

# **DESIGN AND CONSTRUCTION STANDARDS**

**CHARTER TOWNSHIP OF SPRINGFIELD**

**OAKLAND COUNTY, MICHIGAN**



**SPRINGFIELD**  
CHARTER TOWNSHIP

ADOPTED: JULY 11, 2002

CORRECTED: APRIL 27, 2009

AMENDED: SEPTEMBER 14, 2017 (Chapter 13 and Chapter 16)

AMENDED: NOVEMBER 8, 2018 (Chapter 12, Section 5, Subsection 3)

SPRINGFIELD TOWNSHIP BOARD

SPRINGFIELD

TABLE OF CONTENTS

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Table of Contents ..... i

Certification ..... ii

**GENERAL STANDARDS**

Chapter 1 Introduction ..... 1 and 2

Chapter 2 General Requirements and Procedures ..... 1 thru 6

Chapter 3 General Provisions and Plan Requirements ..... 1 thru 4

Chapter 4 General Construction Provisions and Requirements..... 1 thru 16

Chapter 5 As-Built Drawings, Procedures and Requirements..... 1 thru 3

**SPECIFIC STANDARDS**

Chapter 6 Design and Construction Standards for Clearing, Grading, and Surface Drainage ..... 1 thru 5

Chapter 7 Design and Construction Standards for Soil Erosion Control ..... 1 thru 8

Chapter 8 Design and Construction Standards for Storm Water Management Systems ..... 1 thru 16

Chapter 9 Design and Construction Standards for Storm Sewers ..... 1 thru 14

Chapter 10 Design and Construction Standards for Impacts to Wetlands ..... 1 thru 3

Chapter 11 Design and Construction Standards for Impacts to Floodplains..... 1 and 2

Chapter 12 Design and Construction Standards for Streets, Driveways, Pedestrian Facilities and Paving ..... 1 thru 16

Chapter 13 Design and Construction Standards for Rural Fire Protection Facilities..... 1 thru 8

**REFERENCE STANDARDS**

Chapter 14 Design and Construction Standards for Community On-Site Sewage Systems..... 1 thru 6

Chapter 15 Design and Construction Standards for Pump Houses for Community Potable Water Systems..... 1 thru 19

Chapter 16 Design and Construction Standards for Water Mains ..... 1 thru 14

Chapter 17 Design and Construction Standards for Sanitary Sewer Collection Systems..... 1 thru 24

Chapter 18 Franchised Utilities (Electric, Telephone, Gas, TV)..... 1

**APPENDIX**

Chapter 19 Definitions..... 1 thru 10

## CHAPTER ii

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### *CERTIFICATION*

I hereby certify that the foregoing is a true and correct copy of the Design and Construction Standards of the Charter Township of Springfield, adopted at a regular Township Board Meeting held on July 11, 2002 and amended through November 8, 2018.

/s/ Laura Moreau  
Springfield Township Clerk

# CHAPTER ONE

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## INTRODUCTION

### SECTION 1-1 SHORT TITLE

This document shall be known as the Design and Construction Standards of the Charter Township of Springfield (“Township”), and shall hereinafter be referred to as “Standards.”

### SECTION 1-2 PURPOSE

The purpose of the Standards is to establish general requirements for the design and construction of subdivisions, site condominiums, commercial sites, and all other site improvements under the jurisdiction of Springfield Township which require site plan submittal in conformance with the Township’s Zoning Ordinance.

### SECTION 1-3 INTENT

It is the intent of these Standards to:

1. Provide a flexible yet reasonable and proper basis for the design and construction of land improvements, including but not limited to, drainage facilities, storm water management facilities, road and parking lot improvements, pedestrian activities, landscaping, grading, community septic systems, and where warranted, water supply, distribution and fire suppression facilities and sewage collection and disposal systems.
2. Establish uniformity in Township requirements and supplement Township Ordinances.
3. Outline information required for plans submitted for review so that the plans are complete and in a proper form.

### SECTION 1-4 CONFLICTS

If there should exist conflicts or discrepancies between these Standards and adopted Ordinances, resolutions, or policies of Springfield Township, said Ordinances, resolutions, or policies shall govern over these Standards.

### SECTION 1-5 VARIANCE FROM STANDARDS

The Township Board may authorize a variance from these Standards when practical difficulty may result from strict compliance. In granting any variance, the Township Board may prescribe conditions that it deems necessary or desirable for the public safety, health, welfare and interest of the community. No variance shall be granted unless the Township Board finds:

## CHAPTER ONE

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1. That strict compliance with these Standards would either unreasonably prevent the Owner from using the property for a permitted purpose or that conformity with the Standards would be unnecessarily burdensome.
2. That the variance is the minimum necessary to give appropriate relief to the applicant, giving consideration to the effect of the variance on surrounding property owners.
3. That the granting of a variance will not be detrimental to the public health, safety or welfare or injurious to other properties in the area.
4. That the variance will be in accordance with the objectives and policies of the Township.

### SECTION 1-6 INTERPRETATION

Provisions of these standards shall be held to be the minimum requirements necessary for promotion and preservation of public health, safety and general welfare of Springfield Township. The standards are not intended to repeal, abrogate, annul, or in any manner interfere with existing regulations or ordinances of the Charter Township of Springfield, standards or regulations of the County of Oakland where they have jurisdiction, nor to conflict with any statutes of the State of Michigan.

Proprietors and their engineers are encouraged to design facilities to provide for actual conditions encountered in their project work area. As site conditions dictate, the Township in the review process may allow more flexible designs, which are more or less stringent than the minimum requirements specified herein, provided that the design alternative is in accordance with Township objectives and goals (i.e., preservation of natural features).

### SECTION 1-7 RIGHT TO REVISE STANDARDS

The Township reserves the right to revise these Standards at any time and to require that such revised Standards be incorporated into the work at any time prior to final site plan approval. The Township also reserves the right to require revisions or corrections to any plans, that have been “approved for construction,” due to errors, omissions, or changes or unforeseen field conditions and to require that such revisions and corrections be incorporated into the work at any time prior to the final acceptance of the work.

## CHAPTER TWO

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### GENERAL REQUIREMENTS AND PROCEDURES

#### SECTION 2-1 DETAILED ENGINEERING PLANS

Detailed engineering construction plans shall be submitted by the Applicant for site improvements, including but not limited to, storm sewers, storm water management facilities, paving, soil erosion control measures, and site grading. Where applicable construction plans must also be submitted for community sewer systems, sewage collection facilities and water supply and distribution systems. Timing of plan submittal shall follow the requirements of the ordinances and the procedures set forth by the Township.

#### SECTION 2-2 PLANS AND SPECIFICATIONS

All plans submitted for review and approval are to comply with the requirements specified herein and may be rejected for failure to comply.

#### SECTION 2-3 PLAN REVIEW FEES

Plan review fees for projects located in Springfield Township shall be payable to the Township in the amount as set forth in the adopted fee schedule.

#### SECTION 2-4 SPECIFICATIONS BY REFERENCE

Where reference is made in these standards to the specifications of any technical society, association, governmental agency, etc., such as those promulgated by AASHTO, ANSI, MDOT, etc. said specifications shall apply and be binding as if fully set forth herein. It is understood and agreed that such Specifications or standards are incorporated by reference.

Reference to standard specifications of any technical society, organization, association or to codes of local or state authorities, shall mean the latest standard, code, specifications, or tentative specification adopted and published unless specifically stated otherwise.

#### SECTION 2-5 EXISTING UTILITIES AND SITE CONDITIONS

It shall be the sole responsibility of the Applicant to locate, survey, field verify, etc., all existing utilities within the construction area. The Township or their engineers may have completed projects in the same area or have utility information available for review. This information, while intended to assist the Applicant, is not intended to be the only source of such information or to be utilized solely in lieu of the Applicant's own investigation. The Township shall not be held liable or responsible for errors, omissions, etc. of provided utility information.

## CHAPTER TWO

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### SECTION 2-6 EASEMENTS

A developer must provide the Township with the necessary easements for any water mains, sanitary sewers, storm drains, roadways or other facilities that are to be located on the developed property and which may be maintained by the Township. Easements shall be a minimum width to provide proper access as determined by the Township, or as stated in these Standards. Furthermore, it shall be required that the Applicant provide all utility and drainage easements (i.e., storm sewers, surface drainage, private water and sanitary systems, etc.) to the Township for review and approval prior to final project approval. The easements shall be subject to a recommendation of approval by the Township Engineer and the Township Attorney.

Proof of ownership shall be provided along with the easement in the form of title insurance, acceptable to the Township Attorney, to show that the grantor of the easement is the owner of the property. All parties having a legal interest in the property shall execute and grant the easement.

Easements must be submitted to the Township in recordable form prior to the start of work.

### SECTION 2-7 USE OR ACCESS TO PRIVATE PROPERTY

A Contractor shall not enter upon private property for any purpose without first obtaining written permission from the property owner, and he shall be responsible for the preservation of all public property, trees, survey monuments, etc., along, within and adjacent to the private property, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits, and other underground structures.

### SECTION 2-8 TOWNSHIP MAPPING

When the submitted plans are prepared in digital format, the developer may be requested to provide the Township with electronic files of the approved Final Site Plan and as-built plans in order to facilitate any Township map updates. Township Maps may be modified to incorporate the utilities to service the subject development.

### SECTION 2-9 PHASED CONSTRUCTION

On all projects in which construction is to proceed in phases, a separate plan sheet shall be included in the construction drawings which breaks down all improvement quantities by item, i.e.: walkways, paths, grading, landscaping, community septic and sewage collection systems, water supply and distribution systems, sewer, storm sewer, landscaping, pavement base and wearing courses, and utilities for each phase. Said phasing limits shall match those approved or to be approved by the Township. Approval of phased construction shall not supersede the requirement to obtain site plan approval for each phase of the construction.

## CHAPTER TWO

### SECTION 2-10 CODES, ORDINANCES, LAWS AND REGULATIONS

The Contractor and subcontractors shall observe and comply with all Federal, State and Local Codes, ordinances, Laws and Regulations in force at the construction site. The Contractor shall pay for and obtain all building permits, licenses for the work, pay for inspection and testing, and file plans and specifications to the inspection department having jurisdiction.

### SECTION 2-11 SUBMITTALS FOR REVIEW AND APPROVAL

1. All plan documents shall be submitted to the Township. The Applicant is to contact the Township regarding the number of plans to submit and the review process. **No documents shall be submitted directly to the Township Engineer, Planner, or Attorney unless prior written authorization is given by the Township.**
2. All plans, computations, and estimates shall be signed and sealed by a Registered Professional, licensed to practice in the State of Michigan. The Engineer and Planner shall review and make recommendations to the Township. Comments for approval or non-approval shall be in writing. They may also be marked on a set of plans at the discretion of the Township. Copies of the letter recommending approval or non-approval and any marked up plans will be forwarded to the Township, the Applicant, and the Applicant's Consultants. The Applicant shall forward revised copies of the plans or documents in question to the Township for further processing and review should additional information or plan revisions be required.

### SECTION 2-12 AGENCY APPROVAL

Engineering drawings for proposed subdivision or condominium improvements, site plan improvements, and utility construction shall be approved by all jurisdictional agencies and the Township prior to the beginning of any construction. Construction shall not begin until all required approvals and permits are secured.

### SECTION 2-13 SUBMITTAL FOR CONSTRUCTION

Four (4) complete sets of the approved site plan, signed and sealed (3 - Engineer, 1 - Township) must be submitted for the Township's use after final site plan approval and prior to the preconstruction meeting. Additional plan sets, individual plan sheets or digital files may be requested at the Township's discretion.

### SECTION 2-14 MEETINGS

A preconstruction meeting shall be held prior to the start of any site improvements. The preconstruction meeting should include a representative of the Township, the Township Engineer, the applicant or authorized representatives, the contractor, and where necessary any utility company officials whose underground, overhead, or at grade utilities may conflict in any manner with the proposed project, state, county, and local government persons who may be involved, directly or

## CHAPTER TWO

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indirectly, with the proposed project, and any other persons who may be able to contribute information in regard to the construction of the subject project.

It shall be the applicant and/or contractor's responsibility to contact the Township at least seven (7) days prior to planned construction commencement to arrange for a preconstruction meeting. The project shall not be permitted to commence until such time that the Applicant and/or Contractor has secured all required permits, submitted observation (inspection) escrow funds, and submitted all insurance and bonds in accordance with the Township's requirements.

### SECTION 2-15 GUARANTEE

The Applicant may be required to deposit with the Township, cash, certified check, or irrevocable bank letter of credit, whichever the Applicant selects, in an amount sufficient to guarantee the completion of the construction of all required improvements, as shown on the approved final site plan. Copies of Contractor contracts with the Applicant or estimates of cost provided by the Project Engineer shall be required to be submitted to the Township Engineer for review prior to establishment of the required security. The final release of security will only be made after the improvements have been final inspected and accepted by the Township and only upon written request a by the Applicant.

### SECTION 2-16 CONSTRUCTION OBSERVATION

Full-time or part-time observation shall be required for all site improvements associated with subdivisions, site condominiums, commercial sites, and elsewhere as determined by the Township. Part-time observation may also be required for improvements covered by other governmental agencies. Observation personnel shall be provided by the Township or its agents. The developer shall pay all applicable observation fees as established by the Township. The Contractor shall notify the Township and the Township Engineer's supervising field observer at least 48 hours prior to commencing construction. Any work installed without field observation as required by the Township may not be accepted by Springfield Township.

In such an event, the Township's decision regarding removing or exposing covered work, testing, or any other appropriate course of action, shall be final and binding on the Applicant.

The Applicant shall deposit with the Charter Township of Springfield at least 48 hours prior to the start of construction, an observation escrow based on the estimated observation time required as determined by the Township. The observation escrow amount shall be determined prior to or at the preconstruction meeting. The Township may assess an administration fee to cover the construction portion of the project.

The observation fees will be billed to the Township on a time and material basis by the Township Engineer and deducted from the observation escrow deposit.

A minimum of four (4) hours will be charged against the observation escrow if the observer keeps a scheduled observation appointment and the Contractor does not work or cancels work with less than

## CHAPTER TWO

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twenty-four (24) hours notice and the observer cannot be reassigned to another job. In the event of a “rain out” the Contractor shall notify the appropriate personnel prior to the regular starting time or be charged the four (4) hour increment. All costs incurred for consulting services and testing conducted by the Township will be billed against the escrow account.

The Applicant will be notified in the event the escrow deposit has been depleted and/or additional funds are required. Prompt attention to re-establishing this deposit will prevent the project construction from being stopped and/or building or occupancy permits withheld. The account balance upon completion of the project and acceptance of the record plans will be returned to the Applicant and only upon written request by the Applicant.

Review of “As Constructed” or “As-Built” record drawings shall be invoiced against the observation account.

### SECTION 2-17 INSURANCE REQUIREMENTS

It is agreed that the Contractor for all private developments shall comply with the following general stipulations and provide the Township with proof of the insurance requirement herein prior to the start of construction. All monetary amounts quoted herein may be revised at the discretion of the Township at any time and without notice.

Contractor’s Comprehensive General Liability Insurance - The Contractor shall procure and shall maintain during the life of his Contract, Contractor’s Personal Injury Insurance in an amount not less than \$1,000,000 for injuries, including accidental death, to each person, in an amount not less than \$1,000,000 on account of each occurrence; and Contractor’s Property Damage Insurance in an amount not less than \$1,000,000 each occurrence; and \$1,000,000 aggregate including Completed Operations and Contractual Liability Coverage’s.

This Comprehensive General Liability Insurance shall include coverage for Explosion, Collapse, Underground Hazards, and Flooding and coverage assumed in the Indemnification Clause of this section of the work.

1. Owner’s Protective Public Liability Insurance - The Contractor shall procure and maintain during the life of his Contract Owner’s Protective Public Liability Insurance in the name of the Township and Township Engineer in an amount not less than \$1,000,000 for injuries, including accidental death to each person, and in an amount not less than \$1,000,000 on account of each occurrence; and property damage in an amount not less than \$1,000,000 each occurrence, and \$1,000,000 aggregate.

Contractor’s Automobile Bodily Injury and Property Damage Insurance - The Contractor shall procure and shall maintain during the life of his Contract Automobile Bodily Injury Insurance in an amount not less than \$1,000,000 for injuries, including accidental death, to each person, and in an amount not less than \$1,000,000 for each occurrence; and property damage in an amount not less than \$1,000,000 for each occurrence.

## CHAPTER TWO

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The Contractor shall procure and shall maintain during the life of his Contract Hired and Non-Ownership Automobile Bodily Injury and Protection Damage Insurance in an amount not less than \$1,000,000 for injuries, including accidental death, to each person; and in an amount not less than \$1,000,000 for each occurrence; and property damage in an amount not less than \$1,000,000 for each occurrence.

4. Umbrella or Excess Liability – The Contractor is granted the option of arranging under a single policy for the full limit required for general liability and/or automobile liability or by a combination of underlying policies with the balance provided by an excess or umbrella liability policy equal to the total limit(s) requested. The umbrella or excess liability shall be in an amount not less than \$2,000,000.00 per occurrence and \$2,000,000.00 aggregate.
5. Worker’s Compensation Insurance – If requested by the project owner, the Contractor shall procure and shall maintain during the life of his contract, Worker’s Compensation Insurance, including Employer’s liability, in an amount not less than \$500,000.00 for Employer’s Liability and a statutory rate for compensation.
6. Indemnification Clause - The contractor agrees to indemnify, defend, and save harmless the Township and the Engineer, their elected officials, officers, owners, consultants, agents, and employees, from and against all loss or expense (including costs and attorney fees) by reason of liability imposed by law upon the Township and the Engineer, their elected officials, officers, owners, consultants, agents, and employees for damages because of bodily injury; including death at any time resulting there from, sustained by any person or persons or on account of damage to property, including loss of use thereof, arising out of or in consequence of the performance of this work, whether such injuries to persons or damage to property is due, or claimed to be due, to the negligence of the contractor, his subcontractors, the Township, the Engineer, and their elected officials, officers, owners, consultants, agents, and employees, except only as such injury or damage shall have been occasioned by the sole negligence of the Township, or their elected officials, officers, owners, agents, employees, or consultants.
8. Proof of Coverage of Insurance - The Contractor shall provide the Township certificates of insurance for the required coverage. A guarantee that thirty (30) day’s notice to the Township prior to cancellation or non-renewal of or change in any such insurance shall be endorsed on each policy and certificate of insurance.
9. Additional Insured – All insurance policies with the exception of Worker’s Compensation, are to include the following additional insured:  

“Springfield Township – All elected officials, officers, consultants, agents and employees.”  
The Township Engineer – Their owners, officers, consultants, agents, and employees.
10. Sample Forms may be obtained from the Township or Township Engineer.

## CHAPTER THREE

### GENERAL PROVISIONS AND PLAN REQUIREMENTS

#### SECTION 3-1 INTENT

This Chapter is to provide the Applicant with general plan requirements. Failure to comply with these requirements may lead to the plans being rejected.

#### SECTION 3-2 PLAN REQUIREMENTS

In general, plans submitted for review must include the following:

1. Complete improvement plans bearing the seal of a Registered Professional, licensed to practice in the State of Michigan, shall be submitted prior to review and approval of any portion thereof.
2. Plans submitted shall be on 24" x 36" (no larger) prints having blue or black lines, and shall be neatly and accurately prepared. Judgement should be exercised in the design, layout, and the presentation of proposed improvements.
3. For plan sets with four (4) or more sheets, including details, a cover sheet is to be included and contain the following information:
  - a. Title of project
  - b. Property legal description including sidwell number
  - c. Name, address and telephone number of Owner/Applicant and Contact Person
  - d. Name, address and telephone number of Project Engineer and/or Surveyor
  - e. Contacts for existing on-site utilities that may be in conflict with site improvements (in the event of an emergency)
  - f. Plan set index
  - g. Miss Dig information and telephone number
  - h. Location map to site
  - i. Zoning classification of subject and all adjacent properties

For plan sets with less than four (4) sheets, this information must be included elsewhere in the plan set.

4. For projects having more than one plan sheet, a general plan having a scale of 1" = 100' shall be provided showing the overall project, surrounding area, match lines between plan sheets and indicating the size and general location of all improvements shown in the detailed plans. Street names, street and easement widths, lot lines, lot dimensions, lot numbers, and ownership shall be shown on all plans.
5. Engineering plans having a maximum scale of 1" = 50' horizontal and 1" = 5' vertical for profile views shall be provided. Standard engineering scales (i.e. 1"=10', 1"=20', 1"=30', 1"=40', etc.) shall be used. Sanitary sewer and water main shall be shown on the same sheet. Plan and profile

## CHAPTER THREE

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views are required on all sanitary and storm sewers (regardless of size) and water main sixteen (16") inch diameter and larger. Profiles, where possible, shall be shown below the plan view.

6. A boundary survey of the site, or a copy of the completed plat shall be submitted with the engineering drawings, as well as a legal description of the property(ies) and tax parcel number(s).
7. Existing elevations must be provided across the entire site and for a minimum distance of one hundred (100') feet abutting the entire perimeter of the site on a fifty (50') foot minimum interval grid system or two (2') foot elevation contours. Grades shall be indicated at all property corners and along all property lines. The elevation information requirement may be modified by the Township Engineer for developments with significant open space. On-site, intermittent elevations and defined contours are required to establish the existing site drainage. All existing conditions shall be indicated. Locations and elevations must be given on the following:
  - a. Existing drainage courses; ditches; swales; ponds; lakes; rivers; wetlands; etc.
  - b. Upstream and downstream culverts
  - c. All utilities, including sanitary sewer, water main, gas, telephone, electrical, etc. Inverts and finished grades are required where applicable
  - d. All existing sidewalks, roads and driveways within one hundred (100') feet.
  - e. Finished grades of all adjacent buildings within one hundred (100') feet
  - f. All easements
8. Elevations shall be on U.S.G.S. Datum. Two (2) permanent benchmarks for the work shall be indicated on the plans.
9. Existing and proposed road topography shall extend across the entire site with grades shown on both sides of the street for:
  - a. Property lines
  - b. Ditch center line
  - c. Top of bank
  - d. Edge of shoulder
  - e. Edge of pavement or top of curb
  - f. Crown or center line
10. Property lines must be indicated by distances and bearings where applicable.
11. Existing and proposed rights-of-way of adjacent roads must be indicated.
12. All information as required in accordance with the Zoning Ordinance.
13. Tentative finished grades shall be indicated for all proposed structures or new building sites **to be constructed within the development by the Applicant**. These grades are intended to be used as a guide with flexibility encouraged to customize each building site to fit the natural topography

## CHAPTER THREE

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and still maintain some consistency within the development. Building site grades shall be shown at lot/unit corners and every fifty (50') feet along the lot/unit lines.

14. Street names shall be approved by the Road Commission for Oakland County (RCOC) and the Township and labeled on the plans. All street names and traffic control signs shall be the responsibility of the Applicant.
15. Grading plans are required for all developments. Refer to Chapter 6, Site Grading, Clearing and Surface Drainage for specific requirements.
16. Utilities shall be located in accordance with the Township Standards. Utilities shall typically be parallel to lot lines or roadways. Generally, utilities shall be constructed in the road right-of-way or in easements adjacent to the road right-of-way and shall not be located under existing or proposed pavement where possible. Irregular or meandering utilities will be considered and encouraged where natural features or vegetation may be saved.
17. All design calculations for storm sewers, sanitary sewers, and water mains.
18. Storm sewers, open ditch, or swale conveyance systems and pavement shall be shown on the same sheets. Plan and profile views are necessary for all storm water conveyance systems, except for residential side yard swales. A plan view with centerline stationing shown is necessary on all paving. The top-of-curb line must be shown on all profiles.
19. All crossings of utilities must be shown in the profile view. Minimum vertical clearance between utilities shall be eighteen (18") inches. Sand or stone backfill, compacted to at least 95% of maximum unit weight, is required between utilities.
20. Profiles of sewers shall indicate the size, class of pipe, class of bedding, rim elevations of all manholes, length between manholes, slope of pipe, and shall indicate the existing and proposed ground elevations above the route of the sewer. The inverts of all sewers shall be given at manholes. The location of compacted porous backfill required shall be indicated on the plan and profile.
21. All existing and proposed easements, their widths, and intended use are to be shown on the plan sheets.
22. Any wetland areas shall be indicated on the plans. No improvements shall be allowed in regulated wetlands unless the MDEQ issues a permit or a letter of nonjurisdiction for such improvements. See Chapter 10 for specific requirements.
23. Any areas that are determined to be located within the 100-Year floodplains of a water course shall be shown on the plans. The Project Engineer is responsible to determine the extent of the 100-Year floodplain. See Chapter 11 for specific requirements.

## CHAPTER THREE

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24. Plans for landscaping, tree preservation, or tree planting required by the Township or proposed by the Applicant shall be submitted to the Township for review and approval prior to final site plan approval.
25. The developer/owner's consulting engineer shall forward plans, for approval, to any public utility (gas, electric, telephone, cable, etc.) and any Federal, State, or County (Drain Commission, etc.) agency whose facilities or rights-of-way may be affected by the proposed construction, and show the contact name, address, and telephone and fax numbers for all utilities on the plan set. Copies of all transmittals and responses shall be furnished to the Township.
26. Material Specifications for improvements as required by the Township shall be submitted for approval prior to the start of construction.
27. All lots or units must have the proposed location of the individual on-site septic systems, if known, and any alternate locations as required by the OCHD, as well as soil borings, test pits, etc. used to determine the location of such.
28. Springfield Township Standard Notes (Must be included on the plans):
- a. The Township and Township Engineer must be notified a minimum of 48 hours prior to the start of construction and after stoppages and prior to a restart of construction.
  - b. All construction must be in conformance with the current Design and Construction Standards adopted by the Township.
  - c. MISS DIG (1-800-482-7171) must be called a minimum of 72 hours prior to the start of construction.
  - d. All soil erosion must be controlled and contained on site, with strict compliance with State Law for Soil Erosion and Sedimentation Control and Oakland County Drain Commissioner Permit requirements.
  - e. All excavation under the 45 degree zone of influence line from the edge of pavements, bike paths, sidewalks, and/or drive approaches (existing or proposed), shall be backfilled and compacted with aggregate materials to at least 95% of minimum unit weight as specified in the plans.
  - f. Prior to final acceptance, final engineering inspection is required.
  - g. All signs and traffic control during construction shall be per the most current Michigan Manual of Uniform Traffic Control Devices (MMUTCD) or as required by RCOC.
  - h. As-Built mylar drawings in accordance with Township Standards must be submitted prior to final project acceptance

## CHAPTER FOUR

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### GENERAL CONSTRUCTION PROVISIONS AND REQUIREMENTS

#### SECTION 4-1 INTENT

This Chapter is intended to provide the Applicant with general construction requirements to be adhered to throughout the duration of the project. Failure to do so may result in a Stop Work Order being issued to the Contractor requiring the issue to be resolved prior to starting work.

