Charter Township of Ypsilanti

Engineering Standards and Design Specifications

Charter Township of Ypsilanti
"Placing Residents First"

Charter Township of Ypsilanti
7200 S. Huron River Dr.
Ypsilanti, MI 48197

Ypsilanti Community Utilities Authority
2777 State Road
Ypsilanti, MI 48198-9112

Adoption Date: April 2009
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OHM Advancing Communities℠

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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 Charter Township of Ypsilanti (Ypsilanti Township) 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 (standards) are intended to guide public capital improvement infrastructure projects that occur within the Township and that are under the jurisdiction of Ypsilanti Township, the Ypsilanti Community Utilities Authority (YCUA). These standards are also intended to serve those who wish to develop or redevelop a property within Ypsilanti Township and ensure that a high level of quality during the planning, design and construction phase 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, storm water management, paving improvements, grading and earthwork and soil erosion and sedimentation control.

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 the standards and Township ordinances prior to starting design and communicating with Township and agency staff throughout is strongly encouraged and will help achieve positive results with regards to the proposed improvement.

These standards supplement all other applicable requirements of the Township 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 planning, engineering design and construction of an infrastructure improvement, the Ypsilanti Township Office of Community Standards (OCS) can be contacted for information or answers to questions that may arise. The Township OCS can be reached at (734) 485-3943.

B. Capital Improvement and Public Infrastructure Design

For all public capital improvement and infrastructure design being conducted within Ypsilanti Township the Technical specification sections starting with Section III (Topographic Survey) through Section IX (Soil Erosion and Sedimentation Control) should be followed.

1. Permit Requirements

   For all public capital improvement designs, permits and/or waivers may be necessary from Ypsilanti Township, YCUA 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 and what potential existing infrastructure may impact the proposed improvement. A listing of facilities and controlling agency 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 agency may need to be contacted based on the uniqueness of the project area.

Local Facility	Controlling Agency	Permit or Waiver	Contact information
Water Supply System and Wastewater System	Ypsilanti Community Utilities Authority (YCUA)	Letters of Approval	Engineering Department 2777 State Road Ypsilanti, Michigan 48198 (734) 484-4600
Public Roadways	Washtenaw County Road Commission (WCRC)	Letters of Approval & Permits or Waiver Letter Claiming No Jurisdiction	555 N. Zeeb Road Ann Arbor, Michigan 48103 (734) 761-1500
Well / Septic Services	Washtenaw County Department of Planning and Environment	Permit or Waiver Letter	705 N. Zeeb Road PO Box 8645 Ann Arbor, MI 48107-8645 (734) 222-3930
Soil Erosion & Sedimentation Control	Charter Township of Ypsilanti	Permit or Waiver Letter	Office of Community Standards (OCS) 7200 S. Huron River Drive Ypsilanti, Michigan 48198 (734) 485-3943
Bus Stops	Ann Arbor Transportation Authority (AATA)	Letter of Approval where bus stops proposed/affected	2700 S. Industrial Hwy. Ann Arbor, MI 48104 (734) 973-6500
County Water Resources	Washtenaw County Water Resources Commissioner	Letter of Approval, Permit or Waiver Letter Claiming No Jurisdiction	P.O. Box 8645 705 N. Zeeb Road Ann Arbor, Michigan 48103 (734) 994-2525

Regional or State Facility	Controlling Agency	Permit or Waiver	Contact information
State Roadways: Interstate 94, Michigan Avenue, Washtenaw Avenue, and Ecorse Road	Michigan Department of Transportation	Letter of Approval and Permits	Brighton TSC 10321 Grand River Avenue Suite 500 Brighton, MI 48116 (810) 227-4681

Regional or State Facility	Controlling Agency	Permit or Waiver	Contact information
Water Supply System	Detroit Water and Sewerage Department Suburban Design Section and/or	Stamp of Approval or Waiver Via YCUA (Submittal must be via YCUA)	1420 Washington Boulevard, 6th Floor Detroit, Michigan 48226-1718 (313) 964-9505
	Michigan Department of Environmental Quality Public Wastewater and Drinking Water Unit Water Bureau	Act 399 Permit (Submittal must be via YCUA or DWSD)	Jackson District Office 301 E. Louis Glick Highway 4th Floor State Office Building Jackson, Michigan 49201 (517) 780-7900
Wastewater System	Michigan Department of Environmental Quality Public Wastewater and Drinking Water Unit Water Bureau Southeast Michigan District Office	Part 41 Permit (Submittal must be through YCUA)	27700 Donald Court Warren, MI 48092-2793 (586) 753-3700
Wetlands and Impacts to Waters of the State	Michigan Department of Environmental Quality and/or EPA	Permit	LWMD-PCU PO Box 30204 Lansing, MI 48909-7704

Franchise Facility	Controlling Agency	Permit or Waiver	Contact information
Gas	DTE Energy (MichCon)	Letter of Approval (Projects where gas lines are impacted)	Replacement Team Noble Second Floor 3200 Hobson Detroit, Michigan 48201 (313) 577-7350
Electric	DTE Energy	Letter of Approval (Projects where electric lines are impacted)	Case Manager 982 Broadway Ann Arbor, Michigan 48105 (734) 332-3313

Franchise Facility	Controlling Agency	Permit or Waiver	Contact information
Telephone	AT&T	Letter of Approval (Projects where phone/fiber optic lines are impacted)	550 S. Maple Road Ann Arbor, Michigan 48103 (734) 996-5300
Cable Television/Telephone	Comcast Cable Communications, Inc.	Letter of Approval (Projects where cable lines are impacted)	5855 Interface Drive Ann Arbor, Michigan 48103 (734) 369-3776

Private Facility	Controlling Agency	Permit or Waiver	Contact information
Wolverine Pipeline	Wolverine Pipeline	Letter of Approval for crossings	8075 Creekside Drive Portage, MI 49024 (269) 323-2491
BP Pipeline	BP Pipeline	Letter of Approval for crossings	299 Industrial Park Dr Belleville, MI 48111 (734) 699-5514
ANR Pipeline	ANR Pipeline	Letter of Approval for crossings	27725 Stansbury Boulevard Farmington Hills, MI 48334
Norfolk Southern Railroad	Norfolk Southern	Letter of Approval for crossings, ROW Occupation	DMJM Harris 260 S. Broad St., Ste. 1500 Philadelphia, PA 19102 Attn: NS Pipe and Wire Administrator

2. Standard Details

   Standard details for water supply system, wastewater system and stormwater management features are included in the electronic appendix compact disk (CD) included within these standards. For all proposed public infrastructure improvement projects within Ypsilanti Township, the standard detail sheets shall be included in the plan set.

