.

☐ Sanitary Sewer Location

☐ Sanitary sewers shall be located to provide unrestricted access for inspection and maintenance operations.

☐ A minimum horizontal separation of ten (10) feet shall be provided between sanitary sewers and water mains. If it is impossible to obtain proper horizontal and vertical separation as described above, both the water main and sewer must be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the agency. It must also be pressure tested to 150 psi to assure water-tightness before backfilling. In addition, adequate horizontal separation shall be provided between sanitary sewers and all other underground utilities to allow a 1:1 trench slope from the bottom of the deeper utility, which will not undermine any shallower utility.

☐ Depth of Sewers

☐ The minimum depth of cover over the top of the sanitary sewer pipe shall be 4 feet as measured from the proposed ground elevation.

☐ Sanitary sewers shall be a minimum of 10 feet deep when fronting residential parcels to be directly connected to the sewer. Deep setbacks or unusual topographic conditions may require

more depth.

- ☐ A minimum vertical separation of 18" shall be provided between sanitary sewers and water mains. In addition, a minimum vertical separation of 12" shall be provided between sanitary sewers and other underground utilities unless otherwise specified by the agency having jurisdiction over the other utility.

☐ Manholes

- ☐ Manholes shall be installed at intervals not to exceed 300 feet, or at the following locations:
  - ☐ The upstream terminus of a sanitary sewer run.
  - ☐ All changes in pipe grade.
  - ☐ All changes in pipe size.
  - ☐ All changes in horizontal alignment.
  - ☐ All sewer junctions.
- ☐ Manholes for sewers 21" and smaller shall have a minimum diameter of 48". Manholes for sewers larger than 21" shall have a minimum diameter of 60". Larger diameter manholes may be required depending on such factors as the number of sewers at a junction or significant changes in horizontal alignment.
- ☐ Internal drop connections will be required where the invert of the outlet sanitary sewer is 18" or more below the inlet pipe invert. External drop connections will not be allowed.
- ☐ The 0.8 depth flow line of sewers shall be matched at structures when changing sizes of sewers.
- ☐ An allowance of 0.10' in grade shall be made for loss of head through a manhole where sewer alignment is deflected 30° or more.

☐ Building Sewers

- ☐ Building sewers included with sewer construction.
  - ☐ For each parcel along the route of a sanitary sewer, a building lead shall be constructed from the sanitary sewer to a minimum of 10' beyond the property line. This applies to any parcels in the sanitary sewer service design area.
- ☐ The minimum grade for building sewers shall be 1% for 6" sewers and 2% for 4" sewers.

Stormwater Management Systems

☐ Stormwater management systems shall be designed in accordance with these standards. Projects impacting waters of the state will require the review of the MDEQ.

☐ Restricted discharge rates and/or improvements to downstream drainage courses may be required. The applicant shall contact the City Engineer to determine what design criteria will apply to the proposed project.

☐ Where an approved point of discharge is not available on the site, the applicant shall make such offsite drainage improvements as are necessary to provide positive drainage to an approved outlet, as determined by the City Engineer and/or the Oakland County WRC. Such improvements shall be located in an easement secured by the applicant. The easement form and width of the easement shall

be subject to City approval.

- ☐ Plan and profile views shall be provided for all proposed stormwater management system improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
- ☐ Design calculations for all components of stormwater management systems, including, but not necessarily limited to, storm sewers, channels, and detention facilities, shall be provided on the plans.
- ☐ A drainage area map shall be included on the plans. The map shall define the areas tributary to catch basins and inlets (including upstream and offsite areas). The design calculations shall include the determination of the weighted runoff coefficients for the areas tributary to each specific inlet or outlet. The design calculations shall also include justification for the initial time of concentration used for the storm sewer design calculations.
- ☐ The following information must be shown in the plan view of the proposed storm sewer system improvements:
  - ☐ Size, material, and type of pipe.
  - ☐ Length between structures.
  - ☐ Slope of sewer between structures.
  - ☐ Where required, a dedicated stormwater easement must be shown on the plans. The easement width shall be in accordance with the following:
    - ☐ 12 feet for open drainage along rear and side property lines.
    - ☐ A minimum of 20 feet for enclosed storm drains.
    - ☐ A minimum of 30 feet for open swales (cross lot drainage).
  - ☐ Top of casting and all invert elevations at each structure.
  - ☐ Progressive numbering system on structures.
- ☐ The following information must be shown in the profile view of the proposed storm sewer system improvements:
  - ☐ Existing and proposed ground elevations.
  - ☐ Size, material, and type of pipe.
  - ☐ Length between structures.
  - ☐ Slope of sewer between structures.
  - ☐ Hydraulic gradient between structures.
  - ☐ Top of casting and all invert elevations at each structure.
  - ☐ All utility crossings.
  - ☐ Special backfill areas, (i.e. sand).
  - ☐ Progressive numbering system.

- ☐ Adjacent existing or proposed utilities plotted where parallel.

☐ Where public sewer construction is proposed, the City of Farmington Standard Storm Sewer Detail Sheets must accompany the plans. The Standard Details are included in the Digital Appendix.

☐ Components of stormwater management systems shall be designed in accordance with the requirements of the Oakland County WRC, as noted previously. The Oakland County WRC design criteria shall apply to all stormwater management system components, regardless of whether the facilities will be publicly dedicated or privately maintained at the completion of the project.

Paving Improvements

☐ All roads proposed for construction in the City of Farmington shall be public roads under the jurisdiction of the City, unless otherwise permitted by City Ordinance. Plans for such roads and/or accompanying sidewalks/bike paths shall be prepared in accordance with these standards. The plans shall be submitted to the City of Farmington for review of the proposed road improvements in relation to other existing and proposed facilities.

☐ Paving improvements for parking lots, internal roads, and pedestrian facilities on private sites shall be designed in accordance with the requirements prescribed herein.

☐ Concrete curb and gutter will be required for all private roadway construction and parking lot construction with the following exceptions:

- ☐ Large lots of one (1) acre or more for residential detached housing.
- ☐ Industrial storage yards not used for regular road vehicle parking.
- ☐ Bituminous curb may be substituted for concrete curb and gutter in commercial parking lot construction.

☐ Underground storm sewers, including edge drains for parking lots and roads, shall be designed and installed with all paving improvements which require concrete curb and gutter or asphalt curb. Where pavements are to be constructed over clay soils or other poorly drained soils and a granular subbase is used, an approved subdrainage system shall be installed.

☐ Plan and profile views shall be provided for all proposed paving improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically aligned. If possible, stormwater management improvements shall be shown on the same plan sheet as the paving improvements.