#### SECTION 4-2 GENERAL PROVISIONS

1. The Township or their agents will not act as the General Supervisor of the Contract work or be held responsible for on-site safety. This shall be the responsibility of the Owner, Owner's Engineer, and/or Contractor.
2. The Township will provide observation/inspection personnel in accordance with Section 2-16 of these standards.
3. Prior to starting any construction, the Contractor must obtain all required permits, establish all necessary escrow accounts, pay all fees, provide the required insurance certificates and attend the preconstruction meeting.
4. All improvements must also be field staked under the supervision of a licensed professional. Staking must be in accordance with the approved plans.

#### SECTION 4-3 CONSTRUCTION REQUIREMENTS

##### 1. WORKING SPACE

The Contractor shall confine the work operations to the minimum space possible within the project limits. Stockpiling of construction material and equipment will be permitted as necessary, but in no case shall traveled roadways, driveways, or entrances be unduly obstructed. Any offsite storage or disposal areas within the Township must be shown on the final site plan drawings and approved by the Township.

It shall be the contractor's responsibility to use such methods and/or materials, including sheeting, so as to prevent any portion of the work from encroaching on private property.

##### 2. LOCATING WORK

The Contractor shall accurately locate the work from reference points established by the Project Engineer/Surveyor along the surface of the ground and the line of work. "Cut sheets" for all underground work will be furnished to the Contractor and the Township by the Applicant. Reference points shall be protected and preserved by the contractor.

## CHAPTER FOUR

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### 3. SURVEY MONUMENTS

Monuments or other recognized property boundary markers at street intersections, section corners, acreage or lot corners, and right-of-way lines shall be preserved and protected. Where such monuments or markers must be removed during construction, the Township shall be notified and the Contractor shall make all necessary arrangements with a land surveyor registered in the State of Michigan to have these monuments or markers properly witnessed prior to disturbance or removal and later reset by the registered land surveyor at no cost to the Township.

### 4. TRENCH BACKFILL

Special backfill shall be used at all locations and of the type called for on the drawings, and at other locations specified herein whether called for on the drawings or not. The type and method of backfilling is dependent on its locations and function and shall conform with the following requirements. The Applicant will supply field testing on the special backfill compaction requirements.

Backfilling of trenches in the shoulder area and under private gravel drives shall be carried to within six (6") inches of the existing surface as specified under Trench A or Trench B as required. The shoulder shall be defined herein as the area within five (5') feet of the pavement edge, or the width of the existing graveled shoulder, whichever is greater. The remaining depth shall be backfilled with six (6") inches of compacted 21AA aggregate. Backfilling of trenches crossing gravel roads or streets shall be carried to within eight (8") inches of the existing surface and the remaining depth shall be backfilled with eight (8") inches of compacted 21AA aggregate. Compaction shall be performed by a pneumatic-tired roller or a vibratory compactor until the compaction requirements as required for Trench A or Trench B and as detailed in the following paragraphs are met.

The requirements as specified herein are in addition to the conditions provided for under permit granted by the Road Commission for Oakland County (RCOC) or the Michigan Department of Transportation (MDOT) where applicable.

#### Trench A

All trenches under graveled, slag or hard surfaced roads, pavements, hard surfaced parking lots and driveways, sidewalks, curbs and where the trench edge is within three (3') feet of a pavement shall be backfilled with bank run sand meeting the requirements of Granular Material, MDOT Class II. The material shall be placed by the Controlled Density Method or other effective means having the approval of the Engineer and is to be compacted to 95 percent of maximum unit weight as determined by ASTM D-1557 Modified Proctor. Trenches under pavement to be constructed in the near future, as noted or shown on the drawings, shall be backfilled with Granular Material, meeting the requirements of current MDOT Standard Specifications for Construction.

#### Trench B

Trench B shall be used where called for on the drawings.

## CHAPTER FOUR

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All trenches shall be backfilled with granular material, MDOT Class II to a point twelve (12") inches above the pipe for diameters less than twenty-four (24") inches and up to the spring line with materials meeting the requirements of the current MDOT Standards for diameters twenty-four (24") inches or larger. This portion of the backfill is to be placed in layers not exceeding six (6") inches in depth, and shall be thoroughly compacted by mechanical tamping to not less than 95% of maximum unit weight utilizing ASTM D-1557 Modified Proctor. The remainder of the backfill shall be made with suitable excavated material (excluding blue and gray clays, peat, muck, marl or other organic materials) placed in one (1') foot layers with each layer being thoroughly compacted by approved mechanical methods, or other effective means having the approval of the Engineer, to a density of 90% of maximum unit weight utilizing ASTM D-1557 Modified Proctor.

### 5. MAINTENANCE AND RESTORATION OF PAVEMENTS, ROAD SURFACES, STRUCTURES AND TRENCH BACKFILL

Where trenches cross existing improved roadways or drives or where the trench parallels an existing improved roadway which is disturbed by the contractor's operations, the Contractor shall consolidate the trench backfill and shall immediately place a temporary gravel fill, meeting 21AA Aggregate Gradation at least eight (8") inches thick; and shall, during the life of the project, maintain the same in good condition with additional gravel as settling takes place. All structures, including curbing, walks, paving, gravel, or street road surfaces, etc., that may be damaged or destroyed by the contractor's operations, shall be repaired and replaced by the Contractor at their expense. In restoring pavement, a saw shall be used and a cut equal to the thickness of the existing pavement shall be made on each side of the part to be restored. Concrete shall be 3500 psi, using six (6) sacks of cement per cubic yard of concrete, unless otherwise required.

If the pavement removed had an asphaltic concrete surface, the surface shall be removed to a distance one (1') foot beyond the limits of the removed concrete pavement. The butt joint in asphaltic concrete removal shall be prepared by sawing through the total depth of asphaltic concrete. The surface shall be replaced with a nominal three (3") inches of MDOT bituminous surface mixture as required by the Township and meeting the requirements of the Michigan Department of Transportation as to materials and method of replacement at no extra cost to the Township.

### 6. PROTECTION OF THE PUBLIC

The Contractor shall provide sufficient barricades, guard railings, fencing, advance construction signing, coverings or other means to protect the public from injury due to the work operations, including completed or uncompleted work, at all times until final approval of the work by the Township.

## CHAPTER FOUR

### 7. PRESERVATION OF TREES

The Contractor shall protect and preserve all trees and natural areas along the line of work, and will be held responsible for any damage to trees. Construction fencing shall be placed to fence off designated areas at the drip edge of the trees to be protected. Where necessary to preserve a tree and its main roots, the Contractor shall tunnel under such tree. Where specifically called for on the drawings, the Contractor shall remove trees completely, including stumps and main roots.

Where tunneling is required, augering shall be done in a manner to protect the trees and at a distance away from the tree in accordance with the following Table:

#### Tunneling or Augering Beneath Tree Roots:

<u>Tree Diameter (DBH)</u>	<u>Minimum Auger Distance</u>
Up to 2"	Auger 1 foot from trunk of tree
3-4"	Auger 2 foot from trunk of tree
5-9"	Auger 5 foot from trunk of tree
10-14"	Auger 10 foot from trunk of tree
15-19"	Auger 12 foot from trunk of tree
19" and Over	Auger 15 foot from trunk of tree

(Note: Diameter Breast Height (DBH) is measured 4.5' above the ground).

The minimum depth of auger within the root zone, as described above, shall be 24 inches below the soil surface. In any event, the tunneling must be below the major root system of the tree. All voids around the tunneled or augered facility shall be backfilled with excavated material and thoroughly compacted to avoid settlement. Compaction must be completed without compacting the soil within the root zone.

Where tunneling is not required for trees close to the trench and root trimming is necessary, the Contractor shall hand trench ahead of the machine digging and cut all roots cleanly to minimize damage to the roots.

Tree branches shall be tied back to protect them from the contractor's machinery where necessary.

### 8. REPLACEMENT OF LANDSCAPING

The Contractor shall protect and/or replace all shrubbery, trees, lawns, and landscaping damaged or destroyed by operations under his contract.

## CHAPTER FOUR

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### 9. RESTORATION

The Contractor shall restore all disturbed areas to the finished grade shown or to conform with existing grades and provide a smooth and uniform surface to meet existing ground surface. Ground cover must be established and conform to the approved site plan and landscaping plan.

Where areas are to be planted at a later date or construction schedules result in areas exposed for extended periods, they are to be temporarily seeded with an annual rye grass to prevent erosion as soon as rough grade is established. Replant restored areas as needed to provide a well established vegetative ground cover.

The Contractor shall go over the entire area and regrade and fill any areas that may have settled, including fills made from excess excavated materials and all other areas that may have been disturbed during construction operations. Ground covers must be established on all such areas after repair.

Where established lawn or grass areas have been disturbed by the contractor's operations, the Contractor shall provide, unless otherwise specified or called for on the drawings or in the specifications, not less than the minimum depth of approved top soil and shall grade, seed, fertilize and mulch or install Class A sod where directed by the Township.

Restoration areas are to be kept moist by the contractor for fourteen (14) days after planting to insure growth.

### 10. PUBLIC AND PRIVATE UTILITIES

#### Utilities

The Contractor must provide adequate protection for water, sewer, gas, telephone, TV, cable, fiberoptics, drainage, or any other public or private utilities encountered. The Contractor will be held responsible for any damages to such utilities arising from his operation.

When it is apparent that construction operations may endanger the foundations of any utility conduit, or the support of any structure, the Contractor shall notify the utility owner of this possibility and shall take steps as may be required to provide temporary bracing or support of conduit or structures.

When construction operations may impact existing drainage facilities, the Contractor shall make necessary provisions to maintain the integrity of the drainage facility and of flow.

In all cases where permits or inspection fees are required by utilities in connection with changes to or temporary support of their conduits, the Contractor shall secure such permits and pay all inspection fees.

## CHAPTER FOUR

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Where it is necessary in order to carry out the work, that a pole, electric or telephone, be moved to a new location, or moved and replaced after construction, the Contractor shall arrange for the moving of such pole or poles, and the lines thereof, and shall pay any charges therefor.

Where it is the policy of any utility owner to make repairs to damaged conduit or other structures, the Contractor shall cooperate to the fullest extent with the utility and shall see that construction operations interfere as little as possible with the utilities operations. The Contractor shall pay any charges for these repairs.

Where existing gas mains and services are encountered, the Contractor shall arrange with the gas company for any necessary relaying, and shall pay for the cost of such work unless otherwise provided.

### 11. PUMPING, BAILING AND DRAINING OF TRENCHES

The Contractor shall provide and maintain adequate pumping and drainage facilities for removal and disposal of water from trenches or other excavations. No direct discharge to existing water courses is permitted. The Contractor shall contact the Township for approval of the discharge point.

In any event, all pumping and drainage shall be done without damage to any roadway or other property, public or private, and without interference with the rights of the public or private property owners and in accordance with the MDEQ and local requirements for soil erosion and sedimentation control.

### 12. SHEETING, SHORING AND BRACING

Where necessary, in order to construct the work called for on the approved plans, the Contractor shall use and, if necessary, leave in place, such sheeting, shoring, and bracing as is needed to carry out the work or to adequately insure the stability of such work, to protect adjoining areas.

### 13. DISPOSAL OF EXCAVATED MATERIAL

With the exception of an amount of excavated materials sufficient for backfilling and construction of fills, as called for on the drawings, all broken concrete, stone, and excess excavated materials shall be disposed of away from the site by the contractor unless an on-site disposal area has been reviewed and approved by the Township during the site plan review process. The Contractor will be required to obtain his own disposal ground and indicate the location at the Preconstruction Meeting. If disposal site is within the Township, the site must have prior approval from the Township.

### 14. DISPOSAL OF WASTE MATERIALS

Unless otherwise directed by the Applicant or Township, all scrap lumber, stumps, brush, concrete, other waste materials and debris resulting from the construction work shall be removed

## CHAPTER FOUR

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from the premises. No waste materials may be buried or burned on site. Wood may be chipped and used on site for landscaping mulch or paths, but wood-chip stockpile areas must be approved by the Township.

### 15. TUNNELING

The Contractor shall construct the work in tunnel where shown on the drawings or required by permits, and at other locations may, at his option, construct the work in tunnel where it crosses existing roadways, public and private utilities, walks or other structures. Tunnel work shall be constructed in accordance with the drawings and specifications, "Road Permit" requirements, or as otherwise noted on the drawings.

### 16. SITE DEWATERING

Any anticipated construction dewatering activity requires approval by the Township during the site plan review process. If the unexpected need for dewatering arises during construction, dewatering provisions must be submitted to and approved by the Township prior to dewatering.

The dewatering provisions shall include the number and location, depth, and size of all proposed pumps. The maximum flow from each pump should be indicated. In addition, the provisions shall indicate the precise location for discharge of the water. All water must be retained on site, unless extenuating circumstances are demonstrated and the Township approves of the concept to discharge off-site. The Contractor shall be responsible for obtaining permission from the appropriate property owners and regulatory agencies that may have jurisdiction over the proposed receiving waters for off site discharge. Proper soil erosion control and water quality measures must be properly installed at the outlet.

### 17. PROGRESS OF WORK

The work shall start promptly and continue uninterrupted.

If the Township determines it is necessary or advisable that certain portions of the work be done immediately, the Contractor, upon written order, shall proceed with such work without delay.

### 18. EXPLOSIVES

If explosives are used, the Contractor shall comply with all laws, rules, and regulations governing their use. The Contractor shall be fully responsible for the safety of all persons and property and any approval by the Township shall not relieve the Contractor of such responsibility. It shall also be the Contractor's responsibility to provide written notification to property owners and tenants within two hundred (200') feet of the use of explosives.

## CHAPTER FOUR

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### 19. SCHEDULE OF OPERATIONS

If requested by the Township, the Contractor shall submit, for the Township's review and approval, a schedule of his proposed operations. The contractor's schedule shall be complete and shall show in detail the manner in which he proposes to complete the work under his contract.

### 20. REQUIREMENTS PERTAINING TO WORK WITHIN RAILROAD RIGHTS-OF-WAY

Where the contract drawings call for work within railroad rights-of-way or where the work crosses under railroad tracks, the Contractor shall secure the approval of the railroad company of the method and schedule of operations and shall carry out the work in strict accordance therewith, all to the satisfaction of the railroad company. Plan notes, provisions, requirements, etc., for the railroad right-of-way work must be shown on the plans.

### 21. DUST CONTROL

The Contractor shall provide adequate measures to control dust caused by his operation. The methods employed, and frequency of application shall be as approved or as directed by the Township.

### 22. HOURS OF OPERATION

The Township permits construction only between the hours of 7:00 a.m. and 8:00 p.m., Monday through Saturday, except holidays.

### 23. TESTING

Testing shall be required as specified in the respective Chapter detailing the item of work to be completed. Generally, testing will be required when, but not limited to, engineering fill or trench backfill, pavement compaction, concrete break testing, subgrade compaction, etc. Testing may be required in circumstances where unstable soils are encountered and are to be removed and replaced. Additional testing as determined by the Applicant is encouraged.

The Contractor shall obtain the services of a certified testing laboratory approved by the Township Engineer. This laboratory will perform all material testing. Copies of the results shall be furnished to the Township and Township Engineer.

For materials covered by ASTM, AWWA, State and/or Federal Specifications, the required tests are to be made by the manufacturer or supplier and his certificates submitted to the Township Engineer.

At the request of the Township Engineer soil density and compaction tests must be made by a representative of the Applicant, and will be paid for by the Applicant. The tests will be reviewed and accepted by the Township Engineer.

## CHAPTER FOUR

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### 24. SAMPLES

Where called for by the Township or these standards, samples of materials in the quantity required shall be submitted to the Township Engineer for approval. The work shall be in accordance with approved samples.

Samples are to be forwarded to the Township Engineer with all shipping charges prepaid, boxed or wrapped separately and each labeled with the name of the material, the name of the producer, the Contractor furnishing the same and use for which the material is intended.

### 25. SUBCONTRACTS

The Contractor agrees to be fully responsible to the Township for the acts or omissions of his Subcontractors and for anyone employed directly or indirectly by him or them. The Contractor agrees to bind every Subcontractor and every Subcontractor agrees to be bound by these Standards, as far as applicable to his work, unless otherwise specifically approved in writing by the Township.

### 26. EQUIVALENT MATERIALS AND EQUIPMENT

Whenever any of the material or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vender, the term "or equal" if not inserted, shall be implied. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design efficiency and quality desired and shall not be construed in such a manner as to exclude manufacturers' products of comparable quality, design and efficiency. Other manufacturers' products will be accepted provided sufficient information is submitted by the Project Engineer with their approval to use the alternate material to the Township Engineer to determine that the products proposed are equivalent to those named. Whenever material or equipment is submitted for approval as being equal to that specified, the final decision of whether or not such material or equipment is equal to that specified shall be made by the Township Engineer. Upon rejection of any material or equipment submitted as the equivalent of that specifically named, the Contractor shall immediately proceed to furnish the designated material or equipment. The approval by the Township Engineer of alternate material or equipment as being equivalent to that specified shall not in any way relieve the Contractor of responsibility for failure of the material, or workmanship, to perform the functions required of them.

### 27. OWNER'S RESPONSIBILITY

The Owner or his Contractor shall assume full responsibility for the work, specifically including jobsite safety, and take all precautions for preventing injuries to persons and property on or about the work; shall bear all losses resulting to him on account of the amount or character of the work or because the conditions under which the work is done are different, or because the nature of the ground in which the work is done is different from what was estimated or expected, or on account of the weather, floods, elements or other causes, and he shall assume the defense and save

## CHAPTER FOUR

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harmless the Township and its individual officers and agents from all claims arising out of the work performed or to be performed; and to any act, or neglect of the Contractor, his agents or employees.

### 28. GENERAL REQUIREMENTS FOR MATERIALS & WORKMANSHIP

The Contractor shall furnish suitable tools and equipment and employ competent labor to perform the work to be done. Any labor or tools or appliances that shall not, in the judgment of the Township Engineer, be suitable or competent to produce this result may be ordered from the work by the Township Engineer.

### 29. STORAGE OF MATERIALS

Materials and equipment distributed, stored and placed upon or near the site of the work shall at all times be so disposed as not to interfere with work of other contractors, with drainage, fire hydrants or with access thereto and not to hinder traffic.

### 30. CONTRACTOR'S SUPERVISION AND ORIGINATION

The General Contractor shall give efficient superintendence to the work. The Contractor shall at all times keep on the site of the work, during its progress, a competent superintendent and any and all necessary foremen and assistants. The superintendent shall represent and have full authority to act for the Contractor in the latter's absence, and all directions given to him shall be as binding as if given to the Contractor. On request in each case, all such directions will be confirmed in writing to the Contractor.

Copies of the drawings and specifications shall at all times be kept on file by the Contractor at readily accessible points at or near the work.

### 31. FACILITIES FOR INSPECTION

The Township, their agents, and their employees shall at all times have the right to enter upon the premises upon which work is being done, or upon which material is stored, to inspect the work and materials and to ascertain whether or not the construction is carried out in accordance with the approved plans. The Contractor shall promptly remove from the premises all materials rejected by the Township Engineer as failing to meet standard requirements, without expense to the Township.

### 32. CLEANING UP

The Contractor shall remove from the site and from all public and private property, all temporary structures, rubbish and waste materials resulting from his operations on a regular basis so as not to create a nuisance.

## CHAPTER FOUR

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### 33. PROHIBITION OF SALVAGED MATERIALS

No secondhand or salvaged materials will be permitted, except upon specific written authorization from the Township.

### 34. TRENCH ENCLOSURES

All trenches shall normally be backfilled at the end of the workday. Only under special conditions and with the approval of the Township Engineer, shall trenches be left open overnight. Trenches which are allowed to be left open overnight shall be completely enclosed with suitable fencing or lighted barricades. When the trench contains water or when required by the Township Engineer, the exposed end of the pipe shall be securely closed with a watertight plug.

### 35. CLEANUP SCHEDULING

General cleanup, including completion of rough grading of backfilled trench areas, shall continuously progress along with, and shall lag no further than one hundred (100') feet behind, the pipe installation operations.

Fine grading and restoration work not dependent on weather or subject to seasonal limitations shall also progress concurrently with and shall lag no further than five hundred (500') feet behind pipe installation operations.

### 36. EXCAVATION

The trench shall be excavated so that the pipe can be laid to the alignment and grade shown on the plan, taking into consideration the bedding specified. Excavation shall include removal of all materials encountered and disposal (off the site) of those materials not suitable or needed for backfilling of the trench. Excavation shall not proceed ahead of pipe laying a distance that will result in a cave in. All adjacent structures encountered, above and below the ground surface, shall be properly supported.

### 37. WIDTH OF TRENCH

If the maximum trench widths noted on the plans are exceeded, unless otherwise authorized by the Township Engineer, the Contractor shall construct a concrete cradle or other type of approved bedding to provide support for the additional load.

When sand bedding is used, the maximum trench widths shall be used to permit compaction of the bedding around the pipe.

If stone bedding is used, a minimum six (6") inch clearance shall be provided on each side of the pipe with the maximum trench width as tabulated.

## CHAPTER FOUR

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### 38. PIPE BEDDING

Pipe bedding is defined as the material placed from a minimum of four (4") inches below the pipe to the centerline of the pipe. It shall consist of stone or sand, as noted on the bedding detail. The bedding shall be removed under the bell so that the pipe barrel will be uniformly supported for its full length.

The bedding material shall be placed and compacted uniformly on both sides of the pipe to prevent lateral movement. Mechanical methods of tamping shall be used when it is possible to do so without damaging the pipe. Bedding shall be placed in layers of six (6") inches or less as necessary to obtain thorough compaction around the pipe.

In the event density tests become necessary to resolve a question of the sufficiency of compaction of bedding material, the minimum acceptable density shall be considered to be 95 percent of maximum density as determined by the AASHTO T99 method.

Stone used for bedding shall not lose more than seven (7%) percent by washing. Stone used for this purpose shall pass a three-quarter (3/4") inch sieve and be retained on a one-quarter inch (1/4") inch sieve.

### 39. CONCRETE CRADLE

Where called for on the plans, a concrete cradle shall be constructed using MDOT Grade 30P concrete. The cradle shall extend half-way up the sides of the pipe.

### 40. LAYING OF PIPE

Proper and suitable tools and appliances for the safe and careful handling, conveying, and laying of the pipe shall be used. Care shall be taken to prevent the coating of casts or ductile iron pipe from being damaged. Pipe, valves, hydrants, and fittings strung along the route shall be placed in such a manner that they will not be submerged or collect water. Dropping of material directly from a truck or platform is prohibited. All pipe and castings shall be carefully examined for defects. If any materials are found to be defective, they shall immediately be removed from the site.

All lumps, blisters, and excess coal-tar coating shall be removed from both the bell and spigot ends of each length of pipe and each fitting. The outside of each spigot and the inside of each bell shall be wire brushed and wiped clean, dry, and free from oil or grease immediately prior to installation. The inside of the pipe shall be free of dirt and debris. Any damage to exterior pipe coating shall be repaired with an approved coating before the pipe is laid.

Each pipe shall be inspected by the Contractor for possible defects and compliance with the plans before being placed in the trench. Joint surfaces shall be free of foreign matter. Pipe laying operations shall follow immediately behind the excavation.

## CHAPTER FOUR

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Pipe shall be laid from the lower end of the sewer upstream, with bell ends up grade. The use of brick, lumps of clay, wood, etc., to level the pipe will not be permitted. Pipe shall be thrust home and if joints do not remain tightly closed or construction is in saturated sand, a cable and winch, or other approved means, shall be used to maintain a tight joint. Under no circumstances shall pipe be dropped directly into the trench.

All pipe shall be laid to line and grade as called for on the plans. Each pipe as laid shall be checked by the Contractor. The trench shall be excavated to provide equal clearance on both sides of the pipe. After the pipe is set, care shall be taken in backfilling so as not to disturb its line or grade. As work progresses, the interior of the pipe shall be thoroughly cleaned. At all times the open ends of the pipe shall be covered to prevent foreign matter from entering.

### 41. BACKFILLING

Backfilling is defined as the placement in the trench of approved material by an acceptable method, from the top of the bedding to proposed ground surface grade. All backfill material shall be free from cinders, ashes, refuse, organic matter, boulders, rocks or stones, or other material which, in the opinion of the Township Engineer, is unsuitable. Unless otherwise authorized by the Township Engineer, all excavations shall be backfilled at least to a point one (1') foot above the pipe immediately after installation.

From the center of the pipe to a point one (1') foot above the top of the pipe, the trench shall be backfilled with sand approved by the Township Engineer, placed in six (6") inch layers, and thoroughly compacted.

Backfilling to grade shall not fall more than 100 feet behind pipe laying unless otherwise permitted by the Township Engineer. In locations where compaction of the backfill to a specific density is not required by these Standards, backfill may, where practicable, be machined placed. Excavated material (other than clay) may be used for backfill and compacted by a small dozer in lifts of not over nine (9") inches loose measure. Machine compaction of backfill may be required by the Township Engineer.

No frozen material shall be buried more than two (2') feet below the final elevation of ground. At no time shall frozen materials be permitted for use as backfill under pavement structures.

All backfill placed within three (3') feet of manholes, catch basins, gate wells and other underground structures shall be approved sand, placed in one (1') foot layers and compacted. After the structure and/or exterior masonry plaster has set up sufficiently to resist damage, backfilling shall be performed in a manner that will not cause unequal pressure on the structure.

### 42. CONSTRUCTION IN UNSTABLE SOILS OR FILL SECTIONS

Pipe and pipe appurtenances must be supported on a firm foundation. The trench bottom shall remain stable during backfilling and all subsequent pipe laying operations.

## CHAPTER FOUR

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When unstable trench bottoms (wet clays, sands, etc.) are encountered, it will be necessary to excavate below design depth to stable, noncompressible ground and backfill to grade with approved select materials: slag, crushed stone, gravel, etc., one-quarter ( $\frac{1}{4}$ " ) inch to three-quarter ( $\frac{3}{4}$ " ) inch in size.

Where organic materials (peat, marl, muck, etc.) exist at the trench bottom, it shall be necessary to remove these to stable soils and backfill to grade with the aforementioned select materials. Where the material below plan grade is unstable to such a degree that it cannot be removed and replaced with an approved material, the Contractor shall construct supports as recommended by the Project Engineer and approved by the Township Engineer.