C. Private Development Process

The plan review process in Ypsilanti Township 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 check lists 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 which 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 Township, their consultants and local agencies to discuss design concepts and to 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 Township Office of Community Standards (OCS) to distribute for review not less than two weeks before the meeting date. All applicable fees shall be paid by the applicant and the Township will schedule this meeting to be held at the Township Civic Center (located at 7200 S. Huron River Drive, Ypsilanti MI, 48197). The Township will forward invitations to all applicable local agencies. It is intended that the applicant will receive feedback from the reviewing agencies to facilitate and streamline the plan review process.

   b. Site, Sketch or Plot Plan Review

      The Township OCS will require that each development that is subject to site plan, sketch plan or plot plan review per the ordinance, create and submit a plan for review. The Township OCS 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 Township Ordinances. The applicant shall submit plans and fees to all applicable agencies. These submittals can be coordinated through the Township OCS Department. With submittals, review fees shall be paid in accordance with the adopted Township Fee Schedule to the Township OCS for tracking and distribution. It should be noted that other agencies, including YCUA, WCRC and the Water Resources Commissioner's Office may also have review fees that are not covered by those collected at the Township. The Township and / or their consultants and other agencies will then review the plans and prepare letters to be sent back to the Township OCS generally within three weeks of distribution. If OCS staff determines the plans to be in good order, then OCS staff will present the submitted plan to the Township Planning Commission for action. The Planning Commission may approve, approve with conditions, table, deny or make a recommendation to the Township Board. 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 Township Board 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, wastewater system, storm water 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 OCS. The OCS staff will 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 Township Planner, Engineer and YCUA reviews that are required, 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 Township. 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 Township approvals, the applicant shall compile and submit all relevant items requested by the Township, YCUA or the Township Engineer. Once these items have been properly completed the applicant will be able to proceed with construction activity.

a. Pre-Construction Requirements

Upon approval of detailed engineering plan, 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 assumed production rate. The applicant acknowledges understanding of the document by submitting all applicable documents and attending the pre-construction meeting. If any of the items listed in this letter are not in place prior to the start of the pre-construction meeting the Township and/or YCUA holds the right to reschedule the pre-construction meeting to a later date when all items have been properly submitted to the satisfaction of the Township, the Township Engineer and YCUA.

b. Performance Guarantees

As part of the site development process, Ypsilanti Township 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 Section 2307, Security for Completion of Improvements and Section 2308, Guarantee, of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances.

i. The Township will require a performance guarantee in an amount not less than 100% of the engineer's opinion of cost for the storm water 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. 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 Township from the financial institution is received sixty days prior to its expiration date. This security shall remain on deposit with the Township until recommendation of final acceptance of the infrastructure improvements is given by the Township Engineer. At the time of final acceptance, the performance guarantee will be returned to the applicant.

Partial releases of the storm water management system, grading, paving, SESC, and landscaping 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 25% of the original amount. Any reduction of these guarantees will only be considered after a written request has been submitted to the Township OCS during construction and after substantial completion.

ii. In addition to the security and guarantee required by the Township noted above, the applicant shall post with YCUA guarantee for completion of the water supply system and wastewater system improvements as depicted on the approved detailed engineering plans.

The guarantees for YCUA shall be presented in the form of a cashier's check or irrevocable standby letter of credit for 100% of the engineer's opinion of cost for the proposed water supply system and wastewater system improvements, as defined in item I.C.1.c. 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 YCUA from the financial institution is received sixty days prior to its expiration date. This security shall remain on deposit with YCUA until final acceptance of the water supply system and wastewater system improvements as public utilities by the YCUA Board of Commissioners. At the time of final acceptance, the performance guarantee will be returned to the applicant upon receipt of a two-year maintenance and guarantee security.

Partial releases of the water supply and wastewater 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 25% of the original amount. Any reduction of these guarantees will only be considered after a written request has been submitted to YCUA during construction and after substantial completion.

iii. A record drawing and easement guarantee in the form of a cashier's check or irrevocable standby letter of credit is required prior to proceeding with construction. The Township Engineer will determine this amount based on an estimate of what it would take for the Township Engineer to complete this work. This deposit shall be made to either YCUA or the Township at the same time the construction services escrow is established. If AutoCAD drawings are not provided immediately following detailed engineering approval, the cost will be based on a full topographical survey.

iv. 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 either the Township or YCUA must be paid in full prior to commencement of construction.

All YCUA trunk line and transmission charges, YCUA benefit charges, YCUA tap fees and the construction phase escrow deposit shall be paid to YCUA prior to the start of any construction. Information regarding trunk line and transmission charges, benefit charges, and tap fees are available by contacting the YCUA Engineering Department at 734-484-4600. All fees should be verified with Ypsilanti Township and/or YCUA for annual updates.

i. The applicant shall establish a construction phase escrow account in accordance with Section 2306, Fees, of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances and as specified herein to cover costs associated with the inspection of all public improvements. This account shall be maintained by YCUA unless directed otherwise by YCUA and/or the Township.

ii. The construction phase escrow deposit amount will be determined based upon 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 Township Engineer no later than one week prior to the pre-construction meeting.

iii. YCUA will add a non-refundable administrative fee amounting to 1% of the total construction cost as outlined on the approved final engineer's opinion of cost. This fee shall be paid at the time the construction phase escrow account is established.

iv. The applicant shall deposit the construction phase escrow monies (including the non-refundable administrative fee) with YCUA at least 48 hours prior to the pre-construction meeting. For smaller projects, typically those that do not include underground utility construction, the Township may have the construction phase escrow deposit placed with the Township OCS Department. Instructions regarding the construction phase escrow and with whom it is to be placed will be provided in the pre-construction requirements letter from the Township Engineer. The applicant shall provide the Township Engineer with a copy of the receipt verifying that the appropriate deposit has been made with either entity.

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

vi. Construction phase services will be invoiced monthly against the construction phase escrow account based upon the established hourly rate by YCUA and/or the Township Engineer. The Township engineer will track these escrow

accounts and if necessary send notifications to the attention of the Township, YCUA, and the applicant if production rates are less than anticipated, and create the possibility of a deficit or negative balance. The Township engineer will monitor and send notices to the Township, YCUA and the applicant at 50% escrow depletion and 90% escrow depletion if the actual production rate in the field is behind the rate in which escrow is being depleted. If additional deposits are required, then YCUA or the Township will determine an appropriate amount using the same method and 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 YCUA or the Township. In addition, YCUA will add a nonrefundable administrative fee amounting to 5% of the additional escrow deposit to be paid at the time the additional funds are deposited with YCUA. Prompt attention to maintaining the account will prevent construction operations from being stopped and/or occupancy permits 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 and maintain, during the term of the project, public liability and property damage insurance with a responsible insurance company which meets the approval of the Charter Township of Ypsilanti. 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 $1,500,000

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 Charter Township of Ypsilanti and YCUA for examination as to their validity. Any undesirable exclusions deemed improper by legal opinion rendered to the Township and/or YCUA 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 30 days written notice will be given by the insurance carrier to the Township and YCUA prior to 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.