- ☐ The plans shall include typical cross section(s) showing dimensions, materials, type, and thickness of the proposed paving improvements.
- ☐ The following information shall be shown in the plan view of the proposed paving improvements.
  - ☐ Existing right-of-way or road easement, as well as the proposed right-of-way or road easement. A minimum of a 12 foot wide easement for private utilities shall be provided adjacent to each side of the proposed right-of-way or road easement.
  - ☐ Centerline alignment, including curve data, stationing, edge of pavement, and/or curb. Centerline and stationing are not required for parking lots.
  - ☐ Location of existing and proposed topographic features, including utilities.
  - ☐ Location of existing and proposed traffic control devices.

- ☐ Location of existing and proposed streetlight poles.
- ☐ Location of all proposed pedestrian facilities. Bike paths may be required by the City in lieu of sidewalks.

☐ The following information shall be shown in the profile view of the proposed paving improvements. Profiles are not required for proposed parking lots.

- ☐ Existing and proposed ground at the centerline (for rural roads) or top of curb (for urban roads).
- ☐ Percent of grade and vertical curve data.

☐ Cross Sections

- ☐ Dimensional widths and thickness of materials and associated road features shall be designed in accordance with the typical road cross sections prescribed by the RCOC. For public roads, the cross section requirements will be based on the functional class of the road as designated by the RCOC.
- ☐ For parking lots and internal roads at non-residential sites, the cross section requirements will be based on the functional class of the public road serving the property. The minimum width for an internal drive shall be 26' measured from the back-of-curb to back-of-curb or edge of pavement to edge of pavement for non-curbed internal roads.
- ☐ Pedestrian facilities shall be designed in accordance with the requirements prescribed by the RCOC.

☐ Horizontal Alignment

- ☐ Horizontal alignment of pavement and associated road features shall be designed in accordance with the requirements prescribed by the RCOC.
- ☐ Pedestrian facilities shall generally be located outside the right-of-way in a dedicated easement. Pedestrian facilities will be located within the right-of-way with the permission of the RCOC. The horizontal alignment of pedestrian facilities shall be as close to parallel as practical to the right-of-way or easement.

☐ Vertical Alignment

- ☐ The vertical alignment of all public roads, internal roads and parking lots shall be designed in accordance with the requirements prescribed by the RCOC.

Site Grading and Earthwork

☐ All proposed developments should be graded such that stormwater runoff will be intercepted within the boundaries of the site and conducted through a storm sewer system to an approved point of discharge.

☐ Easements for surface drainage shall be dedicated and recorded.

☐ For perimeter lots, the drainage easement width shall be a 20 foot minimum, and for abutting lots with a common rear yard lot line, the easement width shall be at least 10 feet on each lot.

- ☐ The following information must be shown in the plan view of the proposed grading:
  - ☐ Grading plans shall be drawn to a scale of 1" = 50'or larger.
  - ☐ The grading plans shall show the existing elevation topography either by contour method or grade point grid method.
  - ☐ High and low street grade points, slope direction (by arrow), and the location of all catch basins, inlets, and drainage ditches shall be shown on the grading plan.
  - ☐ A detail of the typical lot drainage pattern shall be shown on the grading plan with all grade control points identified. All grade point elevations shall be shown for each lot. This will include the first floor (F.F.), or the foundation grade (F.G.) elevations, high point (grade break), drainage arrows and additional spot elevations to clarify site grading.

Soil Erosion & Sedimentation Control

- ☐ Soil erosion and sedimentation control measures shall be incorporated into the design and construction of all projects as specified by Chapter 24, Article VI – "Erosion Control", of the City of Farmington Code of Ordinances, as amended. All projects shall be designed and constructed so as to minimize soil erosion and sedimentation impacts to the environment.
- ☐ All proposed temporary and permanent soil erosion and sedimentation control measures shall be shown on the plans. All soil erosion control measures shall be identified in accordance with the Michigan Unified Keying System.

CITY OF FARMINGTON
Checklist for Soil Erosion and Sedimentation Control Plans

Note to Design Engineers:

The following checklist is intended to serve as a guide for designers to review prior to submitting plans to the City for review. While the checklist covers all major areas that will be reviewed by the City Engineer, the list is not all-inclusive and the City Engineer or City Reviewer may comment on items not listed herein.

- ☐ The principles and practices of proper soil erosion and sediment control are effectively utilized with the proposed plan.
- ☐ The soil erosion and sediment control plan is an independent plan sheet that clearly shows all soil erosion and sediment control measures.
- ☐ Contact information for the landowner, developer, and petitioner is provided.
- ☐ Legal description and boundary line survey of the site on which the work is to be performed.
- ☐ Vicinity map showing the adjacent properties within 500 feet of the site.
- ☐ Plans are drawn at a scale that is standard for engineering drawings.
- ☐ Topography map with existing contours, shown at maximum one-foot intervals, that accurately shows existing natural drainage patterns.
- ☐ A description of soils located on-site as defined by the Hydrological Soil Groups for Oakland County. A more detailed soil investigation report may be required by the Community and Economic Development Department.
- ☐ The location of any structure located on site or within 50 feet of the site boundary line.
- ☐ Location of all existing and proposed on site drainage facilities, including ditches, catch basins, and detention/retention facilities.
- ☐ An outline of all existing natural woodland features located on site, with an indication of whether these natural features are to be protected or removed during the construction process.
- ☐ All lakes, streams, wetlands, and county regulated drains within 500 feet of any earth changes clearly shown and identified on the plans.
- ☐ Drainage arrows and proposed contours showing the drainage patterns for the proposed earth disturbance.
- ☐ Identification of the ultimate drainage outlet.
- ☐ A map showing the total drainage area and calculations providing the estimated runoff to be generated by the site.
- ☐ The location and limits of all proposed earth disturbances and soil stock piles.
- ☐ Location and type of all proposed erosion and sediment control measures shown graphically on the plans.
- ☐ Location of all existing and proposed on site drainage facilities, including ditches, catch basins, and detention/retention facilities.
- ☐ Construction and installation details of all erosion and sediment control items.

☐ The scheduling and sequencing of all construction activities and soil erosion control measures for the project.

☐ A maintenance agreement, which includes maintenance tasks and schedules, for all permanent erosion and sediment control items. The person(s) or organization responsible for the maintenance program shall be included.

JOB NAME: _____ REVIEWED BY: _____

JOB NUMBER: _____ DATE REVIEWED: _____

CITY OF FARMINGTON RECORD PLAN REQUIREMENT CHECKLIST

Print Date:

This checklist should be completed, signed & sealed and submitted along with the Record Drawings.

Note: *Tie down measurements and top of casting elevations to all utility structures or building corners will also be the responsibility of the engineer providing the record drawings.*
The use of coordinates alone to locate structures is not acceptable.

The Orchard, Hiltz & McCliment, Inc project number must be printed in the lower right hand corner of all plan sheets.