Where it is necessary to lay pipe in a fill area, unstable or unsuitable material shall be removed before fill material is placed. The embankment shall be of suitable material, one vertical on two horizontal fill slopes, and shall be placed in layers not exceeding one (1') foot in thickness compacted to 100 percent of maximum density as determined by the AASHTO T99 Method, to the proposed top of the pipe. The embankment shall not be less than four diameters plus twelve (12') feet wide at the invert of the pipe and shall be continued up to provide no less than three (3') feet of cover over the pipe.

### 43. PIPE CLEARANCE IN ROCKS

Rocks, boulders, and stones over two (2") inches in diameter shall be removed to provide a clearance of at least six (6") inches from any part of the pipe or appurtenances.

### 44. ROADWAY AND WATERWAY CROSSINGS

All work within a road right-of-way or a waterway shall be performed in accordance with the requirements of the governmental body having jurisdiction over the right-of-way involved. Notice and permits as required shall be given and secured from said governmental body before work starts.

### 45. TRENCH BOX

If the trench box rides below the top of the pipe, then care must be taken to protect the integrity of the pipe bedding, particularly when movement of the trench box leaves a void in the pipe bedding. Care must also be taken to ensure that movement of the trench box does not pull the pipe joints apart and, if necessary, the pipe lines should be secured with a wood crossblock, cable, and winch at the downstream manhole.

### 46. BORED AND JACKED CASINGS

#### A. Requirement:

The boring and jacking of steel casings shall be installed in any areas considered to be detrimentally affected by open cut construction in the opinion of the Township.

## CHAPTER FOUR

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### B. Materials:

1. Casing Pipe: Steel casing pipe shall be electronic-fusion welded pipe, conforming to the requirements of ASTM A-39, Grade B, with minimum one-quarter (1/4") inch wall thickness. Pipe ends shall be prepared for field welding of circumferential joints.
2. Carrier Pipe: Pipe materials shall conform to that specified in the applicable sections of these Standards.
3. Grout: Grout material shall be cement-sand mixture containing not less than one part cement to one part sand, unless otherwise approved by the Township Engineer.
4. Pipe Skids: Necessary skidding materials required to protect the pipe during installation shall be approved by the Township Engineer and furnished by the Contractor.

### C. Installation:

1. Casing Pipe: Casing pipe shall be installed in a continuous augering (or mining) and jacking operation with the casing pipe installation following directly behind the face of the excavation. Water shall not be introduced during the boring-jacking operation.
2. Grouting: The annular space between the outside surface of pipe and the inside surface of casing pipe shall be pressure grouted with approved materials. The diameter of the casing pipe shall be of sufficient size to ensure proper placement of the pipe to plan line and grade and to allow the proper installation of pressure grouted material. The ends of the casing pipe shall be closed with a masonry bulkhead at least eight (8") inches thick.
3. Minimum Boring Distances: All work shall be performed from boring and jacking pits adequately sheeted to prevent damage to the roadway, railway, etc. The minimum distance from the edge of the pavement to the trench or boring and jacking pit for dual highway and interstate routes shall be thirty (30') feet. For curb or guardrail section, railway track, or two-lane highway, the minimum distance will vary from shoulder point to the toe of slope, as shown on the plans or as directed by the Township Engineer.

## 47. RIP-RAP

- A. Rip-rap shall be installed at all locations as indicated on the plans.
- B. Typically, all rip-rap shall be installed on a suitable geotextile fabric.
- C. Rip-rap material shall be natural stone, limestone, or broken concrete free of any reinforcement.
- D. Average diameter shall be as indicated on the plans.

## CHAPTER FOUR

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- E. Rip-rap shall be placed so individual stones are fit together to form an interlocking mat. Smaller stones are to fill any large voids.
- F. Grouting rip-rap is permitted in lieu of supplementing settlement.

### 48. MAINTENANCE OF TRAFFIC

During the progress of the work, the contractor shall accommodate both vehicular and pedestrian traffic as provided in these specifications and as indicated on the drawings. In the absence of specific requirements, traffic shall be maintained in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices. Access to fire hydrants and water valves shall always be maintained. The contractor's truck and equipment operations on public roads shall be governed by County regulations, all local traffic ordinances, and regulations of the Fire Department.

Small road openings necessary for manholes, alignment holes, sewer connections, etc. will be permitted. Such holes shall not be open longer than necessary and shall be protected and any traffic detouring necessary shall be done to the satisfaction of the Township. Wherever possible, small openings shall be covered with steel plates at pavement level secured in place during periods that work is not being performed.

Where roads are partially obstructed, the contractor shall place and maintain temporary driveways, ramps, bridges and crossings which in the opinion of the Township are necessary to accommodate the public. In the event of the contractor's failure to comply with the foregoing provisions, the Township may, with or without notice, cause the same to be done at the Contractor's expense.

The contractor shall provide flagmen, warning lights, signs, fencing and barricades necessary to direct and protect vehicular and pedestrian traffic.

The contractor shall inform the Police and Fire Departments in advance of work operations of road obstructions and detours, so that they can set up plans for servicing the area in case of an emergency. The Township Supervisor's Office, Police, and Fire Department shall be notified at least one week prior to obstructing any road.

## CHAPTER FIVE

### AS-BUILT DRAWINGS PROCEDURES AND REQUIREMENTS

#### SECTION 5-1 INTENT

Prior to the Township's final approval of any site improvements or the final acceptance of any public utilities, which the Township will accept for maintenance and operation, "as-built" drawings must be submitted to the Township for review and acceptance.

#### SECTION 5-2 PROCEDURE

"As-built" drawings shall be initially submitted in the form of two (2) sets of prints with blue or black lines. Upon the approval of the "as-built" drawings by the Township Engineer, complete sets, of reproducible mylar drawings, a minimum of 3 mils thick, together with two (2) complete sets of blue-line or black-line prints, shall be submitted to the Township Engineer for distribution and archives. The Township may, at their discretion, also require the plans to be submitted in digital format. The number of As-Built mylar plan sets shall be determined by the Township. The Applicant shall receive copies of any inspection/observation reports from the Township Engineers.<sup>a</sup> This information is only intended to supplement their own, as-built survey, contractor reports, and<sup>k</sup> own field observation and are not intended to be a complete record for all construction activities for the subject project or the only source of documentation to provide the as-built information required herein.

#### SECTION 5-3 SECURITY DEPOSITS

In lieu of submitting final "as-built" plans in accordance with this Chapter, prior to the time of final project approval, the Township may, at their discretion, require a cash security deposit, or letter of credit, in an amount to be determined by the Township. This deposit will be returned upon the submittal of approved "as-built" plans.

#### SECTION 5-4 CRITERIA

"As-built" drawings shall contain, but are not limited to, the following information:

##### 1. General Plan Requirements:

The plans shall contain all information as shown on the approved plans:

- a. The as-built plans shall include all information as included in Chapter 3 – General Plan Provisions, such as location map, legend, project contacts, etc.;
- b. The plans shall be clearly labeled as-built on each sheet;
- c. All as-built survey data shall tie into the same site benchmarks as those used for the construction plans.

## CHAPTER FIVE

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2. Grading, Site Drainage and Open Channel Storm Systems - As-built grading plans shall include, but are not limited to the submittals of a Master Grading Plan with any deviations from the approved Grading Plan noted on the drawing. The plan must also include all drainage courses and open ditch or swale drainage conveyance facilities. In general, the as-built Grading Plan is to provide the Township with an accurate plan to verify that individual plot plans conform to the overall grading and drainage pattern.
3. Enclosed Storm Sewer System - As-built storm sewer system plans shall include, but are not limited to, length, diameter, invert and rim elevations and percentage of grade in plan and profile view. As-Built plans shall also include structure locations (shown with a minimum of two (2) offsets from property lines or an as-built coordinate table), material and joint type used, and quantities.
4. Storm Water Management Facilities - As-built detention or retention plans shall include, but are not limited to, as-built contours, adequate spot grades to substantiate these contours, all overflow and outlet invert elevations, and labels identifying the permanent water, high water, and freeboard elevations. Also, as-built volumetric calculations must be included in the plans which include the required volume calculations from the approved plans and as-built calculations. It must be certified on the as-built drawings that any maximum basin side slopes, as stipulated on the approved plans, have not been exceeded. If the approved plans required perimeter fencing, it must also be shown and properly “as-built”. Furthermore, any restrictor location and size must also be “as-built”.
5. Paving - As-built paving plans for roads, parking lots, sidewalk paths, etc shall include, but are not limited to, centerline elevations, curb and gutter elevations, where installed, pavement widths, and sidewalk lengths. Also, any entrance improvements such as turn lanes, acceleration/deceleration lanes, etc. must also be properly as-built.
6. Sanitary Sewer Collection System - As-built sanitary sewer system plans shall include, but not be limited to, length, diameter, invert and rim elevations and percentage of grade in plan and profile view. As-Built plans shall also include structure location (shown with a minimum of two (2) offsets from property lines or an as-built coordinate table), material and joint type, and quantities. Also, sanitary sewer house lead information is required. This shall include lead length, distance of wye from downstream manhole, a triangulation dimension and invert depth below grade. This information can be shown in an as-built table or using the symbology which is included in the Appendix.
7. Community Sewer System – As-Built Community Sewer System plans shall include, but are not limited to, all sizing dimensions, materials and equipment installed, capacity of system, size, lengths, slopes and inverts of all piping, finished grades of all structures, etc.
8. Water Distribution Facilities - As-built water system plans shall include, but not be limited to, lengths, diameters, gate well and hydrant finished elevations, locations of all hydrants, structures, gate wells, meter pits, PRV’s, etc. (shown with offsets from property lines or an as-built coordinate table), materials used including the make and model of the hydrants and quantities

## CHAPTER FIVE

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9. Community Well System – As-Built Plans for Community Well Systems shall include, but are not limited to, all dimensions as shown on the approved plans, equipment and materials listings, all pipe sizes, lengths, inverts, slopes, rims, etc., tank capacities, design calculations, offset dimensions to nearest property lines, and any other information as required for final site plan approval.
10. Fire Suppression Facilities – As-Built Plans shall include, but not limited to, all dry hydrant dimensions, all dry hydrant assembly parts/fittings information, supply size (i.e., tank dimensions, pond contours and calculations).

### SECTION 5-5 CERTIFICATION

All “as-built” plans shall contain a statement by a licensed Professional who is currently registered in the State of Michigan, certifying the drawings to be “as-built.” All plans must also contain the seal and signature of said Registered Professional.

## CHAPTER SIX

### DESIGN AND CONSTRUCTION STANDARDS FOR CLEARING, GRADING AND SURFACE DRAINAGE

#### SECTION 6-1 INTENT

This Standard establishes the minimum requirements for clearing, grading and surface drainage plans and the construction requirements to implement such plans for all sites within the Township.

#### SECTION 6-2 GENERAL

All new subdivisions, site condominiums, commercial development, or any improvement which requires site plan approval by the Township, will require a clearing, grading and drainage plan. Plans which minimize, to the extent possible, clearing and grading as well as utilize open drainage facilities are strongly encouraged and where these factors can preserve natural features the Township may require such provisions.

#### SECTION 6-3 DESIGN CONSIDERATIONS

##### 1. Clearing

- a. Plans will generally not be approved for sites which are to be “clear-cut” and re-landscaped. It is the intent of the Township to maintain as much of the natural landscaping and features as possible.
- b. The Township reserves the right to have trees preserved and/or protected which they feel enhance the natural characteristics of the property to be developed. These trees may be of unique size, shape, species, location, etc.
- c. All stumps and other tree parts, litter, brush, weeds, scrap construction materials or other debris shall be removed from the site and disposed of in accordance with State and Federal law. Vegetative material may be chipped on site. The method to be used for disposal of vegetative material needs to be shown on the plan. If trees or limbs are reduced to chips, they may be used in landscaping applications. **No burning on site is permitted.**

##### 2. Grading

- a. Filling and grading shall not create a barrier causing entrapment or restriction of water onto or from adjacent properties.
- b. The grading plan shall be designed such as to ensure that storm water will drain away from all building structures and so as not to be detrimental to adjacent properties.

## CHAPTER SIX

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- c. Grading plans shall take into account the desirable natural features, i.e.; trees, wetlands, steep slopes, etc., and the character of the land which must be preserved where possible.
- d. No filling, dredging, grading, or other alteration will be allowed in any areas of land which lie either wholly or in part within the floodplain of a river, stream, creek, lake or regulated wetlands unless under the terms of a permit granted by the Michigan Department of Environmental Quality (MDEQ) or other governmental agency having jurisdiction.
- e. Topsoil stripped during construction shall be stockpiled on site. Stockpiled topsoil shall be contained by appropriate soil erosion measures to prevent the migration of soils (i.e., erosion). Stockpile locations are to be shown on the plans.

### 3. Drainage

- a. The Township encourages open drainage facilities (i.e., ditches, swales, etc.) in lieu of enclosed storm sewers wherever feasible.
- b. All storm water runoff will be intercepted within the boundaries of the site, collected, and conducted through a storm water system to an approved point of discharge. At no time shall storm water discharge from a developed site exceed the restricted rate or volume as set forth in these Standards.
- c. For storm events with a reasonable intensity and frequency, all developments shall freely drain storm water without ponding, except where specifically designed for storage such as detention, retention, or a landscape pond.
- d. All development shall provide for overland flow of storm water from adjacent properties where the existing offsite land slopes to the site. The amount of runoff to be provided for from offsite lands shall be at least equal to the volume and rate of runoff from the land in the undeveloped state.
- e. Easements for drainage facilities shall be of a width adequate to provide proper access for maintenance, centered upon the facilities. Such easements shall be deeded or dedicated to the Subdivision Association, Condominium Association, property owner, or entity responsible for the maintenance of the drainage facilities, with restrictions against use or occupation of easements by the property owners and/or by other utilities in any manner which would restrict maintenance or repair operations. Easements will be in a form as approved by the Township. Whenever a constructed drainage facility is required to cross an adjacent property, an easement for this purpose must be provided on the adjacent property.
- f. All surface drainage facilities must be designed to ensure that, should a failure occur in the system, storm water will drain away in a manner which will not impact existing or proposed structures on site or off site, or cause erosion.

## CHAPTER SIX

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- g. For open ditch storm water conveyance systems, channel slopes shall be set at grades which will not cause erosion. The Project Engineer shall be responsible to provide calculations based on Manning's formula, which demonstrate the velocity and capacity of all open drainage courses based on a ten (10) year design flow in accordance with the methods as outlined in Chapter 9 for enclosed storm sewers. The minimum ditch grade shall be such that water will flow properly and not become stagnant. This requirement does not include side yard swales between lots or units in a residential development.
- h. Hydraulic design calculations and a copy of the drainage area layout used for the hydraulic design shall accompany construction plans submitted for review. The drainage area layout shall, in the case of a design for a new development, be superimposed on the proposed grading plan for the development.
- i. Side slopes of all drainage courses shall be designed in accordance with the proposed slope maintenance. For example, grass slopes to be mowed should be no steeper than one on four (1:4), or armored banks (i.e., riprap or gabion lining) could be up to one on two (1:2) side slopes.
- j. Storm water runoff in excess of the rate and volume generated by the pre-developed property shall be managed in accordance with the storm water management standards (Chapter 8) contained herein.

### 4. Lot (Site) Layout:

- a. Generally, a building shall not be set below the crown of the road on which it fronts, unless it is positioned far enough back from the road to insure positive drainage away from the building.
- b. Each site shall be graded to drain away from structures or units into swales. Swales shall discharge to a storm sewer, roadway gutter, ditch, storm water management facility, or other approved drainage course.

## SECTION 6-4 PLAN REQUIREMENTS

Clearing, grading and surface drainage plans shall show at least, but not limited to, the following information:

1. Existing and proposed topography and ground elevation contours, with a 2-foot contour interval as indicated in Chapter 3, tied together to clearly show cuts and fills.
2. The limits of clearing shall be shown on the same plan sheet(s) as the grading. Construction fencing shall be placed to delineate the limits of the clearing where appropriate to preserve natural features. Individual trees to be protected shall have protective fencing installed at the drip edge of the tree.

## CHAPTER SIX

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3. All proposed and existing storm drainage facilities, such as swales, ditches, storm water management facilities, storm sewers, manholes, catch basins, and inlets including rim and end section finish grades, as well as inverts.
4. Stationing of centerline of street pavements, and pavement elevations at 50-foot intervals. High and low points are also to be shown.
5. Top of curb or shoulder elevation opposite each front lot (unit) corner (and side lot corner for corner lots) to tenths of a foot.
6. Proposed ground elevation at each lot corner (front and rear), and side lot elevations to tenths of a foot, where individual lots are being developed concurrently with site improvements for which plan approval is being sought.
7. Whenever swales for lot drainage are called for on the plan, swale elevations at the high point adjacent to any buildings, even with the back, and even with the front shall be provided. General flow direction of swales shall be shown with arrows.
8. Drainage flow arrows shall be shown to indicate the direction of surface water flows.
9. Proposed elevations shall be provided for pavement, sidewalks, top of curbs, parking islands, and additional locations as required by the Township Engineer.
10. Any proposed grade separation that necessitates the provision of a retaining wall, or the like, must be clearly indicated on the grading plan. Retaining wall design and supporting calculations, with the exception of natural (i.e., boulder) wall construction, must be submitted to the Township at the time of Final Site Plan submittal. The retaining wall design and supporting calculations must bear the seal of a licensed professional engineer, registered to practice in the State of Michigan.
11. Finished building grades shall be compatible with the grades of surrounding existing structures, yards, and with the existing ground at the proposed structure. The building elevation should fit into the natural topography of the individual property (lot) to the extent practical given any site constraints such as drainage or access.
12. Drainage district delineation and area.
13. Cross sections for all proposed open conveyance facilities, including width from top of bank to top of bank, side slope grades, easement width, restoration, slope protection measures, etc.
14. Calculations based on Manning's equations with all assumptions or values used for the variables shown. Calculations are to include design velocity and capacity.

## CHAPTER SIX

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### SECTION 6-5 APPROVALS

The Applicant is responsible for obtaining all required permits and approvals prior to the start of any site grading and clearing. These include, but may not be limited to, the following:

1. Approval from the Township;
2. Off-site Drainage and/or Grading Easements;
3. OCDC – Soil Erosion and Sedimentation Control Permit;
4. MDEQ – National Pollutant Discharge Elimination System (NPDES); Wetland or Discharge and
5. RCOC and MDOT Permits.

### SECTION 6-6 CONSTRUCTION REQUIREMENTS

1. At all times the grading shall be conducted in a timely and orderly fashion, acceptable to the Township. Grading shall be accomplished in a manner that shall adhere to required soil erosion and sedimentation control devices and sequences and shall not alter or in any way effect offsite and adjacent natural drainage. Natural drainage flow passing through any construction site shall be accommodated at all times.
2. Any earth excavations and/or embankment construction shall be in strict accordance with the approved engineering drawings.
3. Any construction fencing to be a minimum four (4') feet high, orange or red in color, and with steel posts spaced every ten (10') feet.
4. All disturbed areas should be stabilized or finished and vegetation established as soon as possible after grading operations.
5. All open ditches or swales are to be constructed per the approved plans.
6. The Project Engineer is to properly stake the centerline and top of bank of all drainage improvements.
7. Prior to final approval by the Township, any accumulated sediment must be removed and the channel restored.
8. Bank and channel armorment is to be constructed per the approved plans or per the manufacturer's suggested installation procedures for proprietary products.

## CHAPTER SEVEN

### DESIGN AND CONSTRUCTION STANDARDS FOR SOIL EROSION CONTROL

#### SECTION 7-1 INTENT

It is the intent of this Chapter to provide guidelines for the design and implementation of soil erosion control measures for and during construction. Development within the Township shall be accomplished with proper safeguards to prevent soil erosion and sedimentation, consistent with Act 451 of the Public Acts of 1994 of Michigan, the Natural Resources and Environmental Protection Act, and corresponding general rules for design and construction standards.

**As each site is unique and requires a special soil erosion and sediment control plan, the “one size fits all” premise is not acceptable. Innovative approaches to erosion control are strongly encouraged.**

#### SECTION 7-2 GENERAL

Soil erosion and sedimentation control as a program (i.e., design, installation, maintenance, removal) shall:

1. Provide proper maintenance of permanent soil erosion and sedimentation practices and adequate restoration of adverse impacts from sediments and erosion.
2. Protect water resources such as lakes, streams, rivers, wetlands, and watercourses from degradation due to sedimentation and erosion.
3. Protect adjacent property from degradation due to sedimentation and erosion.
4. Protect meadows, woodlands, and other natural features from sedimentation and damage caused by erosion.

#### SECTION 7-3 PERMITTING AND COMPLIANCE

Plans conforming to the requirements contained herein shall be submitted to the Township for review. The Township is not considered a Local Enforcement Agency (LEA) and does not issue permits for soil erosion control. Permit Applications for soil erosion control must be submitted to and approved by the Oakland County Drain Commissioner (OCDC). The Township, however, will review soil erosion control plans for conformance to the standards herein and reserve the right to require control measures above and beyond those required by OCDC. Furthermore, while OCDC acts as the enforcement agent in the Township, as a condition of plan approval from the Township, the Township retains the right to stop work for failure to comply with the approved soil erosion control plan or failure to maintain such measures.

## CHAPTER SEVEN

The OCDC Soil Erosion and Sedimentation Control Permit must be approved and on file at the Township prior to any work on site including mobilizing onto the site.

### SECTION 7-4 SOIL EROSION AND SEDIMENTATION CONTROL PROGRAMS

In developing an effective soil erosion and sedimentation control plan, a comprehensive and integrated approach is required for protecting the natural resources during construction. The following are the general principles to be followed and included as part of the specialized soil erosion control program for each individual site:

1. **Minimize Clearing** – Portions of a site near sensitive and critical areas should not be disturbed. Only the areas actually needed to build structures and provide access should be cleared. Limits of disturbance are to be included in the plans or on a separate Soil Erosion and Sedimentation Control (SESC) plan, if provided.
2. **Waterway Protection** – As a necessary form of protection, perimeter controls, such as silt fence, shall be installed along the perimeter of the watercourse buffer. If work is planned across or within the watercourse, special crossings and protective measures are required.
3. **Drainage Way Stabilization** –Special controls such as check dams, silt fence, vegetated buffer strips, erosion control blankets, and riprap are to be applied to the drainage way depending on their slope and length, and the disturbed areas that contribute drainage.
4. **Construction Phasing** – Exposure to the smallest practical area for the shortest time by properly scheduling and staging project activities is preferred. Disturb only first phase areas and stabilize before beginning subsequent phases. The phases should be planned so that earthwork is balanced within a phase; i.e., the cut from one area matches the fill requirement elsewhere. Earthmoving should occur only when it is absolutely needed. The construction sequence indicated on the plans must outline the specific order of construction that the contractor is to follow to complete a single phase.
5. **Slope Protection** – Clearing and grading of existing steep slopes should be avoided. Special techniques are to be used to prevent upland runoff from flowing down a slope and causing gullies. The use of silt fence at the toe of steep slopes should be carefully selected because flow velocities and sediment can quickly overload a silt fence. Additional practices may be required, such as scarification, erosion control blankets, multiple rows of silt fence, check dams, and increased mulch application rates with mulch binders and so noted on the plans.
6. **Perimeter Controls** – Maintain sediment control practices to prevent soils from leaving the site. Common options are properly installed, located, and maintained silt fence, hydroseeded dikes, and diversions.
7. **Employ Advanced Settling Devices** – For critical sites, some form of sediment trap, or sediment basin is required for all basin drainage accumulation points.

## CHAPTER SEVEN

8. Adjust Soil Erosion and Sedimentation Control Plan for Field Conditions – The plan may need to be modified during various construction phases due to discrepancies between planned and as-built grades, weather conditions, altered drainage, and unforeseen circumstances. The need for maintenance repairs or additional, specialized controls may appear evident after storm events. Proposed modifications should be submitted to the Township for review and concurrence.

### SECTION 7-5 RECOMMENDED SOIL EROSION CONTROL MEASURES

The following are commonly used and accepted Soil Erosion and Sediment Control measures. Again, as each site is unique and requires a specialized Soil Erosion and Sediment Control plan, the “one size fits all” premise is not acceptable. Innovative approaches to erosion control are strongly encouraged.

**1. Temporary Seeding and Mulching:** Select and schedule seeding in accordance with the Michigan NRCS Critical Area Planting Guide. Seed should be applied at recommended rates or, if not given, 150-200 lbs/acre. For hydromulching, apply 2 tons/acre for most applications and 3 tons/acre for dormant seeding. Mulch is recommended on any areas exposed to erosion, particularly those next to streams and wetlands, and newly seeded areas, especially slopes, droughty sands, and clayey soils. Organic mulches are preferred for most uses.

Small grain straw of winter rye for protecting seed is preferred since fewer weeds are generally present. Uniformly spread 1.5 to 2 tons/acre for normal applications and 2.5 to 3 tons/acre for critically eroding areas.

By the use of hydraulic equipment (hydroseeders and hydromulchers), seed, soil amendments, wood fiber mulch and tackifying agents, bonded fiber matrix, and liquid copolymers can be uniformly broadcast as a hydraulic slurry onto the soil to control erosion and dust.

This soil erosion control method is assumed to be temporary only. Permanent seeding in accordance to the Township’s Vegetation Recommendations shall replace the temporary seeding in accordance with the approved landscape plan.

**2. Erosion Control Blankets:** Erosion control blankets made of coarse wood fibers, coir (coconut) fibers, synthetic fibers, or a combination reinforced on top or both sides by degradable netting are recommended for protection of sensitive and critical areas such as slopes, temporary and permanent drainage ways, streambanks, detention pond slopes, and concentrated flows such as pipe outlets. Must be installed per manufacturer’s specifications.

**3. Surface Roughening:** Scarification involves running tacked machinery such as bulldozers up and down slopes to leave horizontal depressions in the soil. To avoid undue compaction of the soil, this method should only be used on sandy soils.

Cut Slope Roughening involves stair-step grade or groove cutting the slopes of soft material that are steeper than 3:1. Individual vertical cuts more than two (2’) feet high in soft materials and three (3’) feet high in rocky materials are discouraged.

## CHAPTER SEVEN

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4. **Check dams:** Rock or gabion basket check dams should be constructed across drainage ways to reduce concentrated flows in the channel and protect vegetation in the early stages of growth as well as filter and detain runoff. Check dams will require frequent inspection and sediment removal.