Additional Named Insured under Owners and Contractors Protective Liability and Property Damage Insurance will include the Charter Township of Ypsilanti; the Ypsilanti Township Board of Trustees, jointly and individually; all Ypsilanti Township employees; the City of Ypsilanti; the Ypsilanti City Council, jointly and individually, and all City of Ypsilanti employees; the YCUA Board of Commissioners, jointly and individually; all YCUA employees, agents, and consultants, individually.

e. Construction Drawings

Prior to the pre-construction meeting, the applicant's design engineer shall submit six sets of the approved detailed engineering plans to the Township Engineer for processing and distribution to the appropriate parties. In addition, digital versions of the construction drawings shall be provided that include both AutoCAD and Adobe PDF files. AutoCAD data shall be projected to State Plane Coordinates and shall use NAVD '88 vertical datum.

3. Construction Phase

a. Pre-Construction Meeting

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

Attendees at the pre-construction meeting (as well as any project progress meetings) shall include representatives from the Township, YCUA, the Township Engineer, the Building Department Director, the Fire Marshal, the applicant, the applicant's design engineer, 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 Township Engineer a minimum of 10 calendar days prior to the desired start of construction to schedule the pre-construction meeting. The pre-construction meeting shall be scheduled a minimum of 5 days prior to the start of

construction. The pre-construction meeting will not be scheduled until all required approvals and documentation is received by the Township OCS. Pre-construction meeting forms are included in Appendix C.

b. Construction

The Township, YCUA or designated representative(s) of those entities will provide observation of construction of all public utilities and improvements within 10 feet of any proposed or existing building. Observation will be full time on water supply systems, wastewater facilities, storm water 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 on-site 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 Township, YCUA or designated representative(s) of those entities.

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

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

The Washtenaw County Water Resource Commissioner's office will provide inspection for work associated with county drains or other water courses within their jurisdiction. The Township, or their designated representative(s) may provide assistance observing portions of the project for the other agencies.

The applicant or the applicant's contractor shall notify the Township, YCUA or designated representative(s) of those entities a minimum of 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 the field staking and provide appropriate cut sheets to the Township, YCUA or designated representative(s).

Deviations from the approved detailed engineering plans that are determined by the Township, YCUA or designated representative(s) to be significant will require review and approval of the Township, YCUA or designated representative(s) prior to staking and construction of the revised work. Deviations that are deemed to be significant will need to be submitted in writing (with revised plans as necessary) to the Township, YCUA 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 current MIOSHA safety standards.

c. Substantial Completion

At the completion of the installation and successful testing of all underground utilities and 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 YCUA, the Township, the Township Engineer, and other appropriate agencies. At this meeting a preliminary punch list will be generated and distributed by the Township Engineer. Once all punch list items are addressed to the satisfaction of the Township Engineer a substantial completion letter will be issued by the Township Engineer. Only after this point can performance guarantees be reduced. This may be accomplished by submitting a request in writing to the Township OCS and/or YCUA depending on the guarantee that being considered for reduction. 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 the substantial completion and final acceptance of the underground utilities and paving improvements, said facilities will be subject to periodic inspection by the Township, YCUA 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, 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 YCUA, the Township, the Township Engineer and the applicant's representative.

4. Project Completion

a. Record Drawings

To ensure that accurate records exist for all newly installed infrastructure within Ypsilanti Township, 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 both Ypsilanti Township and YCUA at the time of the pre-construction 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 YCUA and/or the Township 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 date of the issued substantial completion letter) to prepare and submit to the Township Engineer an approvable set of record drawings. These record drawings will be submitted in a digital format (AutoCAD and pdf) and on bond and Mylar. Digital record drawing specifications are included on the Digital Appendix CD.

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

If this occurs, the Township and/or /YCUA will direct the Township Engineer to prepare the record drawings utilizing the digital plans previously submitted. Once this notification to proceed has been given to the Township Engineer, delivery of the record drawings to the Township/YCUA 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 Township Engineer and the appropriate legal counsel for review and approval. Once easements are approved, the easement shall be forwarded by the applicant to the County Register of Deeds and recorded. Copies of recorded easements shall be forwarded to the Township Engineer, YCUA and the Township 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 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 YCUA the applicant shall post with YCUA a two-year Maintenance and Guarantee security. 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 water supply system and 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 might also require maintenance guarantees.

e. Final Acceptance

Final acceptance will not be made until all improvements shown on the approved detailed engineering plans are completed. In addition, all other requirements as outlined in the pre-construction requirements letter or, if applicable, a development agreement must be 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 Section 2115, Site Plan Review, of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances. These engineering standards are not intended to repeal, annul, or in any manner interfere with the existing regulations or laws of the Charter Township of Ypsilanti or the Ypsilanti Community Utilities Authority, nor to conflict with any statutes of the State of Michigan or Washtenaw County. The only exception being, these standards will prevail in cases where they impose a greater restriction than is provided by the existing statutes, laws or regulations.

B. Preapplication Meeting

The applicant seeking site plan approval from Ypsilanti Township is required to set up a pre-application meeting with Township staff, their consultants and other appropriate agencies prior to plan preparation. The purpose of this meeting is to discuss concept, land use, location of utilities, access to the site and 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 intent and nature of the use should be prepared and submitted to the Township 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 Township Office of Community Standards (OCS) to determine review fees and the number of plans to be submitted. When the completed plan and associated fees have been received by the Township OCS, it will be distributed to the staff and consultants for review and comments. The plans are reviewed to determine the practicality of the project and impact on services and surrounding properties. Compliance with Township Standards and Ordinances will also be reviewed. Special engineering design considerations may also be addressed.

It is important that the plan reflect the requirements needed to assure passage through the Township 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 Township OCS has received all reviews from the various agencies and completed their own review, the Township will administratively determine if the package is ready to be forwarded to the Township Planning Commission for their consideration. All documents and fees required for Planning Commission approval must be received by the Township according to the Planning Commission calendar. The Township OCS

Staff will assemble all comments and provide them to the Planning Commission for their review.

If the plan is approved by Planning Commission, or when applicable, the Township Board, 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 applicable comments and resubmit if desired. The plan will be returned to the applicant as often as is necessary to meet Township requirements.

All documents and fees required for Planning Commission approval must be received by the Township 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 Township Civic Center Building and online at: http://www.ytown.org.

D. Plot Plan Review

Any use not covered in section 2115 in Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances shall be subject to a plot plan review. The plot plan review process will follow the procedures and standards prescribed by Section 2302, Plot Plan Review, of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances. These engineering standards are not intended to repeal, annul or in any manner interfere with the existing regulations or laws of the Charter Township of Ypsilanti or the Ypsilanti Community Utilities Authority, nor to conflict with any statutes of the State of Michigan or Washtenaw County. The only exception being, 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 ground water mark or make necessary arrangements with the Township 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 Sections 2115.3.h through 2115.3.j of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances and the requirements specified herein.