SANITARY SEWER

I. PLAN VIEW

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Lengths between manholes
B.	[ ]	[ ]	Size of pipe
C.	[ ]	[ ]	Length & Location of casing pipe
D.	[ ]	[ ]	Ties to manholes
E.	[ ]	[ ]	Type & class of pipe & joint ("O" ring, slip, solvent weld, etc.)
F.	[ ]	[ ]	T/casting grades
G.	[ ]	[ ]	Ties to wye locations
H.	[ ]	[ ]	Permit numbers (County & MDEQ)
I.	[ ]	[ ]	Manhole numbering (sequential)
J.	[ ]	[ ]	Show all sanitary sewer easements on plans
K.	[ ]	[ ]	Provide copies of all sanitary sewer easements

II. PROFILE VIEW (REQUIRED FOR ALL PIPES)

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Lengths between manholes
B.	[ ]	[ ]	Size of pipe
C.	[ ]	[ ]	Lengths of casing pipe
D.	[ ]	[ ]	Depth of wye & riser
E.	[ ]	[ ]	Invert grades
F.	[ ]	[ ]	Type & class of pipe & joint ("O" ring, slip, solvent weld, etc.)
G.	[ ]	[ ]	T/casting grades
H.	[ ]	[ ]	Wye locations (tied to permanent structures, property corners)
I.	[ ]	[ ]	Percent slope between manholes
J.	[ ]	[ ]	Manhole numbering (sequential)

STORM SEWER

I. PLAN VIEW

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Lengths between manholes/catch basins/inlets
B.	[ ]	[ ]	Size of pipe
C.	[ ]	[ ]	Ties to manholes/catch basins/inlets
D.	[ ]	[ ]	Type & class of pipe & joint
E.	[ ]	[ ]	T/casting grades
F.	[ ]	[ ]	Structure numbering (sequential)
G.	[ ]	[ ]	Special structures (low head, 5' dia., 6' dia., 2' sump, etc.)
H.	[ ]	[ ]	Show all easements for storm sewer on plans
I.	[ ]	[ ]	Provide copies of all storm sewer easements

II. PROFILE VIEW (REQUIRED FOR PIPE 12" & LARGER)

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Lengths between manholes
B.	[ ]	[ ]	Size of pipe
C.	[ ]	[ ]	Type & class of pipe & joint
D.	[ ]	[ ]	Invert grades
E.	[ ]	[ ]	T/casting grades
F.	[ ]	[ ]	Structure numbering (sequential)
G.	[ ]	[ ]	Percent slope between manholes

WATER MAIN

I. PLAN VIEW

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Lengths between gate valve & wells, hydrants and fittings
B.	[ ]	[ ]	Size of pipe
C.	[ ]	[ ]	Ties to gate valve & wells, hydrants and fittings
D.	[ ]	[ ]	Ties to hydrants
E.	[ ]	[ ]	Ties to stop boxes
F.	[ ]	[ ]	Ties to building or offsets to pipe
G.	[ ]	[ ]	Offset of pipe from building/property line (if parallel).
H.	[ ]	[ ]	Type and class of pipe
I.	[ ]	[ ]	Finish grade of hydrants
J.	[ ]	[ ]	T/Casting grades
K.	[ ]	[ ]	Horizontal bend locations
L.	[ ]	[ ]	Location of thrust blocks & types of restraints
M.	[ ]	[ ]	Sequentially numbered G.V.W. & Valve Boxes
N.	[ ]	[ ]	Permit numbers (County & MDEQ)
O.	[ ]	[ ]	Manufacturer of hydrant
P.	[ ]	[ ]	Show all water main easements on plan
Q.	[ ]	[ ]	Provide copies of all water main easements

WATER MAIN (continued)

II. PROFILE VIEW

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Size of pipe
B.	[ ]	[ ]	Type and class of pipe
C.	[ ]	[ ]	G.V.W. & Valve Box location
D.	[ ]	[ ]	Hydrant location (identify special structures such as blow off)
E.	[ ]	[ ]	Air relief valves/blow off valve locations
F.	[ ]	[ ]	Vertical bend locations

PAVEMENT

I. Width and station of pavement (measured from centerline)

	[NEED]	[O.K.]	
A.	[ ]	[ ]	At end of radius at intersection
B.	[ ]	[ ]	At beginning of taper
C.	[ ]	[ ]	At end of taper
D.	[ ]	[ ]	Any changes in alignment
E.	[ ]	[ ]	Radius @ intersection
F.	[ ]	[ ]	Right-of-way survey data

II. Drives

	[NEED]	[O.K.]	
A.	[ ]	[ ]	location
B.	[ ]	[ ]	Width
C.	[ ]	[ ]	Radius, if any

III. Sidewalk

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Location
B.	[ ]	[ ]	Width/Material
C.	[ ]	[ ]	Changes in alignment
D.	[ ]	[ ]	Ramps per ADA requirements
E.	[ ]	[ ]	Provide original recorded copies of all easements for bike path and/or sidewalk

GRADING

	[NEED]	[O.K.]	
A.	[ ]	[ ]	Slopes of swales/ditches field verified (50' centerline spot elevations)
B.	[ ]	[ ]	Detention basin sized/located according to approved plan (field verified)
C.	[ ]	[ ]	Side slopes of pond/berms field verified
D.	[ ]	[ ]	Provide original recorded copies of all easements for grading & drainage

DIGITAL VERIFICATION

	[NEED]	[O.K.]	
A.	[ ]	[ ]	PDF's of all Plan Sheets
B.	[ ]	[ ]	AutoCAD version of Construction Drawings with xref files
C.	[ ]	[ ]	DWG Base File in State Plane Coordinates

[ ] Revisions Needed [ ] No Revisions Needed

A Guide for Structure Reviews

In an effort to develop consistent and uniform criteria for structural reviews for private developments and site plans for municipal clients, we have developed the following submittal guidelines. Generally, the review will be based on the following information; however additional data, calculations, and information may be requested to provide for a more extensive review. Any missing items may be grounds for a request for re-submittal.