5. **Buffers and Filter Strips:** A vegetated area surrounding a disturbed area is particularly beneficial when construction operations are adjacent to a waterbody. The buffer strip may be natural undeveloped land where existing vegetation is left intact or it may be planted with vegetation. The vegetative filter absorbs sheet flow and reduces sediment and potential contaminants. Where feasible, a 50 ft buffer/filter strip should be used to protect adjacent areas and a 100 ft buffer filter strip should be used to protect water quality along a stream corridor.

6. **Silt Fence:** Filter fabric is attached to the upstream side of the posts and must be trenched and buried a minimum of six (6”) inches. Posts are spaced a maximum of ten (10’) feet apart. Silt fence is not designed for steep slopes, concentrated flow, or outlet pipes. Silt fence is placed on slope contours to maximize ponding efficiency and reduce erosion.

Inspect and repair silt fence after each storm event or as required. Remove sediment when storage height exceeds nine (9”) inches and deposit to an area that will not contribute sediment off site, or return sediment back into the drainage pattern.

7. **Catch Basin Inserts:** Commercial Products are available to be installed within drainage structures to capture sediment. Install per manufacturer’s directions. Reuse of product, if in good condition, e.g. no rips or tears. Select models with, or install separate, sediment protectors for the back of open curb inlets. Details and manufacturer’s information is to be included in the plans.

Inspection of its collected sediment level is important to maintain effectiveness and prevent ponding. If there are no major events, products should be inspected every two (2) to three (3) weeks and emptied as required.

8. **Sedimentation Basin:** A sedimentation basin is a depression in the land with a defined surface area and detention volume, natural or constructed, to which sediment laden runoff is conveyed allowing sediment to settle out. By definition, they are impoundment structures designed to remove the eroded soil from runoff before it leaves the site, and store the sediment. An effective sedimentation basin detains runoff long enough for sediment to settle out of the water and is typically sized for a 1-year storm event or for 0.5 inches of rain over the tributary area.

To ensure maximum performance on site, each of the sedimentation basin components must be carefully reviewed during the planning phase to conform to site conditions, location, size, etc. In addition to proper design, adequate maintenance is critical to achieving peak performance.

9. **Riprap Energy Dissipater:** Stone or concrete apron at the end of outlet pipe to dissipate energy should be installed at outlets.

## CHAPTER SEVEN

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10. **Commercial Dewatering Filtration:** Non-woven geotextile fabric bag on a flat surface stabilized with aggregate, vegetation, or mulch so filtered water flows downhill at a reasonable rate to a stabilized drainage way.

11. **Scheduling:** The planning process should indicate where all control measures are implemented in a timely and logical fashion during construction. It may be necessary to implement controls sequentially to achieve the required soil erosion control. Grading and stabilization are to be finished in one area before proceeding to the next and so indicated in the Construction Schedule.

12. **Aggregate Access Roads:** Access roads are gravel pads that allow workers and delivery vehicles to enter or leave the site. They remove mud from the tires of vehicles, reduce sedimentation from this disturbed area, and reduce the amount of street cleaning necessary. For residential lots, a minimum 10' by 30' by 6" pad of 2"-3" fractured aggregate stone is recommended on a filter fabric. For larger sites, a minimum 30' by 100' by 12" pad of 3"-4" fractured aggregate stone may be necessary on a filter fabric. The pad should flare out wider at the curb. A filter fabric is recommended to improve stability, reduce the costs of topping up aggregate pads on soft soils, and aid in removal for the grading of concrete drives.

13. **Construction Barriers:** Signs, snow, or barrier fencing or other barriers are to be used to protect critical areas, protect trees, and confine equipment, vehicles, and personnel. Fencing should be adequately fastened with three (3) or four (4) straps per post and maintained regularly.

14. **Stockpiles:** Stockpiles of topsoil or excavated materials should be identified and addressed on the SESC plan. If possible, stockpiles should not be located adjacent to wetland or watercourses. Stockpiles may be located around the perimeter of the site away from activity or in the vicinity of construction. Silt fence must be placed around the stockpile. Provide temporary seeding to all stockpiles when proposed to be left in place for extended periods of time.

### SECTION 7-6 PLAN REQUIREMENTS

Plans submitted to the Township shall contain the following Soil Erosion and Sedimentation Control information:

1. Site development plan showing all proposed Soil Erosion and Sedimentation Control measures.
2. Information as to how excavated material will be handled and stored to prevent erosion.
3. Proposed location of material storage and stockpiles properly protected.
4. Detail Sheet showing all proposed Soil Erosion and Sedimentation Control measures.
5. Sequence of Construction, Operations, and Restoration.
6. Schedule for installation, maintenance, and removal of all proposed Soil Erosion and Sedimentation Control measures.

## CHAPTER SEVEN

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7. Limits of dewatering necessary and proposed discharge location.
8. Permanent stabilization provisions.
9. Any temporary or permanent facility designed and constructed for the conveyance of water around, through, or from the earth change area shall be designed to limit the water flow to a non-erosive velocity.
10. The following notes must also be included on the plans:
  - a. All erosion and sediment control work shall conform to the current standards and specifications of Oakland County Drain Commissioner and the Charter Township of Springfield.
  - b. Daily inspections shall be made by the Contractor for effectiveness of erosion and sedimentation control measures, and any necessary repairs shall be performed without delay.
  - c. Erosion and any sedimentation work on this site shall be contained on the site and not allowed to collect on any offsite areas or in waterways, including both natural and man-made open ditches, streams, storm drains, lakes and ponds.
  - d. Contractor shall apply temporary erosion and sedimentation control measures when required and as directed on these plans or by the Township. He shall remove temporary measures as soon as permanent stabilization of slopes, ditches, and other earth changes has been accomplished.
  - e. Staging the work will be done by the Contractor as directed in these plans and as required to ensure progressive stabilization of disturbed areas.
  - f. Soil erosion control practices will be established in early stages of construction by the Contractor. Sediment control practices will be applied as a perimeter defense against any transporting of silt off the site.

### SECTION 7-7 CONSTRUCTION PROVISIONS

1. All Soil Erosion and Sedimentation Control measures must be installed prior to the start of and work on site including mobilization onto the site.
2. It is the responsibility of the Contractor to maintain the Soil Erosion and Sedimentation Control measures throughout the duration of the project, supplement ineffective measures, and remove all such measures at the time of established restoration and project completion.
3. Pumping or draining from trench excavation shall not be permitted into the waters of the state. It shall be the Contractor's responsibility to secure the necessary approval of private landowners and

## CHAPTER SEVEN

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the Township before discharging water from the trench excavation onto the private lands. Water shall be discharged in such a manner as to not cause any pollution or erosion problems. Under no circumstances may the Contractor discharge sanitary sewage onto the ground surface. The Contractor shall dewater to existing storm system sewers wherever possible. Method of disposal shall be approved by the Township. All discharge from dewatering wells discharged onto the ground before being piped to a natural watercourse or lake via an existing storm sewer system or by a temporary piping system shall have built at the point of entry an approved silt retention structure. The silt structure may consist of several straw bales adequately anchored and placed as directed by the Engineer. Any eventual silt or solids retained in the area of these structures shall be removed prior to the removal of the structure. At no time will silt or similar materials be permitted to filter into a lake or natural watercourse. There shall be no sidcasting of any excavated material into any waterway. Excess excavated material from stream crossings and excavation near streams shall be removed and disposed of elsewhere.

### 4. WATER COURSE BANK PROTECTION

- a. Inland Lakes and Streams Act: All waterway crossings are subject to the provisions of the Inland Lakes and Streams Act, 1972 Public Act 346, as amended and Administrative Rules. Special attention is directed to applicable portions of Rules 22 through 29, inclusive. The Contractor's activities shall adhere to the provisions of this Act. The Contractor shall secure the required Michigan Department of Environmental Quality (MDEQ) Permit prior to any construction activity taking place and shall strictly comply with all permit requirements.
- b. The banks of a watercourse shall not be left unprotected for more than one (1) day after the work is completed. Construction shall not be allowed to continue at the expense of not providing bank protection.
- c. All disturbed watercourse banks shall be finished with a slope not steeper than 4:1 (four horizontal to one vertical) or to match existing conditions. The 4:1 slope shall be graded up and back to the high water line. If the top of the natural bank is more than three (3) feet above the high water line, a minimum of one (1) foot berm shall be constructed at this level and the remaining slope constructed upward parallel with or on a flatter slope than the original natural bank, provided sufficient adjoining property is available. If such property is not available, permanent riprap shall be placed to the top of the bank. Permanent riprap material shall be placed from the bed of the channel to three-(3) foot above the normal high water line or to the top of the bank. If riprap is placed to the top of the bank, a berm will not be required. Permanent riprap shall be 5 to 1 mix of sand to cement in burlap or canvas bags, "Sacrete", broken concrete, man-size rock or other material approved by the Township Engineer. "Sacrete" where used shall be transferred to burlap or canvas bags. All raw soil exposed above the riprap shall either be sodded or seeded, fertilized and mulched. On slopes greater than 10%. sod shall be pegged for stability.

In addition to the aforementioned specific requirements for the stream crossings, stream bank protection and slope stabilization adjacent to streams, restoration shall be completed in accordance with the approved MDEQ Permit and Standards.

## CHAPTER SEVEN

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### 5. SURFACE RESTORATION

Where construction calls for, or the Drawings involve placing underground utilities in the roadways or under other impervious materials, special care shall be provided by the Contractor to:

1. Provide control measures at all storm sewer catch basins by providing straw or other types of filters or construct sediment traps adjacent to inlets.
2. If a roadway has a grass ditch area, minimize disturbance and provide filter berms (straw or gravel) or sediment traps as appropriate.
3. Provide proper downdrain structures to control increased runoff to streams and drains.
4. Stabilize the roadway as soon as possible after placement of the sewer. Temporary erosion control measures shall be instituted until final paving is complete. Such measures may include a subbase surfacing application or gravel surfacing. Compaction of soil may suffice if other control measures are effected.

### SECTION 7-8 INSPECTION

Inspections by the Township or their appointed agent (as well as OCDC) will be made periodically throughout the construction on the maintenance and effectiveness of the Soil Erosion and Sedimentation Control measures. Follow-up inspections may be warranted should failures be noted or additional measures be needed.

The costs of these Township inspections will be charged against the inspection/observation escrow account. If inspection reveals that the controls are not being implemented or maintained, a stop work order on all site construction may be issued until the concern is addressed.

## CHAPTER EIGHT

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### DESIGN AND CONSTRUCTION STANDARDS FOR STORM WATER MANAGEMENT SYSTEMS

#### SECTION 8-1 INTENT

This section sets forth specific design and construction standards that will be used by the Township in the review process of proposed storm water management systems; in accordance with the objectives of managing both the quantity and quality of storm water runoff.

Where feasible, applicants are encouraged to combine storm water management facilities with adjacent developments. This approach is intended on reducing the number of small individual facilities and saving natural features by combining them into regional facilities.

#### SECTION 8-2 THE DESIGN OF STORMWATER MANAGEMENT SYSTEMS

The applicant must evaluate the impact of their project over the long term, and on a watershed scale. This approach requires the consideration and use of Best Management Practices (BMPs) that function together as a system to ensure that the volume, rate, timing and pollutant load of runoff remains similar to or improve upon that which occurred under natural conditions. This can be achieved through a coordinated network of structural and nonstructural methods, designed to provide both source and site control.

##### 1. Source Controls

Source controls reduce the volume of runoff generated on-site, and eliminate initial opportunities for pollutants to enter the drainage system. By working to prevent problems, source controls are the best option for controlling stormwater, and include the following key practices which are strongly encouraged by the Township:

- A. Preservation of existing natural features that perform stormwater management functions, such as depressions, wetlands and vegetation.
- B. The minimization of impervious surface area through site planning that makes efficient use of paved, developed areas and maximizes open space. Impervious surfaces are also reduced by encouraging flexible street and parking standards within the framework of the Zoning Ordinance and the use of permeable ground cover materials.
- C. Directing storm water discharges to open, grassed areas such as swales rather than allowing stormwater to run off from impervious areas directly into an enclosed storm water conveyance system.

## CHAPTER EIGHT

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- D. Careful design and installation of erosion control mechanisms and rigorous maintenance throughout the construction period. Effective erosion control measures include minimizing the area and length of time that a site is cleared and graded, and the immediate vegetative stabilization of disturbed areas.

### 2. Site Controls

After the implementation of source controls, site controls are then required to convey, pre-treat, and treat (e.g., detain, retain or infiltrate) the stormwater runoff generated by development. The range of engineering and design techniques available for these objectives is dictated by site configuration, soil type, and the receiving drainage course. While each site is unique, some universal guidelines for controlling stormwater quality and quantity can be stated as follows:

- A. In general, the most effective stormwater quality controls are infiltration practices, which reduce both the runoff peak and volume. Sediment clogging can potentially reduce infiltration in structural devices if not properly maintained. Therefore, an aggressive maintenance program and extensive upstream pre-treatment measures (such as oil/grit separators, sedimentation basins and grass filter strips) must be incorporated into any stormwater management system. However, the use of oil/grit separators does not replace the need for sedimentation basins. In addition, these practices are only feasible on small sites, with suitable soils and no potential for groundwater contamination.
- B. The next most effective stormwater site controls reduce the runoff peak, and involve storage facilities such as retention and detention ponds. In the selection of an appropriate stormwater pond design, wet ponds are preferable to dry detention ponds, since they hold stormwater much longer, allowing more particulates to settle out. In addition, the aquatic plants and algae within wet ponds take up soluble pollutants (nutrients) from the water column. These nutrients are then transformed into plant materials that settle to the pond floor, decay, and are consumed by bacteria. Since this biological process is dependent upon the presence of water, it does not occur in dry ponds.

Where site conditions make the use of a wet pond infeasible, ponds should be designed to provide extended detention of stormwater, again to promote increased settling of particulates.

- C. Once all possible methods of reducing and treating stormwater on-site have been implemented, any excess runoff may be discharged into a conveyance system and carried off-site to a suitable outlet. For this purpose, vegetated swales with check dams are generally preferred to curb and gutter systems and enclosed storm drains.
- D. Also of primary importance to water quality, is the capture and treatment of the "first flush", a term used to describe the initial washing action that stormwater has on

## CHAPTER EIGHT

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impervious surfaces. Pollutants that have accumulated on these surfaces are flushed clean by the early stages of runoff, which then carries a shock loading of these pollutants into receiving waterways. By capturing and treating the first 0.5 inch of runoff, most of the pollutants that are washed off of the land can be removed from stormwater before it enters the drainage system.

- E. Stormwater should be pre-treated prior to entering a retention or detention pond, by passing first through a sediment forebay. Sediment forebays function to reduce incoming water velocities, and to trap and localize incoming sediments, thereby reducing pond maintenance. Sediment forebays also extend the flow path of stormwater, increasing its residence time.

F. Preferred Best Management Practices

1. Preservation of the natural environment
  2. Minimization of impervious surfaces
  3. Use of vegetated swales and natural storage
  4. Non-Structural (Source) Controls
  5. Structural (Site) Controls
    - a) Infiltration of runoff on-site (trenches, etc.)
    - b) Stormwater retention ponds
    - c) Stormwater detention structures
    - d) Conveyance off-site
3. For each site an effective storm water management plan must be included within the plan set (on a separate plan sheet or included on another plan sheet) submitted for review. Components of an Effective Stormwater Management Program shall consist of the following as applicable to the particular site:

Runoff Source Control by the following:

1. Preserve the Natural Environment
2. Site Design
3. Minimize Impervious Area
4. Disconnect Impervious Areas
5. Vegetative Practices (Filter Strips, Stream Buffers)
6. Grading and Soil Erosion and Sedimentation Control

B. Runoff Conveyance using:

1. Vegetated Swales w/Checkdams
2. Level Spreaders

C. Runoff Pretreatment in:

1. Sediment Forebays
2. Oil Grit Separators
3. Micropools

## CHAPTER EIGHT

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- D. Runoff Treatment by:
  - 1. Infiltration Devices
  - 2. Stormwater Marsh Systems
  - 3. Retention / Detention Basins
  - 4. First Flush Capture
  
- E. System Maintenance such as:
  - 1. Inspection
  - 2. Sediment Disposal
  - 3. Access
  
- F. Secondary Impact Mitigation
  - 1. Stream Restoration
  - 2. Downstream Wetland Protection

### SECTION 8-3 GENERAL

- 1. Drainage for the proposed development shall conform to existing watershed boundaries or any established Township or County drainage districts.
- 2. The proposed drainage plan shall, in every way feasible, respect and conform to the natural drainage patterns within the site and the watershed in which it is located.
- 3. Proposed drainage shall complement any local stormwater management plans that may exist and/or comply with any relevant Township Ordinance in effect.

### SECTION 8-4 DISCHARGE AND OUTLET CONSTRAINTS

- 1. In no event shall the maximum design rate of discharge exceed 0.15 cfs per acre or the rate of existing discharge at the outlet point, whichever is lower.
- 2. The discharge volume shall be similar to conditions prior to development, i.e. runoff coefficient weighted acreage are equal between existing and developed conditions. Additional volume controls and acquisition of rights-of-way from downstream property owners receiving the storm water flow will be required where a volume increase could cause downstream problems.
- 3. It is the Applicant's obligation to meet these standards. Should a stormwater system, as constructed, fail to comply with the standards herein, it is the Applicant's responsibility to design and construct, or to have constructed at their expense, any necessary additional and/or alternative stormwater management facilities. Such additional facilities will be subject to the Township's review and approval.

## CHAPTER EIGHT

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4. The Applicant shall be solely responsible to determine the feasibility of the discharge point and downstream conditions from the outlet. The proposed outlet to the stormwater management facility shall, in every way feasible, respect and conform to the natural drainage patterns within the site and the watershed in which it is located.
5. A description of the off-site outlet, evidence of its adequacy and a detailed description of the effects of said outlet on downstream properties shall be included in the plans submitted for review.
6. The volume and manner of water discharged due to development of the site shall not create adverse impacts to downstream property owners and watercourses (e.g., flooding, excessive soil saturation, crop damage, erosion, degradation in water quality, or habitat destruction). Offsite drainage easements may be required as determined by the Township, to be warranted based on the location and condition of the drainage outlet and subject to all applicable local ordinances and state law in this regard.

### SECTION 8-5 DETERMINATION OF SURFACE RUNOFF

1. The "rational method" of calculating stormwater runoff is generally acceptable. For drainage areas over 100 acres, due caution should be exercised. Other methodologies for predicting runoff, such as runoff hydrographs, may be required by the Township for sizing the stormwater management systems on sites that are deemed potentially problematic. Acceptable alternative methods include The Army Corps of Engineers HEC programs and the Soil Conservation Service (SCS) Technical Releases and Programs.
2. All design rainfall events will be based on the Soil Conservation Service (SCS) Type II distribution.
3. Computations of runoff hydrographs that do not rely on a continuous accounting of antecedent moisture conditions will assume a conservative wet antecedent moisture condition.
4. For watersheds equal to or greater than 2 square miles, where approval of the Michigan Department of Environmental Quality is required, MDEQ will compute the runoff rates at no cost. MDEQ requires applicants to use the UD-21 method by SCS in lieu of the rational method. This method was developed for small watersheds by SCS and can be used for watersheds up to 10 square miles. The current version of UD-21 contains updated rainfall curves. Computer programs such as HEC-1 and HEC-RAS, DEQ permit applications, etc., can be downloaded from the MDEQ's web site located at <http://www.deq.state.mi.us/lwm>.

## CHAPTER EIGHT

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### SECTION 8-6 GENERAL DESIGN STANDARDS

All runoff generated by proposed impervious surfaces for the entire site (all acreage), should be contained on-site. If off-site discharge is permitted by the Township, it must be conveyed into a stormwater management system for water quality treatment and detention/retention prior to being discharged from the site. The following criteria will apply to the design of all stormwater retention and detention facilities.

1. In general, wet ponds and stormwater marsh systems will be preferred to dry ponds. Dry ponds providing extended storage will be accepted when the development site's physical characteristics or other local circumstances make the use of a wet pond infeasible.
2. Pond designs will incorporate gradual side slopes, vegetative and barrier plantings, and safety shelves where warranted or as determined by the Township. Where further safety measures are required, the Applicant is expected to include them within the proposed development plans.
3. Basin side slopes shall generally not exceed one (1') foot vertical to four (4') feet horizontal. Slopes steeper than one foot (1') vertical to four (4') feet horizontal, will be permitted only with the installation of a five (5') foot high chain link fence (or alternate material approved by the Township Planning Commission) completely surrounding the basin including the buffer strip, unless fence is waived by the Township Board due to such considerations as the location of the facility and whether or not the facility is an integral part of the site landscaping. In such cases, where the perimeter fencing is required, a twelve (12') foot wide access gate shall be provided.
4. Storm water management systems incorporating pumps shall generally not be permitted.
5. Storm water facilities, and associated buffer strips, are preferred to be completely located on common-owned property (e.g., parks, outlots, etc.) in multi-ownership developments such as site condominiums and subdivisions, and not on private lots or condominium units. Where complete separation of the storm water facilities from private lots or units are not feasible, an easement over affected lots shall cover the facilities in this situation. The affected lots must be properly sized to accommodate the easement and construction of the house, septic system, etc.
6. The use of underground retention/detention on new and existing developments is strongly discouraged. Exceptions may be granted if each of the following conditions exist:
  - A. The need to rebuild an existing commercial facility or on pre-existing nonconforming parcels that were not previously equipped with retention/detention, and the installation of an above-ground retention/detention facility would significantly reduce the available square footage for a replacement structure.

## CHAPTER EIGHT

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- B. Regional retention/detention is not available.
  - C. The provision of above-ground retention/detention on a existing commercial parcel less than 0.5 acres in size would preclude development of the property for any use allowed under its current zoning.
7. Anti-seep collars should be installed on any piping passing through the sides or bottom of the basin to prevent leakage through the embankment.
  8. All basins will have provisions for a defined emergency spillway, routed such that it can be picked up by the main outflow channel while not discharging directly over the outlet pipe. The emergency spillway will be set at an elevation six (6”) inches below the design freeboard elevation and be able to handle the capacity of a 100-year design storm event.
  9. Adequate maintenance access from public or private rights-of-way to the basin will be provided. The access will be on a slope of five on one (5:1) or less, stabilized to withstand the passage of heavy equipment, and will provide direct access to both the forebay and the riser/outlet.
  10. The placement of retention/detention basins within a floodplain of a stream, creek, or lake is strictly prohibited.
  11. No in-line stormwater management facilities will be permitted on existing water courses.
  12. New in-line facilities will be permitted only as designed and constructed for the subject project (i.e., flow through adjoining basins) provided all control structures can safely pass excess storm events and each basin has overflow provisions.

### SECTION 8-7 USE OF SEDIMENT FOREBAYS

1. Sediment forebays sized for the "First-Flush" of storm water equal to 0.5 inch of water, over the entire tributary area will be provided at the inlet of all stormwater management facilities to provide energy dissipation and to trap and localize incoming sediments.
2. The forebay will be a separate basin, which can be formed by gabions or a compacted earthen berm within the larger basin.
3. Direct maintenance access to the forebay for heavy equipment must be provided.
4. An adequate area for temporary staging of spoils, removed during maintenance, prior to ultimate disposal, shall be provided. This area shall be protected such that no runoff will be directed back into the stormwater management system or onto private property. The temporary staging areas must be included in the stormwater management facility easement or its own separate easement if necessary. Ultimate disposal shall be to an off-site area

## CHAPTER EIGHT

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unless a disposal area is shown on the approved site plan. Easement dedicated to the maintenance entity and the homeowners association must be provided over the disposal area.

### SECTION 8-8 VEGETATIVE PLANTINGS ASSOCIATED WITH STORMWATER MANAGEMENT FACILITIES

1. Basins and marsh designs must be accompanied by a landscaping plan. All landscaping must be in accordance with the Township's Guidelines. Plantings which have been documented to enhance water quality will be required.
2. A permanent buffer strip of vegetation extending at least twenty (20) feet in width beyond the freeboard is encouraged around the perimeter of all stormwater storage facilities. The buffer strip, if provided, should be completely contained in the stormwater maintenance facility easement.

### SECTION 8-9 DETENTION REQUIREMENTS AND GENERAL PROVISIONS

1. On-site management of storm drainage will be designed for control of flooding, downstream erosion, and water quality. Submission of flow calculations, cross-sections, and other pertinent data will be required to be included on the plan set.
2. At a minimum, the volume of storage provided for flood control will be equal to or in excess of that required by the Oakland County Drain Commissioner's "A Simple Method of Detention Basin Design" for a 25-year frequency storm event. If this methodology results in the maximum design rate of discharge exceeding that stated in Section 8-5, No. 1, additional storage will be required. If the discharge does not outlet to a clearly defined downstream channel, the release of water shall not exceed the pre-development volume and/or rate and shall not be concentrated. Easement acquisition from downstream property owners is required for any change in the concentration of flow or increase in volume. "C" Factor assignments shall be as indicated in Chapter 9.
3. Volume reduction credit may be considered/approved by the Township for the voluntary use of BMP's such as storm water infiltration practices, sediment basins, establishment or maintenance of wetland or riparian systems, use of wet basins, extended basins, bio-retention areas, etc., above and beyond the general requirements herein and those of typical soil erosion control programs. Volume credits do not include the freeboard, vegetative buffer, forebay criteria, or required soil erosion control measures. Furthermore, at no time shall volume credits reduce the required volume amount to less than that required under the Oakland County Drain Commissioner's "A Simple Method of Detention Basin Design" for a 10-year frequency storm. In areas deemed environmentally sensitive by the Township, BMP's may be required with or without consideration to volume reduction credits.

## CHAPTER EIGHT

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4. To the extent feasible, the distance between inlets and outlets should be maximized. The length and depth of the flow path across basins and marsh systems can be maximized by:
    - A. increasing the length to width ratio of the entire design.
    - B. increasing the dry weather flow path within the system to attain maximum “flow-thru” time.
    - C. If possible, inlets and outlets should be offset at opposite longitudinal ends of the basin
  5. A minimum of one (1’) foot of freeboard will be required for all detention basins, above the high-water elevation.
  6. All detention ponds must be capable of complete dewatering by gravity. Wet ponds shall be dewatered by a control structure. Only under special circumstances will a pumped discharge be allowed to dewater a wet detention facility and then only upon approval by the Township.
  7. The detention volume for a gravity outflow detention basin is defined as “the volume of detention provided above the invert of the lowest outflow pipe.”
  8. The detention volume must be provided for all onsite acreage unless otherwise determined by the Township. Offsite acreage originally draining across the proposed development must either be intercepted and routed through the project’s storm drainage system or otherwise be handled in a manner satisfactory to the Township.
  9. All detention basins must have a provision for overflow at the elevation indicated in Section 8-6, No. 8. A spillway is an acceptable overflow provision with an outlet located so as not to cause potential hardships to adjacent property. Any overflow spillway must discharge into a recognized natural drainage course. All spillways must be stabilized to prevent erosion using natural rock, staked sod or other means approved by the Township.
  10. An outlet filter shall be provided. Such use in a detention pond shall be considered a temporary measure only. The Developer shall be responsible for maintaining said filters and removing them when necessary vegetative cover is established and for removing soil deposited within the basin during construction.