The applicant shall contact the Township OCS 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 required fees shall be submitted to the OCS. A sample estimate and engineering submittal form has been included in Appendix B of this document.

Three copies of a detailed itemized construction cost opinion for all water supply system, wastewater system, storm sewer, retention/detention basins, grading and paving, and clearing and restoration shall be submitted to the Township OCS 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 Township OCS 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 Township OCS.

A checklist for detailed construction and engineering plans is provided in Appendix A 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 Township.

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

If plan revisions are required following the review, 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 Township OCS. Submittals will not be reviewed unless they are received from the Township OCS. After two reviews without approval, the applicant, the applicant's engineer, the Township Engineer and a representative from the Township OCS, 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 Township Engineer recommends approval but significant changes occur after the fact due to another agencies review, the plans must be resubmitted to the Township for a final review. All applicable fees must be paid for this review. Approval from all applicable agencies is required prior to proceeding with 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 prescribed by Chapter 24 Article VI Sections 156-207 of the Charter Township of Ypsilanti 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 Charter Township of Ypsilanti, nor to conflict with any statutes of the State of Michigan or Washtenaw County. The only exception being, these standards will prevail in cases where they impose a greater restriction than is provided by the existing statutes, laws or regulations.

The Township OCS is designated as the Soil Erosion and Sedimentation Control Municipal Enforcement Agency for the Charter Township of Ypsilanti. All applications, plan reviews, and permitting requirements will be addressed by the Township OCS. When work occurs within the public road right-of-way of either the Washtenaw County Road Commission or MDOT the SESC falls under the jurisdiction of those respective

entities as they are an Authorized Public Agent (APA). This SESC work is subject to MDEQ inspections and audits.

A Township SESC permit is required for any activity that facilitates an earth change which disturbs one or more acres of land or 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 a SESC permit until that permit has been obtained from the Township OCS.

The SESC plan review and permit process begins by completing the Township Detailed Engineering / Soil Erosion Control Application. The plans, a completed application form and required review fees shall be submitted to the OCS. 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 the soil erosion and sedimentation control technical section (Section IX) and also the Washtenaw County Soil Erosion and Sedimentation Control Program Guide.

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 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 utilizing 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. On-site, intermittent elevations and/or defined contours (minimum contour interval of 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 necessarily be limited to the following items:

    a. Ditches.
    b. Culverts.
    c. Water supply system, storm water management and/or sanitary sewer facilities, including inverts and casting elevation 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 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 line.
    b. Ditch centerline.
    c. Top of bank.
    d. Edge of shoulder.
    e. Edge of pavement or top of curb.
    f. Crown or centerline.

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 Detroit Water and Sewerage Department (DWSD), and as specified herein.

2. All water supply system improvements will require the review and approval of Ypsilanti Community Utilities Authority (YCUA). The majority of water supply system improvements will also require the review and approval of both DWSD and the Michigan Department of Environmental Quality (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.

3. YCUA 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 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 YCUA Water System Master Plan may be required as part of the project. The applicant shall contact the YCUA Engineering Department to determine if any improvements identified in the latest revision of the YCUA Water System Master Plan 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 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 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 restraint, including any necessary design calculations, shall be provided on the plans.

e. Plans showing any proposed water supply system improvement, public and/or private, shall be accompanied by the YCUA 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 YCUA. Utility service 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 electronic mail address (if available).

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

c. The utility service plan shall be prepared to a 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 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 from the building corners; dimension the curb stop and box from the building corners.

7. 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 is available by contacting the YCUA Engineering Department.

B. Design Criteria

1. Water Transmission and Distribution Mains

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

   b. Water supply systems shall be designed to provide service from a double source of supply ("looped main") or, with the written approval of YCUA, to be provided service by a double source of supply in the future when adjacent properties are developed. Approval of a single source of supply will require the applicant to post a guarantee with YCUA to allow for provision of a double source of supply if adjacent properties do not develop within a reasonable time.

   c. Terminal dead end water mains with domestic service connections are discouraged, and will not be permitted without the written approval of YCUA. 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:

      i. 40' for 6" diameter fire hydrant service pipe.

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

      iii. 1,000' for 12" diameter and larger water distribution mains.

   d. Wherever possible, water mains and appurtenances shall be located outside the influence of existing or proposed pavement. Within existing or proposed public road rights-of-way, 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 public road rights-of-way will be evaluated individually.

e. A minimum 10' horizontal separation shall be maintained between water main and sanitary sewers and/or storm sewers. A minimum 5' horizontal separation shall be provided between water mains and other underground utilities and/or structures. If it is not feasible 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 IV.C. A variance will be required from both YCUA and MDEQ for any proposed water supply system improvements that will not satisfy the minimum horizontal separation requirements.

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

g. 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 45o 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 YCUA in order to determine if joint deflection will be acceptable.

h. Where changes in 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 finish 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 III.B.1.g .

2. Joint Restraint

a. Joints shall be restrained per the pipe material manufacturer's recommendations. For ductile iron pipe, joint restraint 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 YCUA.

b. Concrete thrust blocks will not be permitted except behind hydrant shoes and tapping sleeves. Use of concrete thrust blocks in other locations will not be permitted without the written approval of YCUA. 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 connecting 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 and smaller shall be gate valves and valves on water mains larger than 16" diameter shall be butterfly valves.

      ii. Valves shall be located such that:

         (a) No more than three valves are required to isolate any section of water main. Four valves to isolate a section of water main may be approved by YCUA.

         (b) Valves shall be located at intervals of not more than 500' in non-residential areas and at not more than one block or 800', whichever is less, in residential areas. In areas where customers are widely scattered and future development is not anticipated, larger intervals between valves may be approved by YCUA.

         (c) No more than 2 fire hydrants are out of service.

         (d) No more than 24 single family residences or 30 multiple family residences are out of service.

   c. Tapping Valves
      i. 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 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 separate 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 YCUA, 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.

i. Hydrants within residential areas shall be located between the back-of-curb and sidewalk within 10' of 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.

ii. 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 YCUA and the Township Fire Marshal.

iii. 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 or equivalent construction, including brick and stone veneer.

iv. 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.

b. 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 allowed within 15' of 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

(a) Domestic water services shall be a minimum of ¾" diameter in the Township and 1" diameter in the City. Larger diameter domestic water services will require the review and approval of YCUA.

(b) Irrigation water services for single-family residences and 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 irrigation water services for multiple-family residences and non-residential properties where the

irrigation water service will be connected directly to a YCUA distribution main will be evaluated individually.

(c) Fire suppression water services shall be designed by the applicant and require the review and approval of YCUA.

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

ii. Responsibility for Connections

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

(b) Connections to YCUA 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.