Contract construction drawings (24" x 36") bearing the seal and signature of an engineer licensed in the state of Michigan shall be submitted to the Municipality/City/Village, etc. The name of the person/company responsible for the project and the estimate of cost for the structure should accompany the plan. The construction documents, as a minimum, shall have the following data noted or referenced on the drawings:

Concrete Walls/Structures

- Clearly identified location of structure in site (plan view) with a location map (200 scale or equivalent)
- Top and bottom of wall elevation (plan view)
- Finished grades adjacent to the structure
- Grading plan corresponds to proposed structure
- Minimum and maximum wall height (cross section)
- Notes identifying or referencing material types and specifications
- Design loads including vehicular impact and surcharge loadings where applicable
- Structural dimensions and footing depth
- Wall and footing thickness
- Steel (reinforcing) grade, cover and spacing
- Bearing pressures (noted or referenced) and soil bearing capacities

- Openings in walls
- Protective guard requirements (required within two feet of pedestrians)
- Drainage requirements
- Filter wrapped drain tile and outlets specified
- Utility conflicts – noted with owner contact information
- Soil boring information & Geotechnical analysis

Block & Timber Retaining Walls

- All of the above except steel reinforcing data
- Segmental wall dimensions and soil reinforcing (if applicable)
- Manufacturer specifications (Block only) – compare to plans
- Geo-grid length noted, dimensioned and labeled on plans
- Embedment depth
- Boulder wall not exceeding four feet in height

In all cases, a signed and sealed letter from the engineer of record certifying that structures have been designed in accordance with applicable structural design codes with the codes identified; that all applicable safety factors, standards and codes (identify safety factors) have been met or exceeded; and that the soil conditions have been reviewed by a qualified geotechnical engineer.

Appendix B

Detailed Engineering Submittal Forms

City of Farmington
Detailed Engineering Review Application

Site Name:			OHM Job Number: (for OHM use)
Zoning:	Parcel ID:		
Date Approved by Planning Commission:			
Applicant:	Phone: ( )		Fax: ( )
Address:	City:	State:	Zip:
Design Engineer:	Phone: ( )		Fax: ( )
Address:	City:	State:	Zip:

Proposed Site Improvements:

Water Main ☐No ☐Yes If yes, _____ feet of _____ inch water main and a total of ____ water services.

Sanitary Sewer ☐No ☐Yes If yes, _____ feet of _____ inch sanitary sewer and a total of ____ leads.

Storm Sewer ☐No ☐Yes If yes, _____ feet of storm pipe with detention facilities designed to detain _____ cubic feet of runoff.

Other Items:

Storm Water Discharge Location: _____

Total area of disturbance: _____ acres

Project Estimate: The applicant shall submit a complete preliminary engineer's estimate including quantity, unit cost and total costs for each individual item (e.g. 8-inch ductile iron water main, 4-foot diameter manhole, etc.). The unit costs shall include the cost of labor and materials for each item. A sample of this estimate can be found attached to this document. A summary of the division costs calculated by the design engineer shall be completed on this form. These prices will be used in development of bonding requirements that will be delivered to the applicant upon receiving engineering plan approval.

The Detailed Engineering Review Application and a detailed engineering estimate must be approved by OHM Advisors prior to submitting plans and the associated fees to the City of Farmington. Estimates and this application can be e-mailed to matt.parks@ohm-advisors.com.

Division	Total Cost
Site Grading	$
Sidewalks & Bike Paths	$
Storm Sewer	$
Water Main	$
Sanitary Sewer	$
Landscaping	$
Soil Erosion and Sedimentation Control	$
TOTAL PRELIMINARY PROJECT COST	**$**

Estimate Prepared by: _____ P.E.

Seal of Professional Engineer Registered to practice in the State of Michigan

Sample Project Estimate*

Site Grading/Sidewalks & Bike paths

Item	Quantity	Unit	Unit Cost	Total Cost
Mass Grading	1	lsum	$75,000.00	$75,000.00
4" Concrete Sidewalk	2500	sft	$3.50	$8,750.00
3" HMA Bike Path	2500	sy	$8.00	$20,000.00
Total Division Cost				**$103,750.00**

Water Main

Item	Quantity	Unit	Unit Cost	Total Cost
8-inch CL 54 Ductile Iron Water Main	555	lft	$ .00	$ 975.00
Polyethylene Wrap	15	lft	$0.	$777.50
8" x 8" Tapping Sleeve Valve & Well	2	e	$2,7 0.00	$5,500.00
1-inch Type K Copper Water Service	1	ea	$7 .00	$775.00
Total Division Cost				**$77,027.50**

Sanitary Sewer

Item	Quantity	Unit	Unit Cost	Total Cost
10" ABS Truss Pipe	1800	t	$65.00	$117,000.00
6" PVC SDR 26 Sewer Leads	0	lft	$50.00	$15,000.00
4' Diameter Manhole	20	ea	$2,250.00	$45,000.00
Total Division Cost				**$177,000.00**

Storm Sewer

Item	Quantity	Unit	Unit Cost	Total Cost
12" C-76 CL IV S r Sewer	351	lft	$28.00	$9,828.00
18" C- CL IV Storm Sew	322	lft	$35.00	$11,270.00
2' l et	4	ea	$1,500.00	$6,000.00
4' Ma le	3	ea	$1,750.00	$5,250.00
36" CMP pipe	1	ea	$3,000.00	$3,000.00
18" Concrete Section	3	ea	$700.00	$2,100.00
Total Division Co				$37,448.00

Soil Erosion & Sedimentation Control

Item	Quantity	Unit	Unit Cost	Total Cost
Silt Fence	2805	lft	$3.00	$8,415.00
Inlet Filters	7	ea	$250.00	$1,750.00
Total Division Cost				$10,165.00

*The applicant shall note that the above document is a sample of an acceptable engineer's estimate. The estimate must include all items of work and appropriate quantities to complete work as described on the plan. Costs shall be based off current material and labor costs.

Appendix C

Preconstruction Meeting Forms

CONSTRUCTION CONTACT INFORMATION

OHM Engineering Advisors

Project Name: _____

Location (include section #): _____ **Project Supervisor:** _____

OHM Project No.: _____ **Municipality Project No.:** _____

Developer/Owner		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	

(If a different professional engineer/professional surveyor is going to complete the record drawings, please list them here)

Design Engineer		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	

Prime Contractor		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	
Safety Officer:			

Advancing Communities™

34000 Plymouth Road | Livonia, Michigan 48150
p. (734) 522-6711 | f. (734) 522-6427
www.ohm-advisors.com

CONSTRUCTION CONTACT INFORMATION continued

Mass grading/soil		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	
Underground		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	
Paving		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	
Landscape		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	
Other: Concrete		Phone:	
Street Address		Fax:	
City, State & Zip		Email:	
Contact Person:		Emergency:	

After the pre-construction meeting, please fax this completed sheet to the OHM Construction Department at 734-522-6427.