### SECTION 8-10 CONTROL STRUCTURE

1. Outlet control structures shall generally be designed in accordance with OCDC Standard Details, including the sediment filter, or other BMP’s as approved by the Township Engineer.
2. Engineered velocity dissipation measures based on discharge flow rates and velocities shall be incorporated into basin designs to minimize erosion at inlets and outlets, to minimize the resuspension of pollutants, and to create sheet flow conditions where feasible.

## CHAPTER EIGHT

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3. The outlet must be well protected from clogging.
  4. The use of a perforated standpipe-type riser or other similar structure as approved by the Township Engineer to assure an appropriate detention time for all storm events is required.
  5. Orifices used to maintain a permanent pool level should withdraw water at least one (1') foot below the surface of the water.
  6. Hoods or trash racks shall be installed on the riser to prevent clogging. Grate openings shall be a maximum of four (4") inches.
  7. Orifice plates are discouraged. Where an orifice plate is to be used in the standpipe to control discharge, it will have a minimum diameter of four (4") inches.
  8. The riser shall be placed near the pond embankment to provide for ready maintenance access.
  9. Barrels and risers will be constructed of materials that will reduce future maintenance requirements. The riser pipe shall be a minimum of 36" in diameter for riser pipes up to four feet in height. Riser pipes greater than four feet in height shall be 48" in diameter. Riser pipes will be constructed with concrete bottoms.

### SECTION 8-11 OUTLET DESIGN

1. All outlets will be designed to be easily accessible for equipment required for maintenance purposes.
2. All outlets will be designed to discharge at an elevation within close proximity to the normal high water of the receiving water lanes. Discharging at the "crest" of slopes or submerged outlets will not generally be permitted.
3. Backwater on the outlet structure from the downstream drainage system shall be evaluated when designing the outlet.

### SECTION 8-12 DESIGN OF PERMANENT RETENTION BASINS

1. Retention basins will be capable of storing two (2") inches of runoff from the entire tributary area, contingent upon the following:
  - A. An overflow assessment will be required. The assessment should include descriptions of the surrounding areas, including nearby homes that would be impacted in the event of an overflow.

## CHAPTER EIGHT

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B. The Applicant must submit a minimum of one (1) soil boring log taken within the basin bottom area to a depth of ten (10') feet (or alternate depth as permitted by the Township) below the proposed basin bottom elevation. The boring must be done by a licensed geotechnical engineer or scientist, unless otherwise permitted by the Township. Test holes dug for septic field evaluation or borings taken elsewhere on site will not negate this requirement. Accompanying percolation calculations must also be included with the boring information to demonstrate that the underlying soils will be sufficient for basin dewatering by percolation.

C. Retention basin volume calculations shall not include volumes below the existing groundwater table.

2. The Township reserves the right to require additional storage up to that required by two consecutive 100 year storm events based on the results of soils data or the overflow assessment. If such additional storage is required, freeboard requirements may be reduced at the discretion of the Township.
3. The freeboard of Retention Basins shall be a minimum of two (2') feet.
4. Side slopes, vegetative buffer strip, and sediment forebay, etc. shall be required as stated for detention basins.

### SECTION 8-13 WET DETENTION BASINS

1. Storage volume and freeboard requirements shall be identical to that for a dry detention basin. For a gravity outflow, the wet basin storage volume is defined as "the volume of detention provided above the invert of the outflow device." Any volume provided below the invert of the outflow device will not be considered as detention.
2. Wet basins can be designed by breaching the existing ground water table or setting the outlet from the basin above the basin bottom. Clay or other liner to maintain the permanent water elevation will generally not be permitted.
3. At a minimum, the volume of the permanent pool is recommended to be at least:  
$$0.5 \text{ inch} \times \text{runoff coefficient} \times \text{site tributary area} = \text{volume}$$
4. The surface area to volume ratio should be maximized to the extent feasible.
5. A recommended minimum length to width ratio of 3:1 should be used.
6. In general, depths of the permanent pool should be varied and average between three (3') feet and six (6') feet.

## CHAPTER EIGHT

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7. Ponds should be wedge-shaped, narrower at the inlet and wider at the outlet.
8. Irregular shorelines are preferred.
9. A marsh fringe should be established near the inlet or forebay and around at least 50% of the pond perimeter.
10. A shelf, a minimum of four (4') feet wide at a depth of one (1') foot, shall surround the interior of the pond perimeter to provide suitable conditions for the establishment of aquatic vegetation.
11. Sediment basins sized for the first flush volume must immediately precede the wet basin. The Applicant must submit a maintenance plan for the basin prior to final site plan approval.
12. A means or contingency plan to dewater the basins must be provided, i.e., pump or valve control structure, in the plans or development documents.
13. If required, the permanent volume of water may be determined by the volume adequate for fire suppression purposes.

### SECTION 8-14 EXTENDED DETENTION BASINS

1. A two-stage design is required, with separate outlet controls to detain both the first flush volume and larger rain events.
2. Lower Stage (wet pond area): The lower stage should contain a shallow, permanent pool designed to store and treat the "first flush," or 0.5 inch, of runoff over the entire tributary site. This pool should be managed as a shallow marsh or wetland and average 6-12 inches in depth. A sediment basin upstream from the lower stage must also be incorporated into the design.
3. Upper Stage: The upper stage should be sized for the 25-year storm event, as defined by OCDC, and should be graded to remain dry except during large storms.
4. A low flow channel, stabilized against erosion, will be provided through the dry portion of the basin. This channel should have a minimum grade of 0.5%, and the remainder of the basin should drain toward this channel at a grade of at least 1%. The low flow channel should end at the lip of the lower stage, where riprap or gabion baffles should be placed to prevent scour and resuspension of pollution particulates.

## CHAPTER EIGHT

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### SECTION 8-15 CONSTRUCTED STORM WATER WETLAND SYSTEMS

1. Stormwater wetlands are defined as constructed systems explicitly designed to mitigate the stormwater quality and quantity impacts associated with development. They do so by temporarily storing stormwater runoff in shallow pools that creates growing conditions suitable for emergent and riparian wetland plants. The runoff storage and emergent plants in the stormwater wetland together form an ideal system for the removal of urban pollutants. Because of their water quality benefits, the use of stormwater wetlands is strongly encouraged.
2. Storm water wetlands shall not be located within a regulated natural wetland area.
3. The design of an effective and diverse stormwater wetland requires an understanding of hydrology and wetland plant ecology. Therefore, a qualified professional with specific wetland expertise should oversee wetland construction, re-construction, or modification.
4. Stormwater wetland systems must be designed to perform in conformance with all standards for storage volume and discharge rate established in these standards for dry basins.
5. The Applicant shall provide for the monitoring of wetland plantings and replacement as needed for a two-year period after construction.

### SECTION 8-16 PARKING LOT DETENTION

1. Commercial parking lot detention of storm water will be permitted on pre-existing non-conforming parcels and only when no reasonable alternative exists and provided it does not adversely affect the functioning of the facility or business which it serves, adjacent property, or create a public nuisance.
2. The required storage volume shall be determined in the same manner as it is done for dry detention basin.
3. The discharge from the parking lot may be controlled by means of restricted inlets.
4. Commercial sites must be equipped with structural BMP's for storm water quality enhancement. BMP's include oil/grease separators, grit chambers, etc.

### SECTION 8-17 UNDERGROUND STORAGE

1. Underground detention will only be permitted if a variance from the Township is granted.
2. The volume of underground storage facilities shall meet the requirements of dry detention basins without any credit reductions.

## CHAPTER EIGHT

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3. Oversized pipes for storage shall be concrete or corrugated metal meeting the class requirements indicated in Chapter 9, or alternate systems as approved by the Township.
4. The means for accessing the storage system for cleaning and inspection shall be provided. Multiple access points per OSHA Standards shall be required.
5. The system must be designed and located so that, should the design event be exceeded, the system overflows toward a positive outlet.

### SECTION 8-18 ROOF-TOP STORAGE

1. Roof-top storage will not be permitted.

### SECTION 8-19 PLAN REQUIREMENTS

Stormwater management plans shall include the following or as directed by the Township:

1. Any natural water courses that traverse or abut the development.
2. Any water course passing through the development with the area, flow calculations, etc., shown on the plan.
3. Description of proposed management facility and outlet conditions.
4. Required volume, freeboard calculations, based on the dry detention basin or retention basin criteria.
5. Proposed volume credits based on Section 8-11.3 and including the OCDC 10-year storm event calculations.
6. Proposed system volume calculations.
7. Outlet and restrictor calculations.
8. Existing conditions summary, including “C” Factors, outlet constraints, existing zoning master plan use, etc.
9. Proposed grading contours for the system, including forebay, storage area, embankment, and buffer area.
10. Proposed location of emergency overflow, maintenance access, sediment removal area, control structures, etc.
11. Planting schedule, including plant types, size, location, timing, maintenance, etc.

## CHAPTER EIGHT

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12. Outlet design in plan and profile view.

13. Animal guards shall be placed on all outlet pipes with a diameter of or greater than eighteen (18”) inches.

### SECTION 8-20 SEQUENCE OF CONSTRUCTION

Detention/retention basin shall be constructed as part of the initial site grading activities and prior to underground utility construction for all projects in the Township. Immediately following construction of the basin, suitable ground cover shall be established, weather conditions and species planting requirements prevailing. Should weather conditions not permit installation of permanent ground cover, temporary erosion control measures must be immediately implemented. Such ground cover shall be established on the basin bottoms, side slopes, vegetative buffer, etc.

### SECTION 8-21 WAIVER OF STORM WATER HOLDING FACILITIES

In cases of additions to existing buildings, the Township may waive the requirements for new or expanded storm water management facilities.

### SECTION 8-22 STORM WATER SYSTEM MAINTENANCE

1. Subdivisions and Condominiums: The Developer must provide for continued maintenance of detention/retention/sedimentation basins and other system components. If the maintenance is to be assumed by a homeowners or condominium association, the covenants of the plat or Master Deed of the condominium must incorporate a procedure to provide for this continued maintenance. The Developer must reference the Township’s ordinances for procedures on providing the necessary documents for continued basin maintenance.
2. Commercial, Industrial, Multiple, and Office Sites: The proprietor shall maintain the storm water facilities in proper working order at all times. The Township may require Developer to submit a plan to continue maintenance.
3. All developments: Through provisions in the plat, condominium documents, or by separate agreement, the Township shall be provided with the right to enter the subject property to repair, at the owner’s expense, any failing stormwater systems. Provisions shall be made in the maintenance agreement for new developments where the Township may cause necessary repairs to the stormwater system to be made and to assess the responsible parties, i.e., homeowners or condominium associations, proprietor, etc., for any expenses incurred, plus up to a 25% administration fee.
4. All storm water maintenance plans or provisions shall include specific time frames for such tasks as routine inspection, sediment removal, basin restoration, etc.

## CHAPTER EIGHT

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5. It is anticipated that any sediment removal operation will disrupt the vegetation around and within the storm water facility. As the plantings are an integral part in the development's storm water quality enhancement, specifications for the reestablishment of the vegetation after maintenance must be included in the maintenance plan.

## CHAPTER NINE

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### DESIGN AND CONSTRUCTION STANDARDS FOR STORM SEWERS

#### SECTION 9-1 INTENT

This Standard establishes the minimum requirements for the design and construction of enclosed storm sewer systems within the Township.

#### SECTION 9-2 GENERAL

1. All storm sewers outside of public road rights-of-way are to remain private within subdivisions, condominiums, and commercial sites. Any storm sewers within the public right-of-way of a Road Commission for Oakland County (RCOC) or Michigan Department of Transportation (MDOT) jurisdictional road shall be under their jurisdiction, respectively.
2. Hydraulic design calculations and a copy of the drainage area layout used for the hydraulic design shall accompany construction plans submitted for review. The drainage area layout shall, in the case of a design for a new development, be superimposed on the proposed grading plan for the development.

#### SECTION 9-3 DESIGN CONSIDERATIONS

1. Location
  - A. Easements for storm sewers shall be of a width adequate to provide proper access for maintenance, centered upon the sewer. Such easements shall be deeded or dedicated to the Subdivision Association, Condominium Association, property owner, or entity responsible for the maintenance of the storm sewer, with restrictions against use or occupation of easements by the property owners and/or by other utilities in any manner which would restrict sewer maintenance or repair operations.
  - B. Sewers shall preferably be constructed outside of paved parking areas, streets and drives, and not closer than ten (10') feet to any building.
  - C. The horizontal alignment of sewers which are not proposed to generally follow street, drive, or parking area pavements shall generally parallel property lines or building lines, with clearance distances sufficient to accommodate the full width of the proposed easement.

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## CHAPTER NINE

### 2. Capacity

#### A. Tributary Area

Sewers shall be designed to serve all natural tributary areas with due consideration given to topography, established zoning, and the capacity of the storm water outlet proposed to be used. Discharge must not be diverted onto abutting properties without necessary easements. The outlet must be in accordance with the existing natural drainage courses in the area. Provisions for storm water management must be included in the storm drainage system as described in Chapter 8 of these Standards.

#### B. Hydrologic Considerations

1. The Rational Formula shall be utilized to determine flows to accommodate using a ten (10) year curve for rainfall or  $I = 175/(t+25)$  where I = rainfall intensity rate and t = time of concentration.
2. Runoff coefficients shall be determined for each individual drainage area and calculations for each drainage area must be submitted as part of the design computations. Coefficient design determinations shall be based upon the following Table:

#### ***RATIONAL METHOD RUNOFF CO-EFFICIENTS***

Forested	0.15
Asphalt, Concrete, Roof Areas	0.90
Brick	0.80
Gravel	0.65
Lawns and Meadows	
Up to 2% slope	0.15-0.18
2% to 7% slope	0.18-0.22
Over 7% slope	0.25-0.35

The Township may require additional soil borings or other data to verify soil type and applicable co-efficients. The final determination of “C” Factor used shall be made by the Township.

### 3. Hydraulics

#### A. Pipe Sizes

1. Minimum pipe sizes for storm sewers accepting surface drainage shall be twelve (12”) inch nominal internal diameter.
2. Trunk sewers shall be sized as design dictates with allowance for extensions.

## CHAPTER NINE

### B. Allowable Pipe Slopes

#### 1. Allowable Pipe Slopes

Pipe Diameter (Inches)	Minimum Slope (Feet Per 100 Feet)	Maximum Slopes (Feet Per 100 Feet)	
		Pipe Slope	H.G. Slope *
8	0.33	8.0	8.0
10	0.25	5.2	6.80
12	0.19	3.9	4.88
15	0.14	2.8	3.60
18	0.11	2.1	2.84
21	0.092	1.7	2.32
24	0.077	1.4	1.92
27	0.066	1.2	1.64
30	0.057	1.05	1.44
36	0.045	0.80	1.12
42	0.036	0.65	0.92
48	0.030	0.54	0.76
54	0.026	0.46	0.64
60	0.023	0.40	0.56

\* H.G. – Hydraulic Gradient also referred to as H.G.L. – Hydraulic Grade Line

2. Generally, all catch basin and inlet leads shall be laid on a slope no flatter than one (1%) percent.

### C. Minimum and Maximum Velocities

1. Minimum design velocity shall be two (2') feet per second with pipe flowing full.
2. Maximum design velocity shall not exceed ten (10') feet per second.

#### 4. Calculations

- A. Kutter's or Manning's formulas shall be used for hydraulic calculations. Allowances for head losses through manholes shall be provided.
- B. The hydraulic gradient shall be maintained by matching the 0.80 diameter depth above invert for pipe size increases.
- C. Provide a drop of 0.10 feet in the downstream sewer invert for direction changes in excess of thirty (30°) degrees to compensate for the hydraulic head losses.

## CHAPTER NINE

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- D. Surcharging under design conditions is permitted provided the surcharged hydraulic grade line (HGL) is maintained lower than one (1') foot below the rim elevations of all upstream structures. The HGL must be shown on the profile view if outside the pipe.
5. Unless otherwise approved, no sewer shall have less than three (3') feet of cover.
6. Sewer pipe (including catch basin and inlet leads) shall conform to the following specifications:
- A. Reinforced Concrete Sewer Pipe – ASTM C-76

Class of concrete pipe shall be:

<u>Cover Over Pipe</u>	<u>Class of Pipe</u>
0' to 3'	V
3.1' to 10'	III
10.1' to 18'	IV
18.1 to 32'	V

Storm sewer pipe shall conform to the current American Society for Testing Materials "Tentative Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe," ASTM C-76 for circular pipe, or C-507 for horizontal elliptical pipe, latest revision. If other materials are proposed for use, the proprietor shall furnish the load carrying design analysis for the pipe for the proposed depth conditions.

Note: All catch basin and inlet leads shall be a minimum of ASTM C-76, Class IV Pipe.

- B. Corrugated high density polyethylene (HDPE) may be approved for use in areas outside the public rights-of-way based upon the Township's evaluation of the application. Corrugated Exterior Smooth Interior High Density Polyethylene (HDPE) shall be at minimum AASHTO M294 types and in accordance with current MDOT Standard Specifications. Installation methods including compacted granular bedding materials per AASHTO Standards, shall be strictly adhered to.
- C. Corrugated Steel Pipe meeting ASTM Standards for driveway culverts.
- D. Schedule 40 PVC or SDR 26, four (4") inch diameter minimum, meeting the requirements of ASTM 2665.
- E. All pipe shall have class, lot number, and date of manufacture conspicuously marked on each length by the manufacturer.
- F. Where approved by the Township, perforated pipe may be used outside of the road rights-of-way.

## CHAPTER NINE

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G. Certification forms, together with a report of the manufacturer test results, shall be provided to the observer with pipe deliveries upon request. Certification forms shall include project name, location, and contractor. All pipe fittings shall be suitably marked to provide manufacturer's name, lot or production number, ASTM Designation, ABS or PVC, nominal diameter, and SDR number, where applicable. Fittings, however, need not contain lot or production number. Pipe shall have a "home" mark.

### 7. Sewer Joints (including catch basin and inlet leads)

- A. Joints shall conform to the requirements of ASTM C443, with the following stipulations and exceptions:
1. Gaskets shall be synthetic rubber only. Natural rubber gaskets are not acceptable.
  2. Gaskets shall conform to the requirements of ASTM C361.
- B. Modified Grooved Tongue (MGT) pipe shall have a rubber gasket snapped into a groove cast into the tongue. The modified groove or bell end of the pipe shall be made smooth and shall have not over a 3-1/2 degree slope for sizes 10"-24", or a 2 degree slope for sizes 27"-108", tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer. MGT joints shall be lubricated and coupled in accordance with the pipe manufacturer's printed instructions.
- C. Rubber gasket joints shall be in accordance with the Tentative Specification for "Joints for Circular Concrete Sewer and Culvert Pipe, Using Flexible, Watertight, Rubber Type Gaskets," ASTM Designation: C443, latest revision. Rubber gasket joints shall be lubricated and coupled in accordance with pipe manufacturer's printed instructions.

### 8. Sumps

- A. All structures, including catch basins, manholes, etc., excluding roadway inlets, accepting surface drainage shall have three (3') foot deep sumps. Furthermore, the last two (2) structures upstream from a storm water management facility or outlet shall also have sumps.
- B. Differences in invert elevations at structures exceeding two (2') feet shall be provided with a three (3') foot deep sump for energy dissipation.

### 9. Footing Drains/Sump Pump Discharge

Generally, sump pump or footing drain discharges shall be surface outletted onto splash blocks. These discharges shall not be directed toward adjacent units. With Township approval, footing drains may be discharged by means of sump pumps connected by underground piping to a storm sewer where site conditions dictate the need to intercept sump pump discharges to prevent drainage problems. Wyes and leads shall be provided to accommodate the connection of the sump pump discharge piping to the storm sewer. Exceptions to this rule may be permitted where

## CHAPTER NINE

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factors such as lot size, soils and hydrology demonstrate that sump pumps discharging to the ground surface will result in a drainage nuisance for the prospective home owner or the adjacent lot owners.

### 10. Manhole, Inlets, and Catch Basins

Manholes shall be constructed at every change in sewer grade, alignment, pipe size, pipe type, and at the junction of sewer lines. The maximum distance between manholes shall be 350 feet for sewers less than 24 inches in diameter, 400 feet for 24 to 30 inches in diameter, 450 feet for 36 inches to 42 inches in diameter, and 500 feet maximum for 48 inch diameter sewers and larger. Generally, manholes should be placed at street intersections. Manholes shall be provided where catch basin and inlet leads are to be connected to the sewer, unless expressly waived by the Township for a specific location to a particular project.

### 11. Catch Basin and inlets shall be located:

- A. So that the flows to be accommodated do not exceed the intake capacity of the cover. The intake capacity of the cover is assumed to be 0.011 cubic feet per second (cfs) per square inch of opening.
- B. At all low points in gutters and in swales and ditches, where applicable.
- C. At the upstream curb return, if more than 200 feet downstream of high point in gutter or of intercepting structure.
- D. At maximum intervals of 600 feet along a continuous slope.
- E. Inlets will only be allowed in pavement areas as a high end structure and when followed by a catch basin within 100 feet of inlet.
- F. End sections may be used as a ditch inflow device when followed within fifty (50') feet by a catch basin.
- G. Where a low point exists in the gutter line, no more than two (2) relief basins shall be used in either direction in advance of the low point, i.e., four relief basins would be possible. When a total of two or more relief basins are used in such a system, a double catch basin will be placed at the low point.

### 12. Stubs

Where future connections to a manhole are anticipated, stubs with watertight bulkheads shall be provided.

## CHAPTER NINE

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### 13. Manholes, Catch Basin and Inlets

Eccentric cones to be provided on all structures, regardless of material used (precast reinforced concrete, manhole block, or brick), to provide a true vertical face for placement of the manhole steps. Manhole steps shall be steel, encased with polypropylene plastic, equivalent to M.A. Industries, Inc., PSI or PS1-B as appropriate. A maximum of five (5) courses (or 15 inches) of brick shall be placed on the cone section of all precast concrete block structures.

### 14. Leaching Basins

- A. Leaching basins are encouraged where native soils are permeable and conducive to such installation, provided the maintenance routine for such basins are approved by the Township.
- B. Concrete leaching basins shall be in accordance with MDOT Standard plans or as approved by the Township.
- C. Materials for the plastic leaching basin drainage structure shall be in accordance with all applicable ASTM Standards and as specified on the plans.
- D. The cover for the leaching basin drainage structures shall be in accordance with Section 403, Subsection 04 of the 1996 Michigan Department of Transportation Standard Specifications for Construction and as specified on the plans.

### 15. Underdrains

Pavement catch basins and inlets, where shown on the approved plans or where determined by the Township or the Road Commission for Oakland County to be necessary, shall have perforated under drain installed. The depth, alignment, diameter, pipe material and backfill shall be as shown on the plans or as directed by the Township or RCOC.

### 16. Pipe End Treatment

- A. The inlet end of culverts and storm drains shall have a properly designed inlet structure (i.e., head wall or flared end section).
- B. Culverts and storm drain outlets shall also have headwalls or flared end sections with necessary erosion control; i.e., grouted concrete riprap.
- C. A prefabricated bar screen shall be used on all storm sewer openings eighteen (18") inches in diameter and larger. The bar screens will be constructed according to an approved separate enlarged detail in the drawings and shall be designed to be sturdy, permanent, easily maintained, nonclogging, and shall have clear openings of no more than four (4") inches.
- D. Grouted concrete riprap, or other approved energy dissipating measure, is required at all pipe outlet points other than structures. The minimum width of the riprap shall be twice the

## CHAPTER NINE

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outside diameter of the pipe. The riprap shall extend from the bottom of slope to the pipe invert. Two (2) types of riprap may be used: 1) field stone or broken concrete of fourteen (14") inch minimum thickness and one (1') square foot minimum area (broken concrete or stone shall be mortared to form a monolithic slab with a minimum thickness of six (6") inches), or poured 3500 psi concrete of four (4") inch minimum thickness scored at a maximum of one (1') foot intervals. A two (2') foot deep poured concrete header shall be installed at the outer edges.

### 17. Special Structures and Appurtenances

Preliminary plans for special structures and appurtenances required for sewer systems shall be submitted to the Township for review and comment prior to their inclusion in the construction drawings.

### SECTION 9-4 PLAN REQUIREMENTS

All plans shall be submitted to the Township for storm sewer approval and shall contain, but not be limited to, the following information:

1. Overall layout of the sewer system with manhole numbers and direction-of-flow arrows.
2. A drainage plan delineating the area tributary to the sewer system.
3. Plan and profile view in accordance with Chapter 3.
4. Locations of all manholes and other sewer appurtenances and special structures.
5. Building sewers, wye branches, or tee inlets to be constructed or installed concurrently with sewer construction with locations at easement and/or property lines. Length, size, end of lead invert elevations, and amount of riser shall be shown on the plan for each building lead.
6. Dimensions to manholes and sewers to property lines, right-of-way lines or buildings.
7. Size, slope, length, pipe type and class, and controlling invert elevations for each section of proposed sewer between manholes in both plan and profile view.
8. Limits of special backfill requirements.
9. Profile, over centerline of proposed sewer, of existing and finished ground and pavement surfaces. Existing profile shall be obtained from actual field survey data.
10. Location of existing or proposed installations crossing the line of the sewer and otherwise affecting sewer construction in the profile view.

## CHAPTER NINE

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11. Location, by station, of every proposed manhole, with manhole number, invert elevation of all inlet or outlet pipes, top of cover elevation, cover type, and manhole type in the profile view.
12. Location, by station, of all building sewers, wye branches, or tee inlets to be constructed or installed concurrently with proposed sewer construction in profile view.
13. Required risers, with control elevations.
14. Invert elevation at property line for building sewers to be included with sewer construction.
15. Each plan and profile sheet shall include a tabulated list of quantities.
16. Detail Sheets
  - A. Details shall include the standard sheet and notes as provided by the Oakland County Drain Commissioner or the Road Commission for Oakland County. Where these Standards require different or more restrictive standards (i.e., three (3') foot deep sump) the Project Engineer shall add appropriate notes and/or plan details to this effect. A standard mylar reproducible drawing of these details may be obtained from the respective agency.
  - B. Detail sheets shall include specific and complete details for all sewer appurtenances and structures to be included with the sewer construction and special or unusual sewer or associated construction requirements. Details not being used which are included on a Standard Detail Sheet shall be crossed out or otherwise clearly marked.
  - C. Scales utilized for special details shall be selected to clearly portray intended construction and component or equipment arrangement. Scales used shall be clearly identified.