(c) Connections to YCUA distribution mains for multiple-family residential and non-residential properties shall be the responsibility of the applicant.

(d) Connections to YCUA distribution mains solely for fire suppression or irrigation purposes shall be the responsibility of the applicant.

iii. Location

(a) 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.

(b) The minimum allowable horizontal separations between water services and other facilities are as follows:

(1) Other water services – 2’ each.

(2) Sanitary sewer leads – 3’.

(3) All other utilities and structures – 5’.

(c) 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 public road right-of-way.

(d) 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. YCUA will be responsible for maintaining the water service(s) and appurtenances from the YCUA 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.

c. Domestic

   i. Each individual residence or building connected directly to the YCUA 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 YCUA meter will be issued.

   ii. No domestic service connections will be permitted from 6" fire hydrant leads or transmission mains. Combined domestic or irrigation and fire suppression services will not be permitted.

d. 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 YCUA distribution mains or to the domestic water service upstream of the domestic meter. Irrigation water services connected directly to YCUA distribution mains require a meter.

   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.

e. 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 YCUA 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 YCUA distribution main and also having supplemental supplies of non-potable water, or being located within 500' of a body of water, shall be isolated from the YCUA distribution main by an approved backflow prevention device.

   iv. Fire suppression systems directly connected to a YCUA distribution main and which incorporate an elevated storage tank for fire protection shall be isolated from the YCUA 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 YCUA 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 to YCUA a service charge equal to the cost of the meter upon making application for service. Ownership of meters will remain with YCUA.

ii. YCUA reserves the right to review and approve the size of meter requested for each meter installation. For premises to be served by a 1¼" or larger water service the applicant shall provide to YCUA a complete itemized building fixture count 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 ¾" 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. 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 an easily accessible area. Nothing shall be stored or placed in the area of the meter which would hinder YCUA personnel from accessing the meter for the purpose of reading, inspecting, repairing, or replacing it.

ii. Meters on irrigation water services connected directly to YCUA distribution mains where the meter cannot be located within a building shall be installed in an above ground meter enclosure, such as Lok 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 YCUA. 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 YCUA. Master meters will be reviewed on an individual basis and shall include such auxiliary equipment as deemed necessary by YCUA, including but not necessarily limited to the following:

i. Master meters shall be installed in an underground vault with 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 YCUA.

8. Design of other water supply infrastructure, including but not necessarily limited to pressure reducing valves, storage facilities, and booster pump stations, will be evaluated and approved by YCUA 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 pressure class 350 ductile iron manufactured in accordance with AWWA C151 (ANSI A21.51), latest revision thereof. 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.

b. 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 ductile iron will not be allowed unless approved by YCUA.

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 YCUA.

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 YCUA. 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 YCUA 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 Lok 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 Township and clockwise (right) within the City. All valves shall be equipped with an operating nut 2" square at the base tapering to $1^{15}/_{6}$" 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. Stem shall be bronze of non-rising design with double O-ring packing.

c. Butterfly valves shall conform to AWWA C504, latest revision, and DWSD 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 5¼" 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 YCUA.

   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:

(a) 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).

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

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

(d) 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.

(e) Connection of water main larger than 24” diameter to valve wells shall be as approved by YCUA.

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 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. Hydrants shall have two 3½” (4.05” O.D.) pumper connections with National Standard 7½ threads per inch. All hydrants shall have City of Ann Arbor standard thread pattern.

e. All hydrants shall have a 4” Storz adapter. 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 from the road.

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

7. Water Services

   a. Water services ¾" to 2" in diameter shall be Type K copper. Pipe material for water services larger than 2" in diameter shall be in accordance with item IV.C.1.b. Water service pipe material shall be homogeneous between the YCUA distribution main and the outlet coupling downstream of the meter.

   b. Couplings for water services ¾" 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 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 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 ¾" to 2" diameter shall be Ford B22-###W Series or approved equal.

   b. Curb boxes shall be extension type with arch pattern base with 1" upper section such as Series 5601 for ¾" and 1" diameter curb stops and Series 5603 for " 1¼" to 2" diameter curb stops as manufactured by A.Y. MacDonald Mfg. Co. or approved equal. Curb box lids shall be cast iron with a one-piece two-hole Erie pattern lid such as 5601L as manufactured by A.Y. MacDonald Mfg. Co. or approved equal.

   c. Curb stops and boxes shall be provided with a stainless steel stationary shut-off rod attached to the curb stop with a stainless steel pin.

10. Meters

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

    b. Master meters 12" and smaller shall be Class 2 Turbine Meters manufactured by Sensus or approved equal. Compound meters are acceptable, subject to review and approval by YCUA. Meters larger than 12" diameter will be considered on an individual basis. Registers on master meters shall be Intelligent Communications Encoder as manufactured by Sensus or approved equal and shall indicate consumption in cubic feet.

    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

        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 Controls 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 4" 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 RangerII 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 pumps stations, will be evaluated individually.

D. Construction Methods

1. General

a. Excavation

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

Subject to the approval of YCUA, 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. The proprietor shall provide YCUA certification for any backflow prevention devices proposed for use and shall coordinate acceptable connection locations with YCUA. As directed by YCUA, any water used from the system may be required to be metered and paid for at the current YCUA water usage rate in effect at the time of the construction of project.

c. Valve Operation

Unless directed otherwise by YCUA, operation of valves on the existing water supply system will be the responsibility of the contractor performing the work. All valve operation performed by a contractor shall only be observed by YCUA and/or its designated representative. Advanced notice to YCUA and/or its designated representative as well as any YCUA customers whose water supply will be interrupted by the valve operation is required. Such advanced notice shall

be the responsibility of the contractor and shall be provided at least two 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

      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

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

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 YCUA.

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

4. Sequencing

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

   a. Install new water main and appurtenances.

   b. Flushing.

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

   d. Disinfection.

   e. Flushing.

   f. Bacteriological testing.

   g. Hydrostatic testing.

   h. Connect to existing water supply system.

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

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

5. Installation

   a. 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.

         (a) Ductile iron pipes shall be fully enclosed in polyethylene encasement and laid on a compacted sand cushion, 4" thick. Sand shall conform to fine aggregate MDOT 2NS.

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

         (c) 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 YCUA shall be installed in accordance with all applicable standards, manufacturer's recommendations, and as directed by YCUA.

      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 methods including, but not necessarily limited to, casing pipe construction and river crossings shall be completed as directed and/or approved by YCUA.

   b. Joints and Joint Restraint

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

      ii. Restraints shall be applied to all joints that deflect pipe 11¼o 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 YCUA, 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 YCUA. 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 of 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 YCUA.

iii. All flexible pipe to valve well connections shall be installed per manufacturers' 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 2 coats of Rustoleum OSHA "Safety Yellow."

e. Cleaning and Testing

i. Cleaning

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 my 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

(a) Bacteriological

After flushing, the water mains shall be disinfected in accordance with AWWA C651, latest revision.