CERTIFICATE OF INSURANCE

DATE (MM/DD/YY)

PRODUCER	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.
YOUR INSURANCE COMPANY	COMPANIES AFFORDING COVERAGE
	COMPANY A:
INSURED	COMPANY B:
CONTRACTOR	COMPANY C:
	COMPANY D:

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
A	GENERAL LIABILITY				GENERAL AGGREGATE	*$1,000,000*
	X COMMERCIAL GENERAL LIABILITY				PRODUCTS-COMP/OP AGG	*$500,000*
	☐ CLAIMS MADE ☒ OCCUR				PERSONAL & ADV INJURY	*$500,000*
	X				EACH OCCURRENCE	*$500,000*
	X				FIRE DAMAGE (Any one fire)	
A	AUTOMOBILE LIABILITY				MED EXP (Any one person)	
	X ANY AUTO				COMBINED SINGLE LIMIT	*$1,000,000*
	☐ ALL OWNED AUTOS				BODILY INJURY (Per person)	*$500,000*
	☐ SCHEDULED AUTOS				BODILY INJURY (Per accident)	*$500,000*
	☐ HIRED AUTOS				PROPERTY DAMAGE	*$200,000*
	☐ NON-OWNED AUTOS					
	GARAGE LIABILITY				AUTO ONLY-EA ACCIDENT	
	☐ ANY AUTO				OTHER THAN AUTO ONLY:	
					EACH ACCIDENT	
B	EXCESS LIABILITY				AGGREGATE	
	X UMBRELLA FORM				EACH OCCURRENCE	
	☐ OTHER THAN UMBRELLA FORM				AGGREGATE	
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY					
					STATUTORY LIMITS	
					EACH ACCIDENT	
	THE PROPRIETOR/PARTNERS/ ☐ INCL				DISEASE-POLICY LIMIT	
	EXECUTIVE OFFICERS ARE: ☐ EXCL				DISEASE-EACH EMPLOYEE	
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS

Project Name, Additionally Insured: Orchard, Hiltz & McCliment, Inc., Charter Township of Ypsilanti, the Township Board and individual members thereof, the City of Ypsilanti, the City Board and individual members thereof, the Township and City Engineer and members of his staff, Township and City employees and agents for the Township and City of Ypsilanti Community Utilities Authority, its Board of Commissioners, and the individual members thereof, the YCUA staff and employees, the YCUA Consulting Engineer and his employees, and any and all other agents of YCUA.

CERTIFICATE HOLDER	CANCELLATION
OWNER/DEVELOPER	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NEMED TO THE LEFT.
	AUTHORIZED REPRESENTATIVE

MAINTENANCE AND GUARANTEE BOND

(for private site development)

Obligee Review or Project No._____ Bond No._____
(if applicable)

KNOW ALL MEN BY THESE PRESENTS:

That we, the developer, _____ (hereinafter called Principal), and _____ (hereinafter called Surety), a corporation organized under the laws of the State of _____ and authorized to do a surety business in the State of Michigan, are held and firmly bound unto the municipal/public agency known as _____ _____ (hereinafter called Obligee) in the full and just sum of _____ Dollars and _____ Cents ($_____), lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has constructed or caused to have constructed the following described public improvements in a public easement and/or right-of-way:

(Check all applicable items)

_____Storm Sewer System	_____Roadway
_____Sanitary Sewer System	_____Sidewalk or Pathway
_____Water Main System	_____Other: _____

which have been or are about to be accepted by the Obligee for the project known as _____ _____ and located in Section _____, T_____, and R_____; more specifically at _____.

AND WHEREAS, it is required that the Principal should guarantee the project from defects caused by faulty materials or workmanship for a period of two year(s) from and after the date of acceptance of same by the Obligee.

The Obligee shall notify the Principal in writing of any defect for which the Principal is responsible and shall specify in said notice a reasonable period of time within which the Principal shall have to correct said defect. If the Principal fails to correct such defect within the time specified in said notice, then the Surety shall have sixty (60) days thereafter within which to take such action as it deems necessary to insure performance of the Principal's obligation. If such defect is not corrected after the expiration of such sixty-day period, then the Obligee shall have the right to correct such defect and the Principal and Surety, jointly and severally, shall pay all costs and expenses incurred by Obligee in correcting such defect; including but not limited to, the engineering, legal, administration and other costs, together with any damages either direct or consequential, which the Obligee may sustain on account of the Principal's failure to correct such defect. In addition, the Obligee shall have the right to contract for the correction of such defect and, upon acceptance of the lowest responsible bid, the Principal and Surety shall become immediately liable for the amount of the said bid.

If any repair is necessary to be made at once to protect life and property, then and in that case, the Obligee may take immediate steps to repair or barricade such defects without notice to the Principal or Surety. In such accounting, the Obligee shall not be held to obtain the lowest figures for the doing of the work, or any part thereof, but all sums actually paid therefore shall be charged to the Principal or Surety. In this instance, the judgment of the Obligee is final and conclusive.

The Principal shall fully indemnify, defend and save harmless the Obligee, and its agents, consultants, employees and officers from all suits and actions for damages of every name and description brought or claimed against them for, or on account of, any injury or damage to person or property received or sustained by any party or parties, by or from any of the acts or omissions or through the negligence of said Principal, and its servants, agents or employees, in the prosecution of the work, and from any and all claims arising under the Workman's Compensation Act, so-called, of the State of Michigan.

NOW, THEREFORE, if the said Principal shall for a period of ____ year(s) from and after the date of acceptance of the completed project by the Obligee replace any and all defects arising in said work whether resulting from defective materials or defective workmanship, then the above obligation shall be null and void; otherwise to remain in full force and effect for ____ year(s) from the date of acceptance by the Obligee.

IN WITNESS WHEREOF, the parties have caused this instrument to be signed and sealed by their respective authorized officers this_____day of_____,
20___.

WITNESS

_____

Name:_____

PRINCIPAL

_____
(seal)

By:_____

Name:_____

Title:_____

Address:_____

_____

Phone:_____

Fax:_____

SURETY

_____
(seal)

_____

By:_____

Name:_____

Name:_____

Title:_____

Address:_____

_____

Phone:_____

Fax:_____

Appendix D

Sample Easement Documents

Sample Sanitary Sewer Easement
Sample Water Main Easement

SANITARY EASEMENT

KNOW ALL MEN BY THESE PRESENTS, that _____,
whose address is_____, (hereinafter referred to as
"Grantor"), being title holder to the following described parcel of land, to wit:

Description of Parcel: (Include address of parcel)

Tax Identification Number:_____

for and in consideration of One ($1.00) Dollar, receipt of which is hereby acknowledged, does hereby grant and convey to the _____, a Michigan Municipal Corporation, whose address is _____, (hereinafter referred to as "Grantee"), a perpetual easement for a sanitary sewer, over, upon, across, in, through, and under the following described real property to wit:

Easement Description

and to enter upon sufficient land adjacent to said sanitary easement for the purpose of exercising the rights and privileges granted herein.

Grantee may install, repair, replace and maintain sanitary lines, and all necessary appurtenances thereto, within the easement herein granted.