### SECTION 9-5 CONSTRUCTION STANDARDS

#### 1. Connections

- A. A proper channel shall be constructed within any existing manhole or other structure to which a connection is to be made to direct the flow to the existing outlet in a manner which will tend to create the least amount of turbulence. Any portion of the existing structure which would interfere with such construction shall be removed.
- B. When connections are made with sewers or drains carrying fluids, special care must be taken that no part of the work is built under water. A flume or dam must be installed and pumping maintained, if necessary, and the new work kept dry until completed and any concrete or mortar has set up.

## CHAPTER NINE

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### 2. Construction of Manholes, Catch Basins, and Inlets

- A. Pipe shall not extend into a manhole beyond the inside face of the manhole wall. Field cutting of pipe to be used at manholes shall be done in a neat, workmanlike manner, using methods approved by the Township. Exposed ends of reinforcing steel shall be cut flush with the pipe end.
- B. All manholes shall be the eccentric cone type.
- C. The joint between a precast riser section and the base of the structure or the top of a brick or concrete radial block riser section shall be set in a full bed of mortar. Similarly, the joint between a precast eccentric cone section and the top of a brick or concrete radial block riser section shall be set in a full bed of mortar.
- D. Brick and radial block used shall be laid in a full bed of mortar and shall be plastered on the outside with at least ½ inch of mortar in a manner that will completely seal the structure. Plastering shall be performed in conjunction with the laying of brick or block. The laying of block shall never be more than two courses ahead of exterior plaster. The laying of brick shall never be more than six courses ahead of the exterior plaster.
- E. All precast sections shall be set in a full bed of mortar.
- F. A minimum of one course and a maximum of five courses of brick shall be placed on the cone section of all precast concrete and concrete block structures.
- G. All brick, block, mortar, and concrete work shall be properly cured and protected from freezing for a minimum of 48 hours. When the temperature is 40°F and falling, brick, block, mortar, and concrete shall be heated to a minimum temperature of 60°F.
- H. After the concrete and/or plaster has set up sufficiently to avoid damage, backfilling shall be done in a manner that will not cause unequal pressure on the structure.
- I. Manholes shall be constructed of concrete block or precast reinforced concrete sections in accordance with the Township.
- J. Precast reinforced concrete manhole sections shall conform to the requirements of the American Society for Testing and Materials “Tentative Specifications for Precast Reinforced Concrete Manhole Risers and Tops,” ASTM Designation C-478, latest revision.
- K. 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 Road and Bridge Design and Construction.”

## CHAPTER NINE

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### 3. Open Cut Sewers

- A. All labor, tools, equipment, and all materials necessary to excavate for, lay, join, backfill, and finish the sewer shall be considered as part of the sewer construction.
- B. Unless otherwise allowed under specific specifications for a particular type of sewer or unless permitted by the Township Engineer, construction shall begin at the outlet end of the sewer and proceed upgrade.
- C. A sewer pipe shall be of approved type and class designated for the specific locations or intended uses shown or noted on the approved plans. Any deviation from the type or class of pipe shown on the drawings will not be permitted, except upon receipt of written approval of the Township Engineer.
- D. Pipe joints shall be of the approved type and/or brand called for on the approved plans.
- E. Pipe shall be laid on a carefully prepared Class B bed, consisting of porous sand extending from at least 4" below the pipe to at least one quarter the pipe diameter above the elevation of the bottom of the pipe.
- F. Plastic pipe shall be laid in accordance with manufacturer's recommendations and good engineering practice. The use of plastic pipe for storm sewer will be only on a case-by-case basis. Typically, no plastic storm pipe shall be placed within the road right-of-way.

### 4. Cement Mortar Pointing

- A. All pipe joints on sewers 36" diameter and larger shall be pointed on the inside with approved non-shrink cement mortar composed of one (1) part cement and two (2) parts sand. On bituminous mastic joints the compound shall be removed to a depth of  $\frac{3}{4}$  of an inch from the inside of the joint and pointed as described above.

### 5. Storm Drainage Structures

- A. Manholes, catch basins, inlets, and special structures shall be constructed at the locations shown on the plans and shall be of the size and type called for on the plans. Manholes and catch basins shall be constructed to conform to the Township specifications and in accordance with the detailed approved drawings.
- B. Storm sewer manholes, catch basins, and inlets shall be constructed of precast reinforced concrete, concrete manhole block, brick, poured-in-place reinforced concrete, or combinations of the above, unless otherwise approved. Storm sewer structures shall conform to the detailed drawings and specifications.
- C. Joints on precast reinforced concrete risers and tops may be either cold applied bituminous mastic or modified grooved tongue with rubber gasket.

## CHAPTER NINE

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

### 6. Construction Methods for Sewer and Drainage Structures

A. Construction methods for the sewer and drainage structures shall conform to current MDOT Standards, inclusive, except as herein provided.

B. Precast reinforced concrete units shall be such that no more than 50% of the circumference, measured on the inside face, shall be deleted on any horizontal plane for sewer pipe openings. There shall be no less than 12 inches of residual concrete measured on any horizontal plane between pipe openings.

C. With the exception of drainage structures having sumps, the bottom of the structures shall be channeled to provide for smooth flow thru the manhole. Channels shall be formed using Grade B concrete, or on straight through manhole, pipe may be laid through the manhole connections, the top half broken out and the voids around the lower half of the pipe filled with Grade B concrete.

### 7. Manhole, Catch Basin, and Inlet Materials and Appurtenances

A. Precast reinforced concrete sections shall conform to ASTM C478.

B. Water for concrete and mortar shall be clean and fresh, free from oil, acids, and organic matter.

C. Mortar for laying brick and block, pointing of joints, and plastering outside of structures shall be in accordance with current MDOT Standards for Construction. No lime shall be used in the mortar.

D. Bolt down frames as called for in the Contract Documents shall be bolted down with four (4) cadmium coated 5/8 inch diameter threaded studs with ¾" x 2" x 1/8" thick metal washers ¾" x 2" x 1/16 thick neoprene sealing washers and nuts.

E. Manhole steps shall be steel, encased with polypropylene plastic, equivalent to M.A. Industries, Inc., PS1 or PS1-B, as appropriate.

F. Covers shall be East Jordan Iron Works 1040 or Neenah No. 12-1916 for manholes and Type M for catch basins.

G. The top section of any structure is to be wrapped with geotextile fabric to five (5') minimum depth below the frame. Enough geotextile fabric shall be left on the top to roll over the cone section.

## CHAPTER NINE

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### 8. Masonry Block

- A. Concrete brick shall conform to the requirements of ASTM C-55-75, Grade N-1 and concrete block shall conform to the requirements of ASTM C139-73 with the following exceptions.
- B. All concrete masonry brick or block shall have a minimum compressive strength of 5500 psi at 28 days. The proportion of cement in the concrete mixture used to make brick or block shall be not less than 564 lb/c.yd. of concrete. The mixture shall contain 6% ( $\pm$  1-1/2%) engrained air. The maximum water adsorption shall not exceed 5 lbs/c.ft.
- C. Block Shape - The blocks shall be solid curved blocks with the inside and outside surfaces curved to the required radii. The blocks shall have tongue and groove or other approved type of joint at the ends so that the units interlock to form a strong, rigid structure. Curved blocks shall have the inside and outside surfaces parallel.
- D. Block Size - The nominal dimensions of the block shall be 18 inches maximum for length, 8" maximum for depth (height), and 6" maximum for width (thickness). The length shall be measured along the chord on the convex face of the block. The tolerances of ASTM C 139-73 shall apply. Where the specified wall thickness on the standard plans is 12 inches, a multiple block wall of two 6 inch wide blocks is permitted. all blocks in one structure shall be of the same height dimension. The blocks shall be designed for length so that only full length or half length blocks are required to lay the circular wall of any one course. Blocks intended for use in the cones or tops of manholes or other structures shall have such shape as maybe required to form the structure as shown on the plans with inside and outside joints not to exceed 1/4 inch in thickness.
- E. Final grade adjustments may be made using either brick and mortar construction or precast concrete adjustment rings at the option of the Contractor; all other provisions for grade rings and brick and mortar adjustments stated above for sanitary sewers shall apply.

### 9. Mortar

- A. Mortar for unit masonry shall conform to the requirements of ASTM C-270 Type M with the exception that it shall be composed of 3 parts sand and one part a mixture of 50% portland cement Type 1A and 50% masonry cement and shall have a minimum entrained air content of 12%. Use of mortar for manhole reconstruction shall be limited to within one hour after the water is added to the dry mix.

### 10. Concrete Grade Rings

Concrete grade rings shall have a minimum compressive strength of 4,000 psi at 28 days. Concrete grade rings shall be reinforced and shall be in conformance with ASTM C-478.

## CHAPTER NINE

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### 11. Elastic Joint Seal

The exterior joint between the manhole frame and the brick block or grade ring adjustment section (chimney) shall be sealed by using any of the following materials or approved equal:

- A. Polyurethane joint sealant
- B. Butyl rubber joint sealant

### 12. Final Inspection

All sewer systems shall be subjected to a Final Inspection prior to approval of the system by the Township.

### 13. Infiltration Limitations

The infiltration rate for all storm sewers, where rubber gasket joints are specified to be used, shall not exceed a maximum of 200 gallons per inch diameter per mile of sewer per 24 hours. In the event of infiltration in excess of the above amounts, joints shall be recaulked, remade, or if necessary, the pipe shall be re-laid. An infiltration test shall be required where deemed appropriate or warranted by the Township Engineer, repeated until results show that seepage has been reduced below the above maximums. The method of testing and measurement shall be approved by the Township Engineer. The Contractor shall provide the necessary equipment and labor for making the tests.

### 14. HDPE Pipe Testing Requirements

All HDPE pipe shall be videotaped after installation and backfill to finish grade. Upon review by the Township Engineer of the videotape, any noted pipe deflections shall necessitate the Contractor providing a mandrel test for the affected sections of pipe. All plastic pipe shall, at no point, have out of round deflections greater than 5% as determined by a nine (9) point Mandrel. Should any sections of pipe not pass the mandrel test, the Contractor shall remedy the situation by excavating and recompacting the bedding material, replacing the failed pipe sections, or any other methods as approved by the Township Engineer.

## CHAPTER TEN

### DESIGN AND CONSTRUCTION STANDARDS FOR IMPACTS TO WETLANDS

#### SECTION 10-1 INTENT

It is the purpose and intent of this standard, to promote and maintain a harmonious and compatible land use balance within the Township and to obviate the nuisance condition, which would arise with the indiscriminate alteration of existing wetlands and watercourse areas and to provide for the protection, preservation, proper maintenance and use of wetlands and watercourses in order to minimize disturbance of and to them.

#### SECTION 10-2 BACKGROUND

It is recognized by the Township that wetland conservation is a matter of Township concern. A loss of a wetland, and, particularly, in cumulation with other losses of wetlands, will deprive the people of the Township, or others, of flood and/or storm control, wildlife habitat, protection of subsurface water resources and provision of valuable watersheds and recharging groundwater supplies, pollution treatment, erosion control and sources of nutrients. The preservation of the remaining wetlands and watercourses in an undisturbed and natural condition shall be and is necessary to maintain important physical, aesthetic, recreational and economic assets for existing and future residents of the township.

#### SECTION 10-3 AGENCY APPROVAL

Pursuant to Part 303 of the Natural Resources and Environmental Protection Act (PA 451, 1994), a wetland area would be regulated by the State of Michigan if it is:

1. Greater than five (5) acres in size and located in a county with a population of greater than 100,000;
2. Of any size and contiguous (within 500 feet) to an inland lake, stream or pond, or within 1,000 feet of the Great Lakes.
3. Of any size if MDEQ determines that protection of the area is essential to the preservation of the natural resources of the state from pollution, impairment, or destruction.

A permit will be required from MDEQ to fill, dredge, drain, construct within, discharge to or otherwise disturb a regulated wetland.

#### SECTION 10-4 TOWNSHIP REVIEW OF WETLAND IMPACTS

1. While permitting may be required through MDEQ, the Township reserves the right to request additional restrictions, alternative design, etc. for wetlands of any size, it determines essential to the quality of the local natural resources.
2. Township approval of the proposed activity shall not be issued unless it is shown that:
  - a. An unreasonable disruption will not result to aquatic resources; and

## CHAPTER TEN

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- b. The proposed activity is primarily dependent upon being located in the wetland; and
  - c. A feasible and prudent alternative does not exist.
3. The Applicant is solely responsible to insure that the manner in which the activity is proposed to be undertaken will result in the minimum negative impact upon the wetland and attendant natural resources under all of the circumstances.

### SECTION 10-5 MITIGATION

1. Any mitigation required shall be designed to remove an impairment to the wetland benefits, to mitigate the impact of a discharge of fill material, or otherwise improve the water quality. Mitigation may be designed for the improvement of the existing wetland resources or the creation of new wetland resources to offset wetland resources lost as a result of the proposed Project.

### SECTION 10-6 BUFFER STRIP REQUIREMENTS

1. To protect the natural resources of wetlands, streams, lakes, ponds, etc., a twenty (20') foot wide natural vegetation buffer strip should be left undisturbed and protected. The Township's reserves the right to increase the buffer strip width for areas they deem to be sensitive or critical natural resources. The Township may also reduce the buffer strip width as deemed appropriate.
2. Any proposed buffer strip must be shown on the plans and properly labeled.
3. No development or encroachment shall be permitted within any required or approved buffer area without Township approval.
4. Any buffer strip shall be protected during development by construction fencing.
5. The entire wetland and buffer strip must be left in open space, protected by use restrictions, contained within a dedicated conservation easement, or protected in another manner.

### SECTION 10-7 PLAN REQUIREMENTS

The following items must be included in the plan set:

1. All wetland, lakes, ponds or watercourses must be shown on the plans.
2. Wetland delineation must be performed by a certified wetland scientist and tied into the site plans by survey. The party responsible for determining the wetland limits must be included on the plans.
3. Any buffer strip is to be shown and labeled.
4. All mitigation areas with landscaping plans and compensatory volume calculations and be shown on the plans.

## CHAPTER TEN

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5. All proposed activities within the buffer and wetland limits must be described and shown on the plans.
6. Restoration provisions for all disturbed areas within the buffer or wetland limits, and must be shown on the plans.
7. Proper soil erosion control measures shall be shown on the plans.

### SECTION 10-8 CONSTRUCTION PROVISIONS

1. All wetland impacts are to be constructed in accordance with the approved plans or MDEQ permit, whichever is more restrictive.
2. All soil erosion control measures and protection fencing shall be installed around the perimeter of the buffer strip prior to any earthwork on site.
3. Any encroachments shall be immediately restored in accordance with the plan provisions and/or MDEQ permit.
4. All mitigation areas must be fully restored prior to final project approval from the Township.

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## CHAPTER ELEVEN

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### DESIGN AND CONSTRUCTION STANDARDS FOR IMPACTS TO FLOODPLAINS

#### SECTION 11-1 INTENT

It is the purpose of this chapter to provide design and construction standards, which are intended to significantly reduce hazards to persons and damage to property as a result of flood conditions in the Township and to preserve the ability of floodplains to carry and discharge a base flood.

#### SECTION 11-2 DISCLAIMER

The degree of flood protection required by this chapter is considered reasonable for plan review purposes and is based upon engineering and scientific methods of study. Larger floods may occur on rare occasions. Flood heights may be increased by man-made or natural causes, such as ice jams and bridge openings restricted by debris. Approval of the use of land under this chapter shall not be considered a guarantee or warranty of safety from flood damage. This chapter does not imply that areas outside the floodplain area will be free from flood damage. This chapter does not create liability on the part of the Township or any officer or employee thereof for any flood damages that result from reliance on this chapter or any administrative decision lawfully made thereunder.

#### SECTION 11-3 PROVISIONS

1. No activity shall be permitted within a floodplain area without full compliance with the terms of this chapter and other applicable regulations.
2. No permanent structures such as homes, businesses, etc. shall be placed in a floodplain.
3. The floodplain limits shall overlay final site plan drawings for improvements adjacent to the floodplain. The boundaries of the floodplain shall be as determined by the Project Engineer. Within the floodplain a regulatory floodway shall be designated by the Project Engineer.

#### SECTION 11-4 AGENCY APPROVAL

Encroachments, including fill, new construction, substantial improvements and other development in the floodplain shall be prohibited. Exception to this standard shall only be made through the granting of a permit by the MDEQ.

#### SECTION 11-5 SUBMISSION OF BASE FLOOD ELEVATION BY REGISTERED PROFESSIONAL ENGINEER

MDEQ shall provide flow data on all jurisdictional watercourses. The Project Engineer shall be responsible for computing the flood stage elevations across the site using this data. The calculations, hydraulic model results, or other means of calculating the floodplain sections used must be submitted for review. The Township reserves the right to require hydraulic modeling or other sophisticated means of calculating the floodplain elevations where specific concerns of potential flooding impacts exist.

## CHAPTER ELEVEN

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### SECTION 11-6 PLAN REQUIREMENTS

The following shall be shown on all plans:

1. A site plan, showing all existing and proposed structures, topographical features, utilities, and all proposed changes. The following shall be shown on the plans: The site plan shall include existing and proposed elevation contours (2-foot intervals). The base flood elevation contour shall be clearly delineated on the site plan.
2. The elevation in relation to mean sea level of each floor, including basement, for all structures proposed by the Applicant adjacent to the floodplain.
3. Pursuant to criteria established in this chapter for protection of the floodplain, any proposed development necessitates certification by a registered professional that no cumulative impact on the base flood elevation will result. A cumulative impact is defined as an increase in elevation exceeding one-tenth foot.
4. A description of the extent to which any watercourse will be altered or relocated as a result of the proposed development. Specifically, the impact on flow velocities and other flood carrying characteristics of the regulatory floodway should be addressed.
5. All utilities and facilities shall be designed, constructed, and located to minimize or eliminate flood damage.
6. Adequate drainage shall be provided to reduce exposure to flood damage.
7. The flood carrying capacity of any altered or relocated watercourse not subject to state or federal regulations designed to ensure flood carrying capacity shall be maintained.
8. Available floodplain data from federal, state or other sources shall be reasonably utilized in meeting the standards of this section. Data furnished by the Federal Emergency Management Agency shall take precedence over data from other sources.
9. All new construction and substantial improvements of structures adjacent to the floodplain shall have the lowest floor, including basement, at least one (1) foot above the base flood elevation.

### SECTION 11-7 CONSTRUCTION PROVISIONS

1. All floodplain impacts are to be constructed in accordance to the approved plans and MDEQ permit.
2. All soil erosion control measures or protective fencing shall be installed around the perimeter of the floodplain.
3. Construction shall be sequenced so that the minimum amount of time possible is required for the work within the floodplain.
4. Restoration shall be completed immediately.
5. Storage of equipment, material, etc. is strictly prohibited within the floodplain.

## CHAPTER TWELVE

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### DESIGN AND CONSTRUCTION STANDARDS FOR STREETS, DRIVEWAYS, PEDESTRIAN FACILITIES AND PAVING

#### SECTION 12-1 INTENT

It is the intent of this chapter to provide the Applicant with a guide for the design and construction of streets, driveways, pedestrian facilities (i.e. bike paths, safety paths, sidewalks, and other non-motorized trails) and all other private paved surfaces such as parking lots.

#### SECTION 12-2 JURISDICTION

Any work proposed within the existing rights of way of the Road Commission for Oakland County (RCOC) or the Michigan Department of Transportation (MDOT) is to be reviewed and approved by the respective agency that has jurisdiction over the subject right of way.

Any roads intended to be publicly dedicated are to be reviewed and approved by the Subdivision Improvement Division (SID) of RCOC. Correspondence regarding the acceptance of the roadway into the public system upon completion must be on file at the Township prior to final site plan approval. Upon project completion and RCOC acceptance of the roadway, a copy of the Board of Commissioners Resolution declaring the road to be public must be on file at the Township.

While RCOC and MDOT will issue construction permits for work within their respective rights of way and their standards will dictate design of roads or other improvements to be dedicated to the public, the Township reserves the right to require additional plan provisions or paving requirements above those required by the governmental agency having jurisdiction.

#### SECTION 12-3 GENERAL

It is the intent of the Township to encourage paving layouts and street designs that preserve natural features by minimizing the clearing and mass grading required to construct streets, parking lots, pedestrian facilities, etc. Paving designs should meet current RCOC standards. However, where deviation from these standards meets the objective of preserving natural features without compromising public safety, current AASHTO standards applicable to the design traffic capacity proposed may be used in the design of paved facilities. For road construction where the design deviates from RCOC Standards, the roads may not be approved by RCOC to be accepted into the public road system; in which case, the applicant should discuss the option of designing and constructing a private road with the Township.

#### SECTION 12-4 REFERENCE TO STANDARDS

1. Public roads shall be designed and constructed to current RCOC standards.
2. Private roads shall be designed and constructed in accordance with sound engineering principles, taking into consideration public health, safety, and welfare, as well as preservation of natural

## CHAPTER TWELVE

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resources. At minimum, current AASHTO design standards applicable to appropriate traffic volumes shall be adhered to.

3. Off-street parking shall be designed in accordance with the current Township Zoning Ordinance and the specifications herein.
4. Sidewalks shall be designed and constructed in accordance with the Americans with Disabilities Act (ADA) barrier free specifications except where modified herein. The more strict interpretation between these standards and ADA shall apply.
5. Non-Motorized Pedestrian Paths such as safety paths, bike paths, paved nature trails, etc. shall be designed and constructed to current AASHTO "Guide for the Development of Bicycle Facilities" and ADA "Outdoor Recreational Trails" standards except where modified herein. The more strict interpretation between these standards and AASHTO and ADA shall apply.

### SECTION 12-5 DESIGN CONSIDERATIONS

#### 1. STREETS

##### A. Layout

1. Street layout shall provide for the continuation of existing major or collector streets in surrounding areas or conform to the development plan approved by the Township.
2. Certain streets, public or private, as designated by the Township, shall be extended to the limits of the property to be developed to provide future connection with adjoining undeveloped land.
3. Proposed streets shall be designed in accordance to the existing topography and produce a reasonable gradient.
4. Service entrances and drives shall be permitted to provide a secondary means of access for service and safety vehicles, provided that appropriate signage limiting usage shall be established as required by the Township.
5. Street jogs with centerline offsets of less than 125 feet shall be approved by the Township only upon an adequate demonstration that there are no reasonably feasible alternatives.
6. Alleys and half-streets are prohibited except where absolutely essential to the reasonable development of the property in conformance to these Standards and the Zoning Ordinance and as reviewed and approved by the Township on a case by case basis.

## CHAPTER TWELVE

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### B. Right of Way Requirements

1. New public road rights of way shall be as directed by RCOC.
2. Private roads shall be contained within a dedicated easement for ingress and egress. The easement widths shall be as necessary to accommodate paving and drainage improvements.

### C. Geometrics

1. Existing public roads or roads intended on being publicly dedicated shall meet the width standards of RCOC.
2. The paved surface width of private roads shall be as necessary in order to accommodate vehicle access, planned on-street parking, and safe vehicular maneuverability.
3. Pavement widths for each side of a boulevard shall, at a minimum, accommodate 1-way traffic. Island widths shall typically be ten (10') to sixteen (16') feet. The nose of the island shall be twelve (12') feet from the edge of pavement of the intersecting street.
4. Private road grades shall be typically eight (8%) percent or less. Where essential to maintain natural features, grades exceeding eight (8%) percent may be permitted, provided AASHTO Standards applicable to the proposed design volumes are met as a minimum. The grade shall not exceed three (3%) for a minimum distance of one hundred (100') feet from the edge of all existing public road rights of way, unless otherwise approved by RCOC. The minimum road grade shall be no less than 0.4 percent.
5. Vertical curves shall be required for all grade changes in excess of one (1%) percent and shall meet RCOC standards for public roads and current AASHTO Standards for the applicable design traffic volumes as a minimum for private roads.
6. For public roads, the minimum sight distance for vertical curves shall be six hundred (600') feet for all major roads and three hundred (300') feet for all other streets. For private roads, current AASHTO Standards applicable to proposed traffic volumes as a minimum shall apply.
7. For public roads, road centerlines that deflect more than ten (10) degrees but less than ninety (90) degrees shall be connected with a horizontal curve radius with a minimum radius of two hundred thirty (230') feet. Actual radii shall be designed for the posted speed of the road and in accordance with RCOC standards. For private roads, current AASHTO Standards applicable to the proposed design traffic volume as a minimum shall apply.

## CHAPTER TWELVE

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8. Streets intersecting major thoroughfares shall do so at approximately ninety (90) degrees.
9. Cul-de-sac lengths shall not exceed 1,000 feet unless approved by the Township. Intermediary turn-a-rounds or other available means to provide fire truck maneuverability shall be required approximately half way along the street if the total length exceeds 1,000 feet.
10. Acceleration, deceleration and passing lanes for approaches to existing roads shall be required as determined by the Township with recommendations provided by the Township Engineer based upon such criteria as traffic volumes, accident data, horizontal and vertical alignment, site distance, land use, topography and other natural conditions. Where required, acceleration, deceleration and passing lanes shall be constructed to RCOC standards.
11. Streets shall be crowned with 2 percent transverse slopes provided from the centerline to the edge of the road.
12. The proposed street cross section shall include shoulders with open ditch drainage or curb and gutter with an enclosed storm sewer system.

### 2. DRIVEWAYS

- A. Unless determined by the Township, property shall be developed to minimize the number of ingress/egress points from an existing or proposed road.
- B. Use of shared or common driveways for all developments, including between two businesses or residences, is encouraged.
- C. Maximum driveway grades shall be ten (10%) percent unless the Applicant receives a variance from the Township.
- D. All driveway approaches to a roadway shall not exceed 1.5% for a distance of twenty-five (25') feet from the edge of the roadway, unless existing site topography dictates a steeper grade. In such cases, the safety of access must be considered in the final driveway grade.
- E. Driveways to individual residential lots shall be surfaced as required by the Zoning Ordinance.
- F. Driveways within the public road right-of-way are to be built to the same standards as a road with the same surface.
- G. Driveways to commercial, industrial, multifamily, institutional, etc. developments shall be surfaced in accordance to the requirements herein specified for Streets.