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

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.

(b) Hydrostatic

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

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

The proprietor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible leaks and cracks, and re-tests with his 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.

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. Testing shall be conducted under the observation of the YCUA or its designated representative.

At the option of YCUA, 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.

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 YCUA for approval. The testing schedule shall be coordinated with YCUA or its designated representative.

f. Water Services

i. Water services ¾” to 2” diameter shall be installed in accordance with manufacturers’ recommendations. 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 a 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 YCUA.

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

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

i. Meters

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

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

j. Backflow prevention devices shall be installed in accordance with applicable AWWA standards and manufacturers' 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 YCUA.

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 YCUA.

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 Ypsilanti Community Utilities Authority (YCUA). Proposed public wastewater system improvements will require the review and approval of YCUA and the Michigan Department of Environmental Quality (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 wastewater system may have to be public even though the project has one owner. YCUA approval will be required for private wastewater system serving more than one residence or building. The extension of sanitary sewers will generally be required across the entire frontage of the site.

3. Wastewater system improvements specified in the latest revision of the YCUA Sanitary Sewer Master Plan may be required as part of the project. The applicant shall contact the YCUA Engineering Department to determine if any improvements identified in the latest revision of the YCUA Sanitary Sewer Master Plan will need to be incorporated as part of the project.

4. 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 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 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 YCUA standard wastewater detail sheets. The standard details are included in Appendix A.

5. 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 YCUA. 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 electronic mail address (if available).

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

c. The utility service plan shall be prepared to a 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 necessarily 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.

6. 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 is available by contacting the YCUA Engineering Department.

7. Projects involving non-residential discharges to the YCUA wastewater collection system may be required to be designed, constructed and operated in accordance with the Industrial Pretreatment Program as identified in the YCUA Sewer Use Ordinance, latest revision.

B. Design Criteria

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 an equivalent residential unit (ERU). The basis of design calculations shall include a tabulation of the proposed usage types and the conversion of the various uses into ERUs. The adopted unit factors as included in the YCUA Trunkline and Transmission Line Service Charge ordinance shall be used to convert different usage types to ERUs. These factors may be obtained by contacting the YCUA Engineering Department.

   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 design flow 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 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 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 discharges to the YCUA 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 YCUA.

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 not feasible 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 YCUA and MDEQ for any proposed wastewater system 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°.

3. Depth of Sewers

a. The minimum depth of cover over the top of 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 YCUA 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 YCUA.

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. Monitoring locations as identified in the YCUA Sewer Use Ordinance, latest revision.

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 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° or more.

5. Building Sewers

a. General

i. Except as permitted by the YCUA Sewer Use Ordinances, each individual residence or building connected to the YCUA 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 sanitary 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 within 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 extension 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 4" diameter pipe.

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

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

g. Cleanouts shall be provided within 5' of foundation walls, at all bends and 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 pipe 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 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 no less than 6" above the invert of the outlet gravity sanitary sewer invert and no more than 2' above the flow line in the gravity sanitary sewer.

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

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

9. On-site sewage disposal will be allowed in locations where public gravity sanitary sewer is not available. A copy of a valid on-site sewage disposal system permit from the Washtenaw County Environmental Health Division must be submitted prior to plan approval.

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 ratio (SDR) no greater than 26.

ii. Extra strength clay pipe conforming to the requirements of ASTM C700, latest revision.

iii. 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 YCUA.

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 YCUA. Push-on type joints shall conform to ASTM D3212, latest revision. Solvent weld joints, where approved by YCUA, shall conform to ASTM D2855, latest revision.

ii. Bell and spigot joints on extra strength clay pipe shall be in accordance with requirements of ASTM C425.

iii. Modified grooved tongue joints for reinforced concrete pipe shall have a rubber gasket snapped into a groove cast in to the tongue. 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 YCUA 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 YCUA.

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 YCUA, 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 YCUA.

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 YCUA.

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 YCUA.
    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 a 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 YCUA, pumps shall be 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.

6. On-site sewage disposal systems shall be constructed using materials approved by the Washtenaw County Environmental Health Division.

D. Construction Methods

1. General

   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.

      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 YCUA.

      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 YCUA.

      ii. The condition of the existing wastewater system will be observed by YCUA 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 actions 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

      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

      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 YCUA.

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

4. Construction Sequence

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

5. Installation

   a. Sanitary Sewer Pipe

      i. General

         (1) All pipe shall be laid true to the required lines and grades. All trenches when pipe laying is in progress shall be kept dry; and all pipes and fittings shall be uniformly supported on a 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 manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the invert. The interior of 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 lining. 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 YCUA, the backfilling shall follow and be completed to the top of the trench within two pipe lengths behind 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 existing or new 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 as shown by the 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 YCUA.

ii. Gravity Sanitary Sewer

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

(2) Extra strength clay pipe shall be installed in accordance with the requirements of ASTM C12, latest revision.

(3) 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.C.1, Water Supply System, Construction Methods, Water Transmission and Distribution Mains.

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

b. 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.

c. Manholes and Vaults

i. Precast base section shall be placed on a well-graded granular bedding course conforming to 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 watertightness.

(2) Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the manhole steps if required by YCUA. 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. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary unless otherwise specified by YCUA.

(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 for 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 the casting 5" below finished grade, unless otherwise directed by YCUA.

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

(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.

d. Pumps and Appurtenances

Pumps and appurtenances, as well as other wastewater system infrastructure, shall be installed in accordance will all applicable ASTM standards, manufacturers recommendations, and as directed by YCUA.

e. Pressure Sanitary Sewer

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

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

      YCUA 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.

      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.

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

   b. Infiltration Test

      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 ground water level is more than 7' above the top of the sewer shall be subjected to an infiltration test.

      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

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

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

      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.

The sanitary sewer shall be pressurized to 4 psig greater than the greatest back pressure caused by ground water 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.

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 ground water level.

The time required for the 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 upon 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															
	Pipe Diameter, Inches														
Length of Line, Feet	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 TableFor 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, seconds	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

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.

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

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.

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

i. 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.

ii. 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.

iii. 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 YCUA.

iv. 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.

v. After filling with water, the line must be allowed to stand for at least 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.

vi. 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.

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

viii. 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 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.

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 or manhole to the top when performing the test.

e. Deflection Test for Plastic Pipe

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 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

As a means of insuring that pipe was properly installed and that all joints are in a "home" position, the proprietor shall be responsible for of all pipe installed that is 36" in diameter and smaller. This shall be done no sooner than 30 days after sewer installation is complete. A minimum of 24 hours notice shall be provided to YCUA prior to so that a representative may be present. The closed-circuit televising shall be recorded on Digital Video Disc (DVD), a copy of which shall be provided to YCUA for review. A satisfactory review of the recorded televising by YCUA shall be a condition for final acceptance by YCUA. Typical items to be reviewed on the DVD will include pipe deflection, pipe settlement, lead connections, joints and pipe cleanliness. If the DVD review reveals unsatisfactory conditions, the deficiencies shall be corrected and the affected pipe sections shall be re-retelevised for review by YCUA.