Grantee will not be responsible for replacing pavement, trees or any other physical objects within the easement herein granted.

Grantor agrees not to build or to convey to others permission to build any permanent structures on the above-described easement.

The premises so disturbed by reason of the exercise of any of the foregoing powers, rights and privileges, shall be reasonably restored to its prior condition by Grantee.

This instrument shall be binding upon and inure to the benefit of the parties hereto, their heirs, representatives, successors and assigns.

IN WITNESS WHEREOF, the undersigned Grantor(s) has affixed signature(s) this _____ day of _____ A.D., 20

CORPORATION: _____
Name

By:_____
Signature

Its:_____
Printed Name & Title

By:_____
Signature

Its:_____
Printed Name & Title

STATE OF MICHIGAN)
)SS
COUNTY OF)

On this _____ day of _____A.D., 20___, before me, a Notary Public in and for said County, appeared _____ and _____ to me known personally known, who, being by me duly sworn, did each for himself say that they are respectively the _____ and _____of _____ the corporation named in and which executed the within instrument, and that the seal affixed to said instrument was signed and sealed in behalf of said corporation by authority of its board of directors; and acknowledged said instrument to be the free act and deed of said corporation.

_____

_____
Notary Public,_____ County, MI

My commission expires_____

This instrument drafted by:
Design Engineer Name
Address

Tax Identification Number:_____

WHEN RECORDED RETURN TO:
OHM Advisors
34000 Plymouth Road
LIVONIA, MI 48150

WATER MAIN EASEMENT

KNOW ALL MEN BY THESE PRESENTS, that _____,
whose address is_____, (hereinafter referred to as "Grantor"), being title holder to the following described parcel of land, to wit:

Description of Parcel: (Include address of parcel)

Tax Identification Number:_____

for and in consideration of One ($1.00) Dollar, receipt of which is hereby acknowledged, does hereby grant and convey to the _____, a Michigan Municipal Corporation, whose address is _____ _____, (hereinafter referred to as "Grantee"), a perpetual easement for a water main, over, upon, across, in, through, and under the following described real property to wit:

Easement Description

and to enter upon sufficient land adjacent to said water main easement for the purpose of exercising the rights and privileges granted herein.

Grantee may install, repair, replace and maintain water main lines, and all necessary appurtenances thereto, within the easement herein granted.

Grantee will not be responsible for replacing pavement, trees or any other physical objects within the easement herein granted.

Grantor agrees not to build or to convey to others permission to build any permanent structures on the above-described easement.

The premises so disturbed by reason of the exercise of any of the foregoing powers, rights and privileges, shall be reasonably restored to its prior condition by Grantee.

This instrument shall be binding upon and inure to the benefit of the parties hereto, their heirs, representatives, successors and assigns.

IN WITNESS WHEREOF, the undersigned Grantor(s) has affixed signature (s) this _____ day of _____ A.D., 20_____.

CORPORATION: _____
Name

By:_____
Signature

Its:_____
Printed Name & Title

By:_____
Signature

Its:_____
Printed Name & Title

STATE OF MICHIGAN)
)SS
COUNTY OF)

On this _____ day of _____A.D., 20___, before me, a Notary Public in and for said County, appeared _____ and _____ to me known personally known, who, being by me duly sworn, did each for himself say that they are respectively the _____ and _____of _____ the corporation named in and which executed the within instrument, and that the seal affixed to said instrument was signed and sealed in behalf of said corporation by authority of its board of directors; and acknowledged said instrument to be the free act and deed of said corporation.

_____

_____
Notary Public,_____ County, MI

My commission expires_____

This instrument drafted by:
Design Engineer Name
Address

Tax Identification Number:_____

WHEN RECORDED RETURN A COPY TO:
OHM Advisors
34000 Plymouth Road
LIVONIA, MI 48150

Appendix E

Grading Certificate

GRADING CERTIFICATE

Date:_____

City of Farmington
33720 W. Nine Mile Road
Farmington, MI 48335

Site Name:_____

Site Plan #:_____

Sidwell #:_____

Design Engineer and Firm Name:_____

Address:_____

Phone:_____Fax:_____

Owner:_____

Address:_____

Phone:_____Fax:_____

I hereby certify that the above-referenced site was graded in substantial accordance with the approved engineering plans dated _____ by Orchard, Hiltz & McCliment, Inc.

Engineer's Seal

Sincerely,

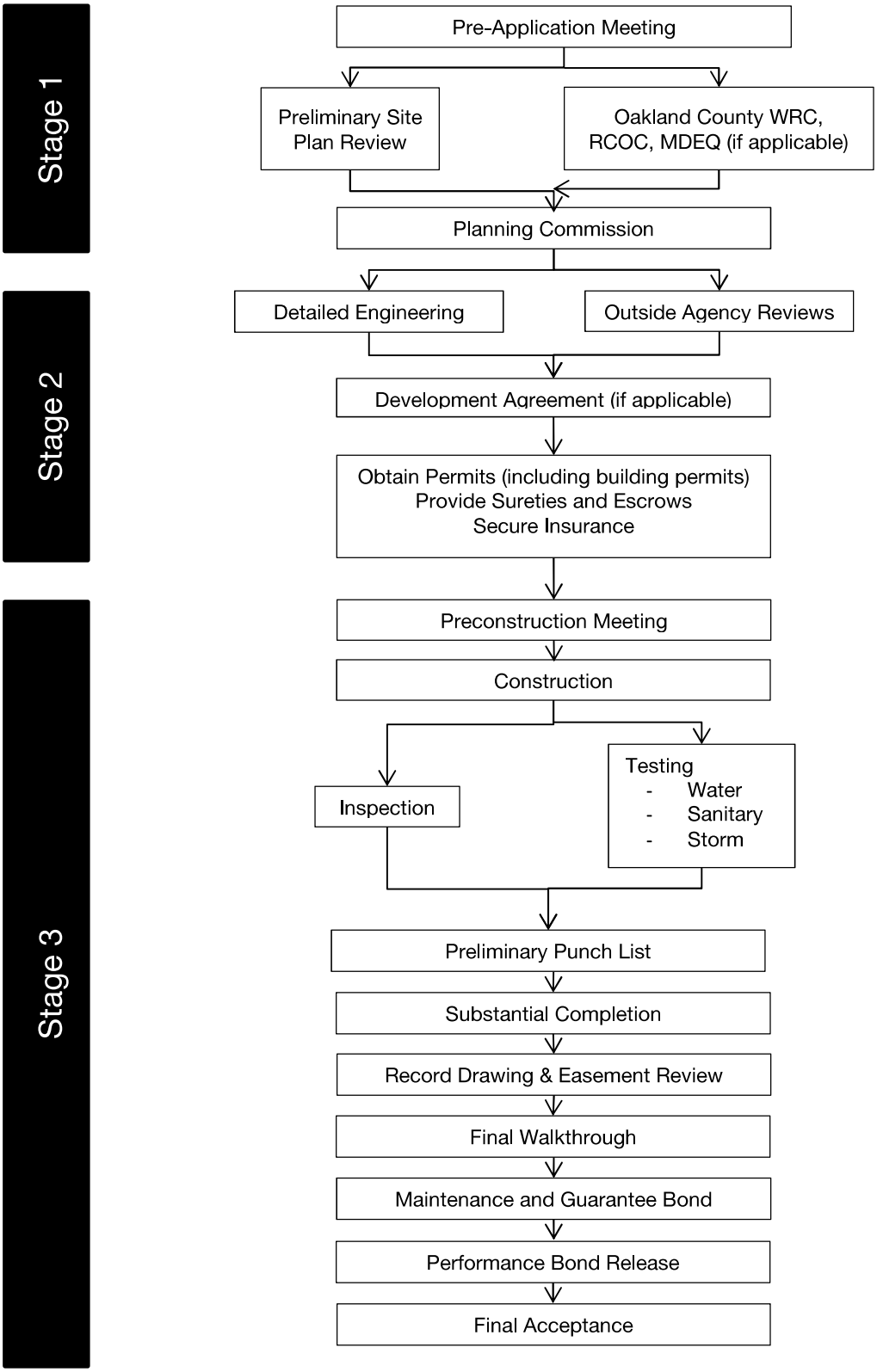
_____
Printed Name of Registered State of Michigan Engineer