## CHAPTER TWELVE

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### 3. PEDESTRIAN FACILITIES

#### A. General

1. Pedestrian facilities are to be installed in accordance with Chapter 40—Zoning of the Springfield Township Code of Ordinances or as otherwise directed by the Township.
2. Pedestrian facilities located within a public road right-of-way must obtain a permit from the Road Commission for Oakland County (RCOC) or Michigan Department of Transportation (MDOT).
3. Pedestrian facilities installed outside of the right-of-way require a dedicated easement recorded with the Oakland County Register of Deeds.
4. Provisions for the repair and maintenance of pedestrian facilities acceptable to the Township must be provided. Such provisions may be Deed Restrictions, Condominium Master Deed provision or agreement but shall be recorded with the Oakland County Register of Deeds.
5. Where topography, vegetation, natural features, utilities, poles, signs etc. dictate, the pedestrian facilities shall be meandered around these features.
6. Barrier free ramps shall be installed in accordance with current ADA barrier free requirements and MDOT specifications at all intersections with drive ways, roads, parking lots etc.
7. Proper signage for the pedestrian facilities shall be the applicant's responsibility.

#### B. Sidewalks

1. Sidewalks shall be sloped to provide for positive drainage of storm water off of and away from the path.
2. Sidewalks shall be concrete with a mix design suitable to achieve a strength requirement of 3,500 psi at 28 days.
3. Concrete sidewalks shall be four inches (4") thick non-reinforced except at driveways and approaches where it shall be six inches (6") thick non-reinforced extending ten feet (10') past the edge of drive pavement or back of curb. The mix design shall meet current MDOT standards. The concrete shall be placed on a prepared granular compacted subgrade void of all unstable soils. If native soils are not granular, then a six inch (6") thick granular Type II sub base shall be provided.
4. Sidewalks shall be no less than four feet (4') wide.
5. Gaps or joints must not be wider than one-half of an inch (1/2") and run perpendicular to the traveled path.

## CHAPTER TWELVE

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6. Transverse slope of sidewalks shall not exceed 5%. Two percent 2% is preferred.
7. Longitudinal grade (running grade) shall be as follows; up to 5% for any length, 8.33% for up to 200 feet, 10% for up to 30 feet and 12.5% for up to 10 feet.
8. Resting intervals shall be required where the running grade exceeds the maximum length as specified in No. 7 above. Resting intervals shall be at minimum five feet (5') in length and match the width of the sidewalk. The slope shall not exceed 5%.

### C. Pathways

1. Pathways shall be constructed of either:
  - a. Three inch (3") thick hot mix asphalt (HMA) on a six inch (6") thick aggregate base. The aggregate base shall be MDOT 21AA crushed concrete or limestone compacted to a smooth and stable surface. HMA mix designs shall meet current MDOT standards; or,
  - b. Concrete four inches (4") thick non-reinforced except at driveways and approaches where it shall be six inches (6") thick non-reinforced extending ten feet (10') past the edge of drive pavement or back of curb. The mix design shall meet current MDOT standards. The concrete shall be placed on a prepared granular compacted subgrade void of all unstable soils. If native soils are not granular, then a six inch (6") thick granular material meeting the requirements of MDOT Class II or IIA sub base shall be provided.
2. Pathways shall be no less than five feet (5') wide.
3. If unsuitable soil conditions to support the pathway are encountered, the soils shall be undercut and replaced with 1x3 crushed concrete or limestone underlain by Tensar BX 13,000 or equivalent geogrid as needed.
4. Pathways shall be sloped to provide for positive drainage of storm water off of and away from the path.
5. Gaps or joints must not be wider than one-half of an inch (1/2") and run perpendicular to the traveled path.
6. Transverse slope of paths shall not exceed 2%.
7. Longitudinal grade (running grade) shall follow the RCOC or MDOT permit requirements if in right-of-way. Where pedestrian routes are contained within a street or highway right-of-way, the grade of pedestrian access routes shall not exceed the general grade established for the adjacent street or highway. Where pedestrian routes are not contained within a street or highway right-of-way, the grade of the pedestrian access routes shall be 5% maximum. For curb ramps, the running slope shall be 5% minimum and 8.3% maximum, but shall not require the ramp length to exceed 15 feet (15'). The running slope of the turning space shall be 2% maximum.

## CHAPTER TWELVE

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### D. Trails

1. Paved trails shall be bituminous or concrete, no less than four feet (4') wide, and constructed to the standards detailed above in subsection C. Pathways.
2. Unpaved trails shall be:
  - a. Six inches (6") of MDOT 21AA crushed concrete or limestone overlain by fine crushed limestone, compacted to provide a firm and stable surface; or,
  - b. Alternate surface as approved by the Township.

## CHAPTER TWELVE

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### 4. PAVING

- A. All areas required to be hard surfaced under the Township Zoning Ordinance shall be surfaced with Bituminous Asphalt or Concrete pavement in accordance with the following minimum cross sections:
1. For residential driveways, private parking lots and storage areas not subject to heavy equipment loads, the required pavement section shall consist of three (3") inches of bituminous asphalt pavement over eight (8") inches of compacted MDOT 22A (or alternate six (6") inches of compacted MDOT 21AA) aggregate on existing sand subgrade. For commercial or industrial driveways, private roads, and storage areas subject to heavy equipment loads, the required pavement section shall consist of four (4") inches of bituminous asphalt pavement over then (10") inches of compacted MDOT 22AA (or alternate eight (8") inches of compacted MDOT 21AA) aggregate on existing sand subgrade. For all pavement on an existing clay subgrade, a minimum of four (4") inches of compacted MDOT Class II subbase or four (4") inches of additional aggregate base material shall be provided. For private developments, all access drives and internal routes to loading areas, dumpsters, equipment storage areas, or any other areas subject to traffic loading by heavy non-passenger type vehicles, shall be required to install the thicker pavement cross-section as outlined above. The Township body responsible for Site Plan approval shall make the final determination regarding the required pavement cross-section for any given development requiring site plan approval.
  2. Alternate deep strength bituminous asphalt or concrete pavement designs will be considered on a case-by-case basis provided adequate engineering data is made available demonstrating equal structural stability and longevity to the section as outlined under Paragraph 1 above. However, at no time, will the thickness of deep strength bituminous pavement be less than seven (7") inches or concrete pavement be less than six (6") inches.
  3. All proposed pavement sections are subject to review and approval by the Township.
- B. All pavement surfaces must be supported upon a prepared subgrade that is properly drained and has been compacted to MDOT standards. When unstable subgrade materials (i.e. peat, muck, marl, wet clays, etc.) are encountered, excavation and removal of such unstable materials and replacement with suitable engineered fill compacted in place shall be required. Fill materials shall be approved by the Township Engineer. Where the removal of unstable soils is not feasible due to excessive depths, an alternative pavement section must be submitted to the Township for review. Soil stabilization measures such as geotextile fabric, geotensile reinforcement products, etc may be required to provide a paved surface that meets the intent of this standard.
- C. Maximum parking lot grades shall be six percent.
- D. Parking lots shall be of the size and configuration as required in the Township Zoning Ordinance.

## CHAPTER TWELVE

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### SECTION 12-6 PLAN REQUIREMENTS

#### 1. PLAN VIEW

- A. Road and right-of-way width must be shown on the plans.
- B. Cross sections of all pavement sections shall be provided, including surface, subbase, and a shoulder and ditch profile.
- C. All parking lots, loading spaces, and driveway layouts, along with typical dimensions and layouts of parking spaces shall be shown.
- D. Entrance, intersection, and cul-de-sac details must be shown.
- E. Existing grade elevations at the center of the proposed roadway curbed in fifty (50') foot intervals or as need to accurately demonstrate proposed plan.
- F. Complete mix design for asphalt or concrete shall be given.
- G. The location of any proposed or existing utilities and structures within the proposed right of way.
- H. Provisions for the removal of any unsuitable soils including peat, muck, and marl, as well as brush, trees, tree stumps, and similar material from the full width of the roadway.
- I. Any proposed culverts (driveway or cross) including size, type and invert elevations
- J. Proposed and existing parking lot and driveway grades
- K. Legal descriptions for the road right of way for public roads and ingress and egress easements for private roads must be provided.
- L. Sight distances must be provided.

#### 2. PROFILE VIEW

- A. Elevations at top of curb or centerline if not curbed in fifty (50') foot intervals or as need to accurately demonstrate proposed plan.
- B. Existing grade elevations at the center of the proposed roadway curbed in fifty (50') foot intervals or as need to accurately demonstrate proposed plan.

## CHAPTER TWELVE

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- C. Station and elevations of all high and low points, grade breaks, curb returns, intersecting property lines and vertical curve information.
- D. The station and elevation of the rim grade of all drainage structures.

### SECTION 12-7 CONSTRUCTION PROVISIONS

#### 1. CONCRETE

Portland cement, aggregates and water shall be furnished only from sources of supply approved by the Township before shipments are started. No aggregates shall be used which have become mixed, while in storage, with foreign material. Frozen aggregates or aggregates containing frozen lumps shall be thawed before use.

Fine aggregate shall consist of natural sand. It shall be composed of clean, hard, strong, durable, uncoated grains and shall conform to current Standard Specifications 2NS for fine aggregate for Portland cement concrete pavement of the Michigan Department of Transportation (M.D.O.T.).

Coarse aggregate shall be crushed stone, rock, gravel or blast furnace slag weighing not less than 75 pounds per cubic foot in accordance with ASTM C-29, and shall be composed of hard, sound, uncoated pieces conforming to Michigan Department of Transportation designation 6A.

Cement shall be Air-Entraining Portland Cement, Type 1A conforming to ASTM C150. Air-Entraining Portland Blast-Furnace Slag Cement, Type IS-A conforming to ASTM C595 or High-Early-Strength Air-Entraining Portland Cement, Type IIIA conforming to ASTM C150.

The water used in mixing or curing concrete shall be clean, clear, and reasonably free of oil, salt, acid, alkali, sugar, vegetable, organic or other matter or substance injurious to the finished product. If the water is of questionable quality, it shall be tested in accordance with AASHTO T-26.

Air-entraining agents shall conform to the requirements of ADTM C-260. Air-entraining agents shall have proven compatibility with all local concrete materials, including cement, and shall be capable of providing in the concrete the required air contents and an air-void system known to produce durable, scale-resistance concrete.

Water-reducing admixtures shall conform to the requirements of ASTM C-494, Type A. Water-reducing retarding admixtures shall be used only when specified or authorized, in which case they shall conform to the requirements of ASTM C-494, Type D. When conditions warrant, the Township may allow or require the use of an accelerator conforming to the requirements of ASTM C-494 for chemical admixtures or ASTM D-98 for calcium chloride.

The proportioning of concrete mixtures shall be based upon the water-cement ratio.

## CHAPTER TWELVE

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All concrete must be placed using forms built to current standards.

The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. All forms shall be cleaned and oiled each time they are used.

Forms shall not be removed from freshly placed concrete until it has set for 12 hours unless slipform is used. The forms shall be carefully removed so that no damage will be done to the pavement.

The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subbase in such a manner as to require as little rehandling as possible. Necessary hand spreading shall be done with shovels, not rakes.

The sequence of finishing operations shall be the strike-off and consolidation, floating, if necessary, straightedging, and final surface finish. The pavement shall be struck off and consolidated with a mechanical finishing machine, vibrator strike board, or by hand-finishing methods when approved by the engineer.

In general, adding water to the surface of the concrete to assist in finishing operations shall not be permitted. If it is permitted, it shall be applied as a fog spray with approved spray equipment.

Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans.

The final surface of the concrete pavement shall have a uniform gritty texture true to the grades and cross-section shown on the plans. The Township may require changes in the final finishing procedure to produce the desired final surface texture.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, and mechanical injury for at least three (3) days after placement.

All longitudinal and transverse joints shall conform to the plans, specifications, and standard details.

All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement.

Sealing of joints shall be completed before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just before sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and the joint faces shall be cleaned by means of sand blasting and thoroughly blown out with a stream of compressed air and surface-dry when the seal is applied. Material for seal shall be stirred during heating to

## CHAPTER TWELVE

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prevent localized overheating. Joint sealing material shall not be placed when the air temperature in the shade is less than 50 deg. F., unless approved by the Engineer.

The Contractor shall take such precautions as are necessary to protect the concrete from rain damage.

Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90 degrees F.

No concrete shall be placed unless the temperature of the air in the shade and away from artificial heat is at least 20 degrees F. and rising, unless specifically approved.

The Contractor shall employ whatever measures are necessary to prevent damage to the work and shall be responsible for the concrete placed during cold weather. Any concrete injured by frost action, as determined by the Engineer, shall be removed and replaced at the Contractor's expense.

All materials proposed to be used may be inspected and tested at any time and at any place during their preparation, storage and use. All tests of materials will be made in accordance with methods as described or designated in the specifications. All rejected materials shall be removed immediately from the job site.

The project under construction, or any section thereof, shall not be opened to traffic until so directed or authorized by the Township. Whenever any section of the project is in suitable condition for travel, it may be opened for traffic previous to completion of the whole project, when so directed by the Township.

### 2. CONCRETE CURB AND GUTTER

This work shall consist of constructing portland cement concrete curb, gutter or combination curb and gutter, with or without steel reinforcement as provided on a prepared base. The construction shall follow the construction of concrete base course or concrete pavement but shall be in advance of the construction of non-rigid types of pavement or base course. The materials and construction shall be as specified in MDOT Specification Section 6.09.

### 3. REINFORCEMENT

When steel reinforcement or tie bars are called for on the plans, the bars shall be properly spaced and held in the correct position during the placing of concrete by the use of bar chairs or other approved devices. Bars shall be lapped at least ten (10") inches unless otherwise shown on the Plans. Reinforcement bar materials shall be in accordance with current MDOT standards.

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4. BACKFILLING

After the concrete has sufficiently cured, the curb, gutter or combination curb and gutter, shall be backfilled to the required elevation with approved material, which shall be compacted and left in a neat and workmanlike condition.

5. AGGREGATE SHOULDER

The subgrade for the shoulders shall be graded to an elevation below the finished surface that will permit the placing of the specified thickness of shoulder material.

The aggregate shall be placed on the prepared subgrade to such a depth that the compacted layer will be not more than five (5") inches thick. Where the completed shoulder is to be more than five (5") inches thick, it shall be constructed in two or more courses. The aggregate shall be deposited on the shoulders by means of an approved mechanical spreader. On irregular areas where the use of a mechanical spreader is not practical, the use of hand tools or power grading equipment will be approved for spreading and shaping of the shoulder material.

Dumping the aggregate on the road and grading it onto the shoulder will not be permitted.

The aggregate shall be compacted to not less than 100 percent of the maximum unit weight, by the use of pneumatic-tired compaction equipment or vibrator compactors

The rolling and compacting operation shall be performed immediately after the shoulder material has been spread. Water shall be applied, when directed by the Engineer, to aid in the compaction and shaping of the surface. The water shall be applied by means of approved sprinkler equipment.

6. BITUMINOUS PAVING

The bituminous mixture required shall be as specified on the plans. The bituminous mixture shall be designed to meet the applicable requirements for stability, flow, voids in mineral aggregate (VMA) and air-voids, all as specified in current MDOT standards. The aggregates, mineral filler (if required) and asphalt cement shall be combined as necessary to produce a mixture proportioned within the master gradation range limits as included in current MDOT standards.

For bituminous base course mixtures required to be placed directly on the sub-grade or sub-base, the density, grade, and cross-section shall meet the approval of the Township prior to placement of any mixture. The sub-grade or sub-base shall meet the specified tolerances for grade and elevation and shall be compacted to not less than 95% of maximum density as determined by ASTM Method D-1557 for a depth of not less than nine (9") inches. If a prime coat is specified, it shall be placed at a rate of 0.25 gallons per square yard or as directed by the Engineer. Before placing the prime coat, the surface shall be clean and free from excessive

## CHAPTER TWELVE

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moisture. Under no circumstances shall pools or excess bituminous prime coat material be allowed to remain on the surface. The prime coat shall be properly cured before placing the bituminous mixture, but in no case less than 24 hours. The prime coat may be omitted or reduced when authorized by the Township Engineer.

Prior to placing the bituminous mixture on the aggregate base, the finished surface shall be shaped to line and grade within a tolerance of +/- 3/8 inch, unless otherwise specified. The aggregate base course shall be compacted for its full depth to not less than 98% of maximum density as determined by ASTM D-1557. The aggregate surface shall be maintained in a smooth, compacted condition and in close conformity to line, grade, and cross-section. No bituminous material may be placed until the aggregate surface has been inspected and approved by the Township.

Catch basin and manhole covers, monument boxes, and water shutoffs shall be adjusted in accordance with current MDOT procedures or under the specific specifications within the approved site plan.

Before placing any bituminous mixture, the surface of the pavement and paved shoulders, if applicable, shall be thoroughly cleaned of all dirt and debris using a method approved by the Engineer. This work shall also include routine blowing, with compressed air, of the joints and cracks to remove loose material. The Contractor shall not place any bituminous mixture until the condition of the pavement to be resurfaced has been inspected and approved by the Township Engineer or the agency having jurisdiction over the road. Existing bituminous patches with a high bitumen content, cold patches, or any patches which may cause an unsatisfactory performance of the overlay shall be removed. Prior to placing of an intermediate or surface course, the underlying or level course shall be cleared of all foreign or objectionable matter and debris with power blowers, power brooms, or hand brooms.

Hand patching consists of filling holes and depressions in the existing pavement and replacing patches. The patches shall be compacted in maximum three (3") inch lifts to a grade which is approximately 1/8 inch above the adjacent pavement surface by use of a machine vibrator or approved roller.

A bond coat shall be applied to the prepared surface of the existing pavement and/or the previously placed layer of bituminous mixture and to the vertical edge of the adjacent pavement and structures. The rate shall be 0.10 gallons per square yard or less. The bond coat shall be applied ahead of the paving operation for a distance of at least 1500 feet, depending upon traffic conditions, as determined by the Township Engineer. The bituminous mixture shall not be placed until the bond coat has cured.

The bituminous mixture shall be placed by an approved self-propelled mechanical paver to such a depth that when compacted, it will have the thickness specified on the approved plans. Pavers will be required to have an automatically controlled and activated screed and strikeoff assembly except when placing mixtures for 1) variable width sections; 2) the first course of a base course mixture on a sub-grade or on a sand sub-base; 3) base course mixtures for shoulders and

## CHAPTER TWELVE

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widenings less than 10.5 feet in width; or, 4) top and leveling course mixtures for shoulders and widenings less than 8 feet in width.

When necessary to take out irregularities in the existing road surface, wedging with bituminous mixture shall be done by placing several layers with the paver, or as directed by the Township Engineer. Any corrections made to the foundation by wedging with bituminous material shall be placed, compacted, and allowed to cool prior to placing base, leveling, or top course mixtures.

Bituminous base course mixtures shall not be placed in lifts exceeding three (3") inches, compacted, unless otherwise approved by the Engineer. Approval to place lifts in excess of three (3") inches will be based on the ability of the Contractor to place and compact the base course to the required density, cross section, and within the specified tolerances.

The base may be opened to traffic for a period of time to be determined by the Township Engineer prior to placing of the surface.

When placing the bituminous top course, or the top two (2) courses of multi-level pavement on the traveled portion of the roadway, the paving operation shall be conducted in a combination of widths which will cause the final course longitudinal joint lines to coincide with the proposed painted lane lines.

When the temperature of the previously placed mat falls below 170°F prior to placement of the adjacent mat, the vertical edges of the initial mat shall be coated with bituminous bond coat material before the mixture is placed on the adjacent section. In placing the mixture adjacent to all joints, hand raking or brooming will be required to provide a dense smooth connection.

When placing the bituminous mixture in a lane adjoining a previously placed lane, the mixture shall be placed such that it uniformly overlaps the first lane by two (2") to four (4") inches and is placed at a height above the cold mat equal to the breakdown roller depression on the hot mat.

A sufficient number of experienced shovelers and rakers shall follow the spreading machine, adding hot mixture and raking the mixtures as required to produce a course that, when completed, will conform to all requirements specified herein. Broadcasting or fanning of mixture over areas being compacted will not be permitted. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot shovels and hot rakes in a loose layer of a thickness that, when compacted, will conform to the required grade and thickness. During hand-spreading, each shovel full of mixture shall be carefully placed by turning the shovel over in a manner that will prevent segregation. In no case shall the mixture be placed by throwing or broadcasting from a shovel.

## CHAPTER TWELVE

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Each layer of bituminous mixture shall be compacted to the required density. Except for base and leveling courses used for overlays, steel 3-wheeled rollers may be used for initial compaction immediately following the paver. On base and leveling courses used for overlays, pneumatic-tired rollers shall be used for initial compaction immediately following the paver except where severe mat displacement takes place, in which case, a steel-wheeled roller shall be used for breakdown followed by a pneumatic-tired roller.

The final rolling operation on each layer of bituminous mixture placed shall be accomplished by use of tandem steel-wheeled rollers. Vibratory rollers shall be operated in the static mode when used for finish rolling or pinching the joint. Pneumatic-tired rollers will not be permitted on top courses. Steel rollers wheels shall be kept properly moistened with water but usage of an excess is prohibited. Pneumatic-tired rollers shall be wiped down, off the paved surface, with fuel oil prior to rolling.

Rolling of the mixture shall begin as soon after placing as it will bear the roller without undue displacement, picking up the mat or cracking. Rolling can start longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the drive wheel of the roller. Alternate passes of the roller shall be of slightly different lengths. The maximum roller speed shall not exceed the manufacturer's recommended speed for the type of mixture or thickness of layer being placed.

When compacting an adjoining lane, the longitudinal joint shall be rolled first with the roller supported mainly on the cold lane with three (3") to six (6") inches of the roller extending onto the freshly placed bituminous mixture.

Pneumatic-tired rolling of longitudinal joints shall overlap the hot joint. Pneumatic-tired rollers shall not mark or rut the surface or displace the pavement edges. The pneumatic-tired roller shall be ballasted to obtain the required ground-contact pressures. In order to obtain a uniformly textured mat and the desired in-place density, the Contractor shall raise or lower tire pressures at any time during the rolling operations. The roller operations shall be conducted in such a manner as to prevent scuffing or chatter marks in the pavement surface. The number of passes made by the pneumatic-tired roller shall not be less than two round trip passes over each area.

In all places not accessible to the roller, the hot mixture shall be compacted by hand-tampers. Skin patching on an area that has been rolled will not be permitted. Any mixture that becomes contaminated, or is in any way defective, shall be removed, replaced with hot mixture, and compacted to the density of the surrounding area.

When the placement rate exceeds 800 square yards per hour, a separate finish roller shall be used in addition to the roller(s) used in establishing the rolling procedure. Roller speeds shall not exceed those established by the rolling pattern. Rolling shall proceed continuously until the required in-place density is attained. This density shall be not less than 97% of density of laboratory compacted specimens of the same mixture, using the Marshall Method with 50 blows per side. If specified on the plans, the compaction of the bituminous mixture may be controlled

## CHAPTER TWELVE

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by the MDOT Nuclear Gage Method, in which case requirements of MDOT Section 4.00.11 will apply.

Finish rolling shall continue until all roller marks are eliminated. No traffic shall be allowed on the surface being placed until rolling has been completed and the surface has cooled sufficiently to prevent damage from traffic.

After final rolling, the surface may be tested by the Engineer using a 10 foot straight-edge at selected locations. The variation of the surface from the testing edge of the straight-edge between any two contacts with the surface shall at no point exceed 1/4 inch. Variations in excess of the specified tolerance shall be corrected.

Joints between old and new pavements or between successive day's work, or joints that have become cold because of delay, shall be made carefully to insure continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the layer. Contact surfaces of previously constructed pavements that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with an approved power saw, as directed. The surface against which new material is to be placed shall be sprayed with a thin, uniform tack coat of bituminous material. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

The roller shall pass over the unprotected end of freshly placed mixture only when placing of the layer is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, the edge of the previously placed layer shall be cut back to expose an even, vertical surface for its full thickness. In continuing placement of a strip, the mechanical hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified. When required, the fresh mixture shall be raked against the joints, thoroughly tamped with hot tampers, and smoothed with hot irons and rolled.

Longitudinal joints in surface course or leveling course shall be so placed that the joint will be offset from that of any underlying course by at least 1 foot. Edges of previously placed strips that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be cut back to expose a clean, sound surface for the full thickness of the course as directed. When required, fresh mixtures shall be raked against the joint, thoroughly tamped with hot tampers, smoothed with hot irons, and rolled.

Bituminous material shall not be applied when rain is threatening or when the temperature in the shade is lower than 60 deg. F.

## CHAPTER THIRTEEN

### DESIGN AND CONSTRUCTION STANDARDS FOR RURAL FIRE PROTECTION FACILITIES

#### SECTION 13 - 1 INTENT

This chapter is to serve as a guide for Applicants to design and construct facilities for fire suppression needs such as cisterns, ponds, dry hydrants, etc.

#### SECTION 13 - 2 GENERAL

Springfield Township is a rural community, which is not served by a municipal water system. Currently, the Fire Department relies on tanker trucks, surface water, dry hydrants in lakes, cisterns, and private water sources for fire fighting purposes. This chapter is to be used to standardize the design and construction of such similar systems where the Township has determined they are required. The Township, however, retains the right to require larger systems or additional facilities, include special provisions, waive criteria, etc. which may be in the Township's best interest.

The specifications are divided into three (3) sections; Dry Hydrants, Cisterns and Ponds. The dry hydrant standards are to include both individual hydrant assemblies for installation into proposed or existing ponds and piping systems from Cisterns. Therefore, the dry hydrant standards apply to all systems except where specifically noted in the other sections.

#### SECTION 13 - 3 DRY HYDRANTS

##### A. Design Considerations

1. All hydrant systems are to be designed to provide the required flow rate within the allowable total head loss as specified:
  - a) The suction piping system must be capable of delivering 1,250 gpm for the entire required water volume.
  - b) Total head loss must be less than twenty (20') feet.
  - c) Static lift is not to exceed fifteen (15') feet.
2. Each design must be specific to the proposed site and based on actual soil conditions, layout, water source, etc.
3. Longevity and ease of long term maintenance are of high priority. Innovative approaches to this are encouraged provided the minimum standards herein can be achieved.
4. Seasonal variations such as ice formations, snow pack, accessibility etc. must be considered and the system designed for year round and all-weather use.