VI. STORM WATER MANAGEMENT

A. General

1. Storm water management systems shall be designed in accordance with the Rules of the Washtenaw County Water Resources Commissioner's Office (WCWRC) Procedures and Design Criteria for Storm Water Management Systems, latest revision.

   Projects in the following watersheds will require the review of the MDEQ due to thermal/environmental sensitivity: Chicking Ditch and Paint Creek watersheds.

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

3. Restricted discharge rates and/or improvements to downstream drainage courses may be required as prescribed by the Charter Township of Ypsilanti Storm Water Master Plan of 1994. The applicant shall contact the Township Engineer and/or the WCWRC to determine what design criteria specified in the Storm Water Master Plan apply to the proposed project.

4. 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 Township Engineer and/or the WCWRC. Such improvements shall be located in an easement secured by the applicant. The easement form and width of the easement shall be subject to Township approval.

5. Soil borings in the location of any proposed storm water 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 ground water characteristics of the site.

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

   a. Design calculations for all components of storm water 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 or 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 storm water 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 casting and all invert elevations at each structure.
      (5) Progressive numbering 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.
   x. Adjacent existing or proposed utilities plotted where parallel.

e. Where public storm sewer construction is proposed, the Charter Township of Ypsilanti standard storm sewer detail sheets must accompany the plans. The standard details are included in Appendix B.

B. Design Criteria

Components of storm water management systems shall be designed in accordance with the requirements of the WCWRC, as noted previously. The WCWRC design criteria shall apply to all storm water management system components, regardless of whether the facilities will be publicly dedicated or privately maintained at the completion of the project.

1. Storm water 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 WCWRC.

3. Storm water conveyance systems shall be designed per the requirements prescribed by the WCWRC. The following are acceptable forms of storm water conveyance:

   a. Natural streams and channels.

   b. Vegetated swales and open ditches.

c. Storm sewers. Enclosed storm sewer systems 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 WCWRC 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 WCWRC.

6. Low impact design (LID) and/or Best Management Practices (BMPs) for storm water management is encouraged within Ypsilanti Township however must be in conformance with the Low Impact Design Manual of Michigan and also in compliance with the requirements of the Washtenaw County Water Resources Office. Examples of low impact design

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 WCWRC.

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:

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

   c. The modified groove or bell end of the pipe shall be made smooth and shall have not over a 3 ½% slope for sizes 10” – 24”, or a 2% slope for sizes 27” –

108", tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer.

d. 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.

e. 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 Ypsilanti Township Standard Details as seen in Appendix B.

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 Township's Engineer.

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

e. Brick for casting 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 Township's Engineer.

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

g. A minimum of three to a maximum of six 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 Ypsilanti Township Standard Details.

b. Pavement catch basin and inlet frames and grates shall be in accordance with the requirements of the Washtenaw County Road Commission.

c. Lawn catch basin and inlet frames and grates shall be East Jordan Iron Works #1000, with Type "N" grate, or approved equal. All storm structures receiving runoff shall include raised lettering reading "Dump no waste, Drains to Waterways" and a fish logo.

d. Ditch catch basin frames and grates shall be East Jordan Iron Works #1000, with Type 01 Beehive grate, or approved equal.

e. Parking lot 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 storm water runoff. Where possible, catch basins shall be placed out of the expected wheel paths of vehicles. When catch basins are placed within areas of travel, a concrete apron shall be provided.

D. Construction Methods

1. Construction Progress

   Unless otherwise permitted by the Township Engineer and/or the WCWRC, construction of storm sewers shall begin at the outlet end of the sewer and proceed upgrade.

2. Certification and Inspection

   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 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.

   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 Township.

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

3. Excavation

   Excavation, bedding, and backfill for open cut pipe installations and structures shall be accomplished in accordance with requirements in the Grading and Earthwork Section.

4. Laying Pipe

   a. Handling Pipe and Fittings

   All pipes 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

      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.

      Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in the direction of flow. Pipes shall be laid on a 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.

      Pipes 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

      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. Pipe 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 sight device will be used to maintain line.

   d. Excavation Below Bottom of Pipe

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 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 the Grading and Earthwork section.

e. Laying and Bedding of Pipe

Pipe installation shall be made in accordance with the published installation guide 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.

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 installation of the pipe.

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 Township 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.

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 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

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

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.

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 1 foot above the top of the pipe with MDOT Grade S3. The concrete shall have a 5"slump and be mechanically vibrated to insure 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

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 carrier pipe, place bulkheads, and complete all backfilling.

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 Township Engineer. The contractor will furnish the Township Engineer with information on the quantity of sand placed.

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.

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

h. Jointing

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 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.

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

i. Gravity Pipe

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

Refer to the Water Supply System Section for acceptable construction methods and approved materials for joints and joint restraint for ductile iron pressure pipe.

k. Backfill

Backfill shall be placed in accordance with the Grading and Earthwork section.

5. Structures and Appurtenances

a. Construction methods for drainage structures shall conform to section 403.03 of the 2003 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 Ypsilanti Township Standard Details. The excavation shall be sufficiently wide 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 Appendix B.

e. With the exception of drainage structures having sumps, the bottom of the 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 plans.

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

7. Cleaning

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

8. Testing

a. General

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

b. Deflection Test for Plastic Pipe

The allowable maximum deflection shall be 5% of 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)

As a means of insuring that pipe laying was properly done 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 Township Engineer shall review and approve which pipe runs are to be recorded. The recording shall be done no sooner than thirty (30) days after sewer installation is complete. The applicant shall provide 24 hours notice to the Township Engineer prior to recording so that a representative may be present. A small amount of water must be poured in the pipe before recording to ensure identification of low spots. A satisfactory review of the DVD by the Township Engineer shall be a condition for sewer acceptance by Ypsilanti Township. 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 Township Engineer.

VII. PAVING IMPROVEMENTS

A. General

1. All roads proposed for construction in Ypsilanti Township shall be public roads under the jurisdiction of Washtenaw County Road Commission (WCRC) unless otherwise permitted by Township ordinance. Plans for such roads and/or accompanying sidewalks/bike paths shall be prepared in accordance with WCRC "Procedures and Guidelines For Developing Public Roads," latest revision. In addition to any submittals required for WCRC approval, plans shall also be submitted to the Charter Township of Ypsilanti for review of the proposed road improvements in relation to other existing and proposed facilities. The applicant shall submit three sets of WCRC approved paving plans to the Township upon County approval.