_____
Signature

Appendix F

Development Flowchart

City of Farmington Development Process Flow Chart



Appendix G

Example Stormwater Calculations

STORMWATER MANAGEMENT FACILITIES

All stormwater calculations shall be done in accordance with the Standards and Specifications of the Oakland County Water Resources Commissioner's Office (WRC) which can be found at the following location: http://www.oakgov.com/water/Pages/standards_specs.aspx.

Composite runoff coefficients should be based on the values shown below:

Stormwater Management Facilities Composite Runoff Coefficients			
Type of Surface	**Runoff Coefficient**		
Water Surfaces	1.00		
Roofs	0.95		
Asphalt or Concrete Pavements	0.95		
Gravel or Brick Surfaces	0.85		
Semi-Pervious; Lawns, Parks, Playgrounds	Slope <4%	Slope 4%-8%	Slope >8%
Hydrologic Soil Group A	0.15	0.20	0.25
Hydrologic Soil Group B	0.25	0.30	0.35
Hydrologic Soil Group C	0.30	0.35	0.40
Hydrologic Soil Group D	0.45	0.50	0.55

A minimum of one (1) foot of freeboard must be provided above the detention basin design storm event.

The applicant is encouraged, but not required, to utilize Best Management Practices (BMPs). Examples of BMPs can be found in the SEMCOG Low Impact Development (LID) Manual, which can be found at http://www.semcog.org/lowimpactdevelopment.aspx. Utilizing BMPs can reduce V_T (Equation 5).

Detention Basin Calculations:

The storage volume for the 100-year storm event is based on the allowable outflow of 0.20 cfs/acre (Q_a) per the Oakland County WRC and as shown by the equations below:

The following equations were taken from The Oakland County Water Resources Commissioner's Engineering Design Standards for Storm Water Facilities.
http://www.oakgov.com/water/Documents/2013_updates/2007_storm_water_facilities_design_standard_051513.pdf

Detention Basin Volume:

$$V = \frac{H}{3} * \left(A_1 + A_2 + \sqrt{A_1 * A_2}\right) \qquad [Eq.\ 1]$$

V = Volume
H = Difference in depth between two successive depth contours
A_1 = Area of the basin within the outer depth contour being considered
A_2 = Area of the basin within the inner depth contour line under consideration

This procedure will determine the volume for each layer. Summing the layer volumes will give the total volume of the basin.

For the 100-year storm:

Calculate Q_0:

$$Q_o = \frac{allowable\ outflow, Q_a}{(acreage) * (runoff\ coefficient)} = \frac{Q_a}{A * C} \qquad [Eq. 2]$$

$$A = acreage\ of\ site$$
$$C = composite\ runoff\ coefficient$$

Calculate storage time, T:

$$T = -25 + \sqrt{\frac{10{,}312.5}{Q_0}} \qquad [Eq. 3]$$

Calculate the total volume of storage per acre of imperviousness, V_s;

$$V_s = \frac{16{,}500 * T}{T + 25} - 40 Q_0 T \qquad [Eq. 4]$$

Calculate total volume of storage required for the entire site, V_t:

$$V_t = V_s * A * C \qquad [Eq. 5]$$

Calculate bankfull volume, V_{bf}:

The bankfull storm is defined as the 24 hour, 1.5 year storm event:

$$V_{bf} = 8170 * A * C \qquad [Eq. 6]$$

Calculate first flush volume, V_{ff}:

The first flush storm is defined as the first 0.5" of rain over the entire site:

$$V_{ff} = 1815 * A * C \qquad [Eq. 7]$$

Calculate the sediment forebay volume:

The sediment forebay shall be at least five percent (5%) of the design storm event (V_T).

Area of outlet pipe:

$$Area = \frac{Q_a}{0.62 * \sqrt{2 * g * h}} \qquad [Eq. 8]$$

Rainfall Intensity for 100-year storm event:

$$I = \frac{275}{T + 25} \qquad [Eq. 9]$$

Appendix H

Stormwater Management Agreement

STORMWATER MANAGEMENT
LONG-TERM MAINTENANCE AGREEMENT AND PLAN

THIS AGREEMENT is made this _____ day of _____, 20__, by and between the City of Farmington, a municipal corporation, with principal offices located at 23600 Liberty Street, Farmington, MI 48335, hereinafter "City" and a _____ Michigan _____ _____, with principal offices located _____, hereinafter "Owner".

RECITALS

1. Owner is developing certain property located in the City of Farmington, Oakland County, Michigan as _____("Development") and as more particularly described in Exhibit "A" attached hereto.

2. The development, shall contain certain storm drainage, detention and/or retention facilities, including but not limited to, a detention/sedimentation basin for the collection, conveyance, storage, treatment and/or discharge of storm water from the Property in accordance with all approved plans, and all applicable ordinances, laws and regulations in order to provide adequate drainage in the proposed Development as more particularly described in Exhibit "B" attached hereto.

3. The City and the Owner desire that the stormwater management system to be constructed in the Development be maintained in perpetuity to ensure that it functions properly as designed and in conformity with applicable laws and regulations.

NOW, THEREFORE, for and in consideration of $1.00, receipt and sufficiency of which is hereby acknowledged, and fully incorporating the above-stated recitals into the agreement, the City and the Owner agree as follows:

The Owner shall fully, completely, and unconditionally assume the obligations of maintaining the stormwater management system in the Development. The Owner shall establish a regular and systematic program of maintenance (the "Schedule of Maintenance") for such facilities and areas to insure that the physical condition and intended function of such areas and facilities shall be preserved and maintained. The Schedule of Maintenance and the annual estimated costs for maintenance and repairs for the first three (3) years are described in the attached Exhibit C.

In the event that the Owner shall at any time fail to carry out the responsibilities specified within this agreement, and/or in the event of a failure to preserve and/or maintain the storm water drainage, detention and retention facilities in reasonable order and condition, the City may serve written notice upon the Owner setting forth the deficiencies in maintenance and/or preservation along with a demand that the deficiencies be cured within a stated reasonable time period, and the date, time and place for a hearing before the City for the purpose of allowing Owner an opportunity to be heard as to why the City should not proceed with the correction of the deficiency or obligation which has not been undertaken or properly fulfilled. At any such hearing, the time for curing and the hearing itself may be extended and/or continued to a date certain. If, following such hearing, the person conducting the hearing shall determine that the obligation has not been fulfilled or failure corrected within the time specified in the notice, as determined by the City in its reasonable discretion, the City shall thereupon have the power and authority, but not the obligation, to enter upon the Property, or cause its agents or contractors to enter the Property through the Ingress/Egress Easement Area as described and depicted in **Exhibit D** and perform such obligation or take such corrective measures as reasonably found by the City to be appropriate or necessary with respect to the detention/sedimentation basin within the Detention/Sedimentation Basin Easement Area described and depicted in **Exhibit D**, for the purposes described above. The cost and expense of making and financing such actions by the City, including notices by the City and reasonable legal fees incurred by the City, plus an administrative fee in an amount equivalent to twenty-five (25%) percent of the total of all such costs and expenses incurred, shall be paid by Owner within thirty (30) days of a billing to the Owner. All unpaid amounts may be placed on the delinquent tax roll of the City as to the Property, and shall accrue interest and penalties, and shall be collected as, and deemed delinquent real property taxes, according to the laws made and provided for the collection of delinquent real property taxes. In the discretion of the City, such costs and expenses may be collected by suit initiated against the Owner, and, in such event, the Owner shall pay all court costs and reasonable attorney fees incurred by the City in connection with such suit.

The Owner, its agents, representatives, successors, and assigns shall defend, indemnify, and hold harmless the City and the City's, elected officials, agents and employees, from any and all costs, claims, suits, actions, losses, damages, or demands, including court costs and attorneys' fees, relating in any way to or arising out of the design, construction, use, inspection, maintenance, repair, or operation (or omissions in such regard) of the storm drainage system which is the subject of this Agreement.

The parties hereto make this Agreement on behalf of themselves, their heirs, successors, assigns and transferees, and hereby warrant that they have the authority and capacity to execute this Agreement and bind the property as described in the terms and conditions of this agreement.

Invalidation of any of these covenants or conditions by Judgment or Court Order shall in no way affect the validity of any other provision which shall remain in full force and effect.

This agreement shall run with the land and be binding upon all owners, their agents, heirs, successors, assigns and transferees.

IN WITNESS WHEREOF, the Owner and City have executed this Agreement on the day and year first above written.

_____
Name of Entity

_____
By:

_____
Its:

STATE OF MICHIGAN)
)ss:
COUNTY OF _____)

The foregoing instrument was acknowledge before me on this ____ day of _____, 20____ by ____ _____, who stated under oath that s/he is the _____ of the _____ _____ and that this easement was signed on behalf of the _____, by authority of its _____, and s/he acknowledged the granting of this easement to be the free act and deed of the _____.

_____
Notary Public
_____ County, Michigan
Acting in Oakland County
My commission expires: _____

INSTRUMENT DRAFTED BY:
City of Farmington

WHEN RECORDED RETURN TO:
City of Farmington
Sue Halberstadt, City Clerk
23600 Liberty Street
Farmington, Michigan 48335

EXHIBIT A

PROPERTY DESCRIPTION EXHIBIT

EXHIBIT B

Map Depicting Physical Limits of Stormwater Management System

EXHIBIT C

SCHEDULE OF MAINTENANCE

Detention Pond/Forebay

REQUIRED MAINTENANCE:

- Check the outlet regularly for clogging and clean when necessary (annually).
- If necessary based on surroundings, mow grass side slopes (two times per year).
- Inspect entire system annually, including inlet/outlet pipes, restricted outlet structure(s), animal grates, and filters.
- Check banks and bottom for erosion and correct as necessary (annually).
- Remove sediment when accumulation reaches six (6) inches or if resuspension is observed.
- Re-seed banks near inlet/outlet and stabilize eroded banks as necessary.
- Add grasses such as sedges and rushes.
- Remove dead vegetation (early spring) that obstructs flow.
- Maintain a record of all maintenance performed on the system for City inspection upon request.

If the outlet is pumped, then only a licensed electrician or company that provided the pump system should conduct any maintenance. Chemicals should not be applied to the detention basins, side slopes, or butter strip.

Manufactured/Underground Detention Systems

REQUIRED MAINTENANCE:

- Check the outlet regularly for clogging and clean when necessary (annually).
- Inspect the entire system, including inlet/outlet pipes, restricted outlet structure(s), and water quality structures (two times per year).
- Clean detention system, if its volume has been reduced by more than ten (10) percent due to accumulation of silt and sediment.
- Maintain a record of all maintenance performed on the system for City inspection upon request.

Storm Sewer Collection Systems

REQUIRED MAINTENANCE:

- Check the outlet regularly for clogging and clean when necessary (annually).
- Inspect entire storm sewer distribution system (two times per year).
- Clean storm sewer structures when accumulation of silt and sediment reaches six (6) inches or greater.
- Clean grates on inlets, outlets, and other storm sewer structures regularly.
- Water channels should be cleaned regularly.
- Maintain a record of all maintenance performed on the system for City inspection upon request.

COST ESTIMATE FOR 3-YEARS OF MAINTENANCE_____

Upon completion of the annual routine inspections,
documentation shall be provided to the City of Farmington.

Mail to: City of Farmington,23600 Liberty Street, Farmington, MI 48335, Attn: Planning and Zoning Department

EXHIBIT D

INGRESS/EGRESS AND DETENTION BASIS ACCESS EASEMENTS

Digital Appendix

These items are to be included in the Digital Appendix but have been printed for your reviewing convenience.

City of Farmington Standards for Submitting Digital Record Drawings
City of Farmington Sanitary Sewer Standard Details
City of Farmington Storm Sewer Standard Details
City of Farmington Water Main Standard Details