2. Private roads, when permitted, shall conform to the requirements of the Township Private Road Ordinance, Ordinance No. 97-174.

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

4. 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 Ypsilanti Township Office of Community Standards.

5. 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 sub-base is used, an approved sub-drainage system shall be installed.

6. 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, storm water 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 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 street-light poles.
vi. Location of all proposed pedestrian facilities. Bike paths may be required by the Township 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 prescribed by the WCRC. For public roads, the cross section requirements will be based on the functional class of the road as designated by the WCRC.

b. For parking lots and internal roads at nonresidential 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.

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 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 inches 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 6" thick within the right-of-way or easement and a minimum of 4" thick outside 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 township Planning Department on a case by case basis.

d. Pedestrian facilities including the inclusion of an accessible route as required by the American's with Disabilities Act (ADA) shall be designed in accordance with the requirements prescribed by the ADA and WCRC.

2. Horizontal Alignment

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

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 sections 2105 and 2106 of Appendix A – Zoning of the Charter Township of Ypsilanti Code of Ordinances. If the proposed parking abuts a proposed sidewalk that will be 7 feet wide adjacent to a building, the parking space length may be reduced by 18 inches to allow for 2 foot of overhang by a parked vehicle.

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 31' wide.
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 WCRC. 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 10' wide.

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 WCRC.

    b. Vertical alignment of driveways shall be designed in accordance with the requirements prescribed by the WCRC.

    c. Pedestrian facilities shall be designed to meet the requirements of the American with Disabilities Act, 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.

    b. Underdrainage

        i. Underdrain pipe shall be smooth plastic pipe or corrugated plastic tubing meeting Michigan Department of Transportation (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 MDOT requirements and must be approved by the Township Engineer.
        iv. Bituminous pavement materials shall be in accordance with MDOT requirements as specified on the typical cross sections prescribed by the WCRC.
        v. Concrete pavement materials shall be in accordance with MDOT requirements as specified on the typical cross sections prescribed by the WCRC.

D. Construction Methods

1. Construction methods shall be in accordance with the plan details and the 2003 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 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 completion of backfilling operations. Temporary pavements for streets and alleys shall conform to the WCRC 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, drives 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 Township Engineer for sub base, base and paving course construction.

5. Inspection

a. The Township Engineer shall be contacted prior to the preparation and placement of any of the following materials for roadways and pedestrian facilities.
   i. Subbase and underdrain
   ii. Aggregate base course
   iii. Paving course

VII. GRADING AND EARTHWORK

A. General

1. All proposed developments should be graded such that storm water 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 per Detail A or B illustrated in the standard details included in Appendix A. This 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 D.
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 Township Engineer. Earth change in excess of 0.5 Acres requires a soil erosion & 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 in part 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 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 the require the review of a structural engineer.

2. Drainage Pattern

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

   b. Standard Detail B (rear to front drainage) will be allowed by the Township Engineer only where, due to existing topography, rear to front drainage would be very difficult to achieve or not feasible.

   c. Drainage patterns other than those shown in Details A and B may be used. All non-conforming lots with drainage patterns other than those in Standard Details A or B shall be noted on the grading plan. Each 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 shall not be exceeded for terracing. The toe of 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 be not 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 Washtenaw County Water Resources Commissioner's 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 2003 Michigan Department of Transportation (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.

C. Construction Methods

1. Methods of Excavation in Earth

   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 will give ample room for:

   a. Building the structures.
   b. Bracing, sheeting and supporting the sides of the excavation.
   c. Pumping and drainage of ground water and sewage which may be encountered.
   d. 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 so that 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

      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. Unless otherwise called for on the Township's standard details, the width of a trench from the invert to a height 12" above the top of the pipe barrel shall be indicated as follows:

Pipe Size	Maximum Trench Width
4" through 12"	30"
Larger than 12"	O.D. +24"

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

      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.

Excavation for structures shall be made to the outside lines and surfaces of such structures wherever it is practicable 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 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.

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

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

Not more than 50' of trench shall be open at one time in advance of the pipe unless permitted by the Township 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 Township 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 WCRC and the Township Engineer.

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

3. Stone Refill

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

4. Excavation & Trench Dewatering

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

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 ground

water is discharged to a County Drain then a permit may be required by the Washtenaw County Water Resources Office.

Discharge from any dewatering operations shall have a suitable outlet and 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.

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.

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

   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 Township Engineer.

6. Sheeting, Bracing & Shoring

   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 to the adjacent property.

7. Crossing Existing Structures/Pipes

   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 Township Engineer. Either granular backfill or concrete shall be brought to the spring line of the higher utility.

8. Tunneling Trees

   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.

   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.

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

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

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

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

9. Backfilling

a. General

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.

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.

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.

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.

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

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

Backfill material shall be placed in layers not to exceed 12” in thickness unless approved by the Township Engineer.

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.

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

c. Backfilling Trenches

i. Bedding

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

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

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

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 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 Township Engineer, water jetting may be accepted in lieu of tamping for granular backfill only.

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.

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

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 up to the ground surface with suitable excavated backfill and shall require compaction equal to adjacent undisturbed earth.

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

d. Backfilling Around Structures

As soon as practicable 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 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 of the Township has been obtained.

10. Disposal of Excavated Material

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

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.

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 Township.

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

11. Contractor Safety Requirements

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

    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.

    Trench sides shall be either cut back to the slope as required by soil and ground water 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.

    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.

    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 Ypsilanti Township Office of Community Standards (OCS) and/or Michigan Department of Environmental Quality (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 Ypsilanti Township OCS and/or 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 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 WCSED and/or MDEQ. At a minimum, the following shall be provided for all project:
   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 Practices (BMP) guidelines published by the MDEQ and/or the Washtenaw County requirements.
2. Permanent soil erosion and sedimentation control measures shall be in accordance with the material requirements specified in other sections of above-mentioned standards.
3. The use of straw bales may only be permitted with written approval form the Township and otherwise will not be permitted in Ypsilanti Township.

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 certificate of occupancy. Inclement weather exceptions will be made from November 15th through June 15th as determined by the Ypsilanti Township CED.
5. A soil erosion and sedimentation control inspection escrow deposit must be made in an amount to be determined by the Township Planning Director, building Director or an authorized agent of the township. This deposit is required to conduct necessary inspections during the construction phase. If the escrow is depleted prior to the issuance of the final certificate of occupancy then the escrow account must be replenished to a level determined by the Township.
6. Standard SESC details have been included in the Digital Appendix and should be included with plan sets. If special SESC provisions are being proposed or required, then special details and/or notes may be needed in addition to the standard details.

Appendix A

Checklists

Appendix B

Detailed Engineering Submittal Form

Appendix C

Pre-Construction Meeting Forms

Appendix D

Sample Easement Documents

Appendix E

Grading Certificate

Appendix F

Private Road Ordinance

Appendix G

Development Flowchart