## CHAPTER THIRTEEN

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### B. Materials

1. All dry hydrants shall be constructed of six (6") inch diameter or larger pipe and fittings.
2. Ductile iron pipe (DIP) Class 52, Schedule 40 galvanized steel, PVC Schedule 40, or heavier pipe and fittings are to be used.
3. Mechanical restraint fitting connections and field lock pipe joints are to be used for DIP. Solvent welded premium joints with concrete thrust blocks are to be used for PVC pipe. All connections should be clean and free of debris and sealed to the manufacturer recommendations for an airtight seal.
4. All exposed, above ground fixtures are to be primed and painted with high visibility red paint to prevent deterioration and corrosion. Each fixture is to be clearly identified and labeled.
5. Prefabricated screens or strainers must be installed at the intake. Holes are to be 5/16" diameter and be of sufficient number to allow the proper flow rate. Strainers should be on only one longitudinal half of the pipe to prevent whirlpooling. Brand and manufacturer of strainer must be shown on the plans.
6. The hydrant connection is to be EJIW 5BR-250 with cap (bonnet) color reflecting flow rate Per ISO (0-499 gpm Red, 500-999 gpm Orange, 1,000-1499 Green & 1,500 and higher Blue).

### C. Calculations

1. The following calculations must be included with the design for Township review:
  - a) Determination of required static lift
  - b) Total lineal feet of straight pipe including the screen, laterals, and riser.
  - c) Total straight feet equivalent for all fittings connections, adapters, etc. Reference material used for the values of equivalent footage, based on pipe type, is to be included.
  - d) Total length of straight pipe equivalent.
  - e) Using 1,250 gpm determination of the total head loss due to friction for the piping system. Reference material used to determine friction losses to be provided.
  - f) Total Head Loss from pipe friction and static lift.

### D. Layout

1. Hydrants are to be located as directed by the Township or generally within equal distances of travel from all structures in the development, if intended to serve as a new development.
2. The hydrant must be located so the connection is no more than ten (10') feet from the edge of an improved road or designated access road as permitted by the Township.
3. A maximum of forty (40') feet of horizontal distance from the intake to hydrant connection is required.

## CHAPTER THIRTEEN

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4. Wide sweep bends (i.e. 2-45 deg. bends with a short piece of pipe in between in lieu of ninety (90°) degree bends) are preferred to provide the Fire Department with the ability to insert a smaller diameter suction hose through the assembly should the hydrant connection be damaged and inoperable.
5. A minimum number of ninety (90°) degree bends should be used, preferably less than two (2), in the hydrant assembly.
6. The static water level should remain below the frost line. Where not possible insulation suitable to the Township must be placed around the piping.
7. All horizontal suction piping should be placed to slope slightly upwards toward the hydrant connection.
8. Where a hydrant is installed in an existing lake and the potential for damage due to boating exists, the end of the hydrant is to be marked with a buoy or visible stake.
9. The hydrant connection should be twenty to twenty-four (20"-24") inches above the grade where the vehicles would park to connect to the system. The hydrant connection should be slightly lower than the connection on the vehicle.
10. The hydrant connection should be anchored below the frost line or to the cistern where appropriate.
11. The bottom of the suction pipe in a cistern to the hydrant connection should not exceed fourteen (14') feet.

### E. Construction

1. Construction in existing watercourses is subject to Michigan Department of Environmental Quality (MDEQ) permits and all other permits as required.
2. The dry hydrant assembly must be placed on undisturbed ground or on engineered fill as specified by a certified geo-technical consultant. Special provisions for unstable soils such as pile support, mud mats, geo-textile fabrics etc. must be included in the design.
3. Proper soil erosion control measures around the upland construction area and in the water are to be installed and maintained throughout the construction.
4. The trench is to be excavated full length and the trench bottom is to be checked for unstable soils.
5. The hydrant assembly is to be constructed outside of the trench. Joints should be allowed to dry fully prior to placing the entire assembly into the trench.
6. The riser must be braced vertically and the pipe backfilled starting at the riser. Backfill to be clean native material or as specified by the Project Engineer.
7. Where the assembly extends more than four (4') feet into the water, braces to the water source bottom must be installed.

## CHAPTER THIRTEEN

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8. Hydrant fittings, connections and supports should be installed at the proper grade once finished grade is established at the connection.
9. Entire system must be tested by the Fire Department prior to final approval and acceptance.

### SECTION 13 - 4 CISTERNS

#### A. General Design Considerations

1. Minimum capacity of any cistern shall be 30,000 gallons or as determined by Township.
2. A means to maintain the required water level in the tank must be included in the design. This may include an on-site water source suitable to the Township or the required connections for pumping into or filling up the cistern from a water transporter.
3. Locking MIOSHA standard access openings for maintenance and inspection must be included in the design of any system. Multi-chamber or systems with more than one tank must have access ports in all chambers or tanks. Steel reinforced polypropylene steps are to be built into the tank to provide access.
4. Each design must be site specific to existing soil conditions, groundwater levels, seasonal frost cycles, etc.
5. A licensed professional structural engineer shall certify the design of any prefabricated or built in place cistern.
6. Long term maintenance factors such as silt potential, evaporation, freezing, etc. or other factors as determined by the Township are to be addressed.
7. The cistern system shall be designed for ease of maintenance and longevity. Innovative approaches to this are encouraged provided that the minimum requirements herein are met. The cistern design shall incorporate the proposed access means for maintenance.
8. Formed in place concrete or prefabricated concrete, steel, fiberglass or plastic cisterns are allowed. Detailed shop drawings including material testing results and specifications must be submitted to the Township for review.

#### B. Design

1. The cistern must be designed and rated for highway loading.
2. The design of the cistern must take into account how it is to be refilled.
3. The collection and transportation of surface waters into a constructed cistern is not permitted for fire suppression.
4. All cisterns with a water level above the frost line are to be insulated with vermin-proof insulation. A means to break ice formations such as a pike pole or floating barrel are to be included in the design considerations for those systems above the frost line.

## CHAPTER THIRTEEN

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5. The cistern must not float when empty and must be adequately anchored when placed in areas of high ground water.
6. Should multiple tanks be used to achieve the required volume, two (2) twelve (12") inch diameter concrete pipes are to be installed between tanks and be located along the bottom.
7. It must be demonstrated that the tank will be waterproof. Hydrostatic testing results of prefabricated systems should be provided to the Township. The joints, floor and walls of built in place tanks must be waterproofed by an approved method suitable to the Township.
8. Prior to acceptance by the Township, successful testing by the Fire Department is required. The applicant is to provide a full tank for testing prior to final approval.

### C. Piping

1. All suction and fill piping should be ASTM Schedule 40 galvanized steel or PVC.
2. PVC piping for water elevation test tubes or ventilation pipes shall be Schedule 40 or heavier PVC. PVC joints should be solvent welded with PVC glue. All-purpose cement should not be used.
3. The ventilation pipe is to be minimum four (4") inch diameter pipe mortared into the top of the tank. The pipe is to have a 180-degree bend installed with an insect screen. The inlet to the ventilation pipe is to be thirty-six (36") inches from finished grade.
4. A 2.5-inch diameter PVC pipe with cap is to be mortared into the top of the tank for checking the water level without having to open the tank. The cap should be twenty-four (24") inches from the finished grade.
5. The suction line is to be Schedule 40 galvanized steel or PVC mortared into the concrete and fastened to the top of the tank with a minimum eight (8") inch riser clamp welded to the pipe.
6. The suction line is to be installed to six (6") inches from the bottom of the tank. A 4'x4'x1/4" galvanized steel anti-vortex plate is to be welded to the suction pipe and anchored to the bottom of the tank. The hydrant connection should be 20"-24" inches above finished grade
7. The filler pipe is to be mortared into the top of the tank and a 2'x2'x1/4" galvanized steel plate welded to the pipe and anchored to the top of the tank. A single four (4") diameter Storz fitting with cap is to be installed for the filler pipe. The filler pipe shall be located thirty-six (36") inches above the finished backfill grades.

### D. Construction

1. The entire cistern should be completed, and inspected before it is backfilled
2. Clean backfill material should meet Class III granular material specifications and be compacted to ninety-five (95%) percent density.
3. The bedding should be specified based on soil borings taken at the cistern location. A minimum of twelve (12") inch thick Class II sand or 21AA aggregate on undisturbed ground

## CHAPTER THIRTEEN

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is required. Cisterns placed in fill areas are generally not permitted without specialized fill and construction provisions certified by a certified geo-technical specialist.

4. The top of the tank should be lower than the frost line or be properly insulated.

### SECTION 13 - 5 PONDS

#### A. Design

1. Ponds designed or retrofitted to provide the required storage volume must provide a minimum volume of 30,000 gallons, in addition to storm water design volumes, or as required by the Township year round. Volume available in the pond shall be measured from the invert of the intake to the low water elevation as determined by a professional engineer and with consideration of freezing, seasonal drought conditions and recorded historical data.
2. The storage elevation must be two (2') feet above the top of the intake pipe to avoid cavitation and loss of pump capacity. Ice layers are not to be included in the specified two (2') feet.
3. The intake pipe must be at minimum eighteen (18") inches above the pond bottom or as determined by the Township Engineer with consideration to siltation potential, vegetative growth, potential for clogging etc.
4. Elevations of the pond bottom, intake, design permanent water surface, low water surface in drought conditions, ice cap depth, etc. must be clearly labeled on the plans.
5. The pond must be accessible near the hydrant for inspection of the intake, maintenance of intake, and use, should the hydrant be damaged, to provide a secondary pumping source.

### SECTION 13 - 6 ACCESS

- A. Access to dry hydrants, cisterns and ponds must be all weather bituminous or gravel roads.
- B. Access roads are to have a maximum sustained grade of eight (8%) percent.
- C. Roads are to be a minimum of twelve (12') feet wide.
- D. Maneuverability and provisions for the turn around capabilities of fire vehicles must be included in the road layout.
- E. Access must be free of obstructions including landscaping.
- F. Drainage improvements must be included in the design to provide positive drainage away from the road and the fire facility. Culverts should be installed in ditch lines to convey storm water under the road.
- G. When located near the road, guardrails, concrete bollards, timber posts, etc. must be installed to protect the cistern and the exposed hydrant connection pipes.

## CHAPTER THIRTEEN

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### SECTION 13 - 7 EASEMENTS

- A. The entire fire facility must be situated within a dedicated easement granted to the Township. This easement is to be located in an outlot or park area in residential developments. The easement is not to be located within a residential lot. In commercial developments the easement is to be accessible from a public road or a dedicated access easement.
- B. The easement must be sized and the site designed to allow construction equipment to maneuver around the perimeter of the facility for future maintenance.
- C. The Easement area is to be free of both buried and overhead utility lines.
- D. The easement area should be designated with warning signs and delineated from other areas of the development with landscaping or decorative fencing.

### SECTION 13 - 8 MAINTENANCE

- A. Until final acceptance by the Township, the Applicant must maintain the fire facility.
- B. After final acceptance, the fire facility shall be maintained by the Township. The Township may request annual maintenance costs be deposited by the Applicant.
- C. Access roads should be plowed in the winter. Snow plowing should not block access to the cistern or dry hydrant.
- D. For pond water sources, vegetative control measures and scheduling must be taken into consideration and included in the development master deed, bylaws, or maintenance agreement.

### SECTION 13 - 9 PLAN REQUIREMENTS

- 1. Location of fire facilities.
- 2. All pipe types, size, joints used, etc.
- 3. Specify type of red paint to be used.
- 4. Include notes on labeling all pipes in field.
- 5. Suction screen brand and manufacture with hole size and number.
- 6. Specify hydrant connection type (N.S.T. 6" dia. female thread).
- 7. All pipe sizing calculations with back up reference material.
- 8. Dimension, of facilities to road edge water source, nearest structure, and furthest structure.
- 9. Assembly configuration including all bends and connections.
- 10. Show static water elevation and dimension the lift height.
- 11. Extent and type of insulation and waterproofing.
- 12. Buoy or marker types and locations for pump installation.

## CHAPTER THIRTEEN

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13. Dimension to all connection from proposed finished grades.
14. Proper soil erosion control measures.
15. Specify backfill and compaction requirements.
16. Intake and connection brace or supports.
17. Specify the means to maintain cistern water level.
18. Show access openings and specify cover type, brand and manufacturer.
19. Include detailed cistern shop drawings, material certifications; design loading, buoyancy potential.
20. Include plan notes, stating testing responsibilities.
21. Show connections between multiple tanks.
22. Details for pipe connections to the cistern.
23. Construction sequence of operation.
24. Tank elevations.
25. Required volume calculation.
26. Elevations for permanent pond elevations, documented low water, intake, pond bottom, ice cap, etc.
27. Location of access road.
28. Access road cross-section.
29. Provisions for fire truck maneuverability.
30. Necessary drainage improvements.
31. Locations of bollards, posts guardrail, protective landscaping, fences, etc.
32. Limits and dimensions of easement area.

## CHAPTER FOURTEEN

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### DESIGN AND CONSTRUCTION STANDARDS FOR COMMUNITY ON-SITE SEWAGE SYSTEMS

#### SECTION 14-1 INTENT

This Standard establishes the minimum requirements for the design and construction of community on-site sewage systems for the treatment and disposal of wastewater located within the Township.

#### SECTION 14-2 BACKGROUND

The Township relies primarily on individual or community onsite sewage disposal systems. It is considered unlikely that a public sewer system to serve the Township will be constructed in the future. All sanitary sewer collection and treatment facilities shall remain private and are to be maintained in accordance with Township Ordinance No. 63, "Community Sewer System Ordinance."

#### SECTION 14-3 GENERAL

1. This Chapter applies to the treatment and disposal of wastewater in a community wastewater system.
2. Community sewage systems, including the collection, treatment, and disposal facilities are subject to the Township's "Community Sewer System Ordinance" (Ordinance No. 63).
3. It is intended to be a supplement to non-Township regulatory programs to provide increased protection of human health, the environment, and provide cost effective operations and maintenance.
4. A community wastewater treatment and disposal system refers to any facility which accepts sewage for treatment and disposal from more than one lot, unit, building, etc. This includes systems that serve subdivisions and condominiums (community sewer systems), mobile home treatment plants, public and private wastewater treatment plants, etc.
5. Reference is to be made to Chapter 17 for the design of a gravity collection system serving the community wastewater treatment and disposal system. Other types of collection systems including pump stations, pressure sewers, etc, will be considered on a case-by-case basis.
6. The Township may require more stringent treatment and disposal technology to protect environmentally sensitive areas.

## CHAPTER FOURTEEN

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### SECTION 14-4 AGENCY APPROVALS AND REFERENCES

1. Collection systems shall be reviewed and approved by Michigan Department of Environmental Quality (MDEQ) and the Township.
2. Treatment system design and operational plans shall be reviewed and approved by the MDEQ, the Oakland County Health Department (OCHD) and the Township.
3. Overall design, operation and escrow agreements shall be reviewed and approved by the Township.
4. Inspections shall be performed as required by MDEQ, OCHD, and the Township.
5. The Township shall be copied on all submittals to the MDEQ and OCHD. The Owner shall send copies of all MDEQ or OCHD correspondence to the Township.

### SECTION 14 –5 DESIGN CONSIDERATIONS

1. Wastewater flows shall conform to requirements of MDEQ and OCHD with additional flow to account for infiltration and inflow into the sewer from the specific type of collection system.
2. The system siting standards, including setback distances and distances to groundwater or restrictive layers, for community treatment and disposal systems of the MDEQ and OCHD, shall be met as a minimum. In areas determined to be environmentally sensitive by the Township, more restrictive provisions will be required.
3. Treatment Systems.
  - a. The treatment system requirements of the MDEQ and OCHD for community systems shall be adhered to.
  - b. Primary treatment, i.e. septic tanks for settling, are encouraged on the individual lots.
  - c. Treatment may be provided by septic tanks, effluent filters, intermittent media filters, and recirculating media filters. Filter media are typically properly graded sand or gravel. Other materials or treatment components may be approved on a case-by-case basis.
  - d. Discharge from a primary treatment facility and discharge to a sand filter shall be through a filtration unit.
  - e. Tanks shall be bedded on a minimum of 6-inches of compacted sand or crushed stone.
  - f. Tank penetrations must be provided with watertight joints. This includes inlet and outlet lines, riser pipes or hatches, and electrical penetrations.

## CHAPTER FOURTEEN

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### 4. Disposal Field Requirements.

- a. The requirements of the MDEQ and the OCHD for soil texture, disposal system sizing, and allowable system type shall be adopted as the minimum standard.
- b. The use of soil observation pits instead of borings shall be strongly encouraged to allow observations of soil structure, soil texture, soil color and root development by an experienced soil evaluator. These observations can be used to determine the type of community wastewater treatment and disposal system that is appropriate for the site.
- c. Community disposal systems shall be pressure dosed. Alternative disposal systems will be considered on a case-by-case basis.

### 5. Electrical and Control Requirements.

- a. Electrical provisions must meet the requirements of the State electrical code.
- b. Controls must be mounted on a sturdy panel that is accessible for maintenance.
- c. Pumps must either be completely submerged during normal operating conditions, or must be explosion proof.
- d. Explosion proof electrical components are required.
- e. Redundant off floats shall be required for all pumps.
- f. Audio and Visual Alarms with battery backup shall be provided. These alarm functions shall be activated by power outage, pump or equipment failure, and designated high water. Common alarms may be used. Off-site notification of operators via telephone system or other means shall be required for remote treatment and disposal systems.
- g. An audio and visual alarm shall be provided for individual pumping units to the residence. Provision of alarms to the system operator should be considered.

### 6. Emergency Power Provisions

The community treatment system shall be designed such that there is not a substantial hazard of pollution from overflow or surcharge onto public or private property with sewage from the community collection or treatment system. The impact of common failures of power to wastewater generators shall be considered. If the wastewater producers and the community treatment system are on separate electrical lines, emergency requirements must be addressed. Options for reliable operation include:

- a. Provision of storage in an offline containment structure for the expected length of power outage.
- b. Alternate electrical power supply from either the power company or with an emergency generator.
- c. Pipe connections for utilizing a portable pump to bypass existing pumping systems. If portable pumps or generators are used, a telemetry device shall be provided for 24-hour notification and deployment of the equipment.

## CHAPTER FOURTEEN

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### 7. General Requirements

- a. Community treatment systems shall be provided with all weather access roads.
- b. Off street access shall be provided for maintenance vehicles.
- c. Access for septage tank pump trucks shall be provided.
- d. Access for sampling the treatment system shall be provided.
- e. The community treatment system shall be delineated with landscaping, decorative fencing, and where need to protect critical system components, security fencing shall be provided around the community treatment system.

#### SECTION 14-6 PLAN REQUIREMENTS

1. Reference is to be made to Chapter Three, General Requirements and Procedures, for general plan submittal requirements.
2. Additional requirements specific to this Chapter:
  - a. Engineering calculations and background information shall be provided as follows: consistent capacity of the collection, treatment and disposal systems; tank buoyancy; hydraulic calculations for pumps, force mains, filtration units, wastewater distribution pipe networks; and calculations demonstrating the capacity of the proposed system to meet any necessary advanced treatment requirements.
  - b. Electrical and control requirements shall be clearly described on the plans or in specifications.
  - c. Equipment, materials or processes that are specifically described in either these regulations or those addressed in MDEQ or OCHD regulations may be considered on a case by case basis. Adequate documentation including at a minimum test results from similar applications, design calculations, and references for successful previous installations shall be provided to support this consideration.

#### SECTION 14-7 CONSTRUCTION PROVISIONS

1. Reference is to be made to Chapter Four, General Construction Provisions and Requirements, for general construction provisions.
2. Areas to be used as disposal fields (including future reserve areas) shall be protected from construction activities and vehicular access during construction and operation in a manner appropriate for disposal system. Shallow disposal systems and those that utilize existing soils shall receive the highest degree of protection.

## CHAPTER FOURTEEN

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### SECTION 14-8 INSPECTIONS, TESTING AND APPROVALS

1. The inspections and testing requirements of the MDEQ and the OCHD shall be adopted as a minimum. Additional project specific inspection and testing requirements may be imposed during Township review.
2. A hydrostatic test of system tanks will be required prior to site delivery and after installation. The test shall include sealing the empty tank, inlets, and outlets, filling tanks with water to a height of one foot above the normal top construction joint for 24-hours, topping the tank off after the completion of the initial 24-hour period, and then measuring the loss of water over a 1-hour period. If no loss of water occurs, the tank shall be considered acceptable. Vacuum testing shall be considered on a case-by-case basis and shall be conducted in accordance with current ASTM standards.
3. Acceptance tests for gravity collection systems and force mains shall be as described in Chapter 17.
4. The operation of pumping systems and controls shall be demonstrated to show that they meet the specified operational requirements prior to system acceptance.
5. The Township may choose to impose effluent testing requirements upon systems. These requirements will be detailed in the approval of the operation and maintenance plan described below.

### SECTION 14-9 OPERATION AND MAINTENANCE

1. An operation and maintenance plan must be submitted for review by the Township prior to system approval.
2. An operating and maintenance manual suitable for resident use shall be provided to each new resident that uses the community treatment and disposal system. This manual shall address at a minimum a description of the system, operational procedures that could affect the collection, treatment and disposal system, materials and practices that should not be used, troubleshooting procedures, and emergency response requirements.
3. Easements shall be provided for access of maintenance personnel to on-lot components of the collection and treatment systems and the community septic systems.
4. The community association or owner of the community sewer system must contract with a responsible maintenance entity for the operation of the community collection, treatment and disposal system.
5. The frequency of operation inspections of the community system shall be set in the operation and maintenance plan.

## CHAPTER FOURTEEN

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6. Annual inspections of on-lot components of the collection and treatment systems shall be performed by the contracted maintenance entity.
7. As outlined in “The Township’s Community Sewer System Ordinance No. 63,” the Township has the authority to intercede to effect repairs or maintenance if the system owner or operator fails to perform and the Township has the right to assess the association or owner for costs incurred.

## CHAPTER FIFTEEN

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### DESIGN AND CONSTRUCTION STANDARDS FOR PUMP HOUSES FOR COMMUNITY POTABLE WATER SYSTEMS

#### SECTION 15-1 INTENT

This Chapter is intended to provide a sound but reasonable basis for the design and preparation of plans and the construction of community well pump houses affecting the public. These standard specifications and plans should facilitate improved operation and maintenance by providing standard parts and similar mechanical and electrical plans. The Standards may not apply to all conditions, and alternate solutions shall be permitted as approved by the Township.

#### SECTION 15-2 BACKGROUND

These standards shall be used in conjunction with the requirements of local and State Health Departments for publicly controlled water systems. These standards are only intended to supplement County and State requirements. (The more strict interpretation of such requirements between these standards and those of OCHD and MDEQ shall be used).

#### SECTION 15-3 GENERAL

1. All construction work, materials and equipment shall comply with all applicable federal, state, and local laws, ordinances, and regulations or utility company rules.
2. Equipment and material brand names, types and sizes specified are an indication of design criteria. Other makes, styles, types and sizes may only be used at the direction of the Project Engineer and with prior written approval of the Township if they are considered equal to the item specified. All deviations must be approved by the Township before any construction will be accepted.
3. Please check with Township for the current review fees required.
4. A hydrogeologic study shall be prepared of the site including sinking a test well. All geological formations encountered while drilling the test well shall be recorded in a well log including the depths at which they are found. A pump shall be placed in the test well and the well shall be pumped for a period of not less than twenty-four (24) hours in order to determine amount of water that can be withdrawn from the well for an indefinite period.

As a minimum the following data shall be recorded during the pumping test:

- a. Date, time and location of test.
- b. Static level, which is the distance from the ground surface to the water in the well measured after at least twelve (12) hours without pumping.

## CHAPTER FIFTEEN

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- c. Pumping rate at which the water is withdrawn from the well.
- d. Pumping levels, which are the distances from the ground surface to the water in the well measured every five (5) minutes for the first hour of pumping every one-half (½) hour thereafter for the duration of the tests, which shall be at least twenty-four (24) hours.
- e. Recovery levels which are the distances from the ground surface to the water in the well measured every five (5) minutes for the first hour after the pumping stops and every one-half (1/2) hour thereafter until no change in level is noted.
- f. Towards the end of the pumping test, a water sample shall be taken by a qualified technician or by a Township representative. The sample shall be delivered to a testing laboratory acceptable to the Township where it shall be tested for total coliform, metals, other inorganic chemicals, VOC, total trihalomethanes, arsenic, and any other compounds required to obtain approval from the State of Michigan Department of Environmental Quality.
6. A sheet of the plan set shall contain a service district map drawn at a scale of one (1") inch = two hundred (200') feet showing each lot or parcel to be serviced by this well. This sheet shall also show the calculation of the design peak water usage requirement for the entire service area. These calculations shall clearly identify the demand associated with each parcel in the district. The fire flow requirements or provisions of the well system shall be stated and approved by the Township.
7. One or more sheets of the plan set shall be dedicated to and include the pump discharge curves; all well logs and sieve analyses; the diameter, size of opening, and length of the screens; the proposed settings for the screens and pumps; motor name plate data; proposed hydropneumatic tank sizing calculations and drawings; and reference to the hydrogeologic study.
8. Prior to construction, a pre-construction meeting shall be scheduled as required by these standards. Attendees shall include the maintenance company representatives, the general contractor, the construction contractor, the well driller, and others as appropriate. Prior to final acceptance, a meeting of the same people shall be scheduled by the Applicant to address the punch list items.
9. All wells shall be properly disinfected by chlorination before being placed into service. After disinfection a water sample shall be submitted to a testing laboratory, satisfactory to the Township, for microbiological analysis. Results obtained shall be acceptable to the Michigan Department of Environmental Quality.
10. At the discretion of the Township or MDEQ, radiological testing may be required.
11. The exterior of all pump housing shall be architecturally compatible to the development and approved by the Township.

### SECTION 15-4 CONSTRUCTION

1. All applicable Township building permits shall be obtained by the Applicant, and all inspections performed and approved at the Applicant's expense.

## CHAPTER FIFTEEN

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2. State of Michigan Building and Construction Codes are to be adhered to.
3. All pump house walls shall be minimum eight (8") inch masonry block. Only eight (8") inch glass block window openings will be allowed. All exposed interior wall surfaces shall receive two coats of masonry paint.
4. Roofs shall be of frame construction and shall be hip or gable style with minimum 4 to 12 pitch.
5. Either gable attic ventilators with insect screens at each gable or screened ridge vents shall be provided. Soffit vents, gutters and down spouts shall also be provided.
6. Polyurethane sealants shall be used to seal all joints between exterior metal frames, siding, etc., and adjacent surfaces.
7. Insulation is required on the foundation walls and in the ceiling. Insulation shall provide the following minimum value:

Foundation walls	R-10
Building wall	R-11
Ceiling	R-24

Insulation thickness and type of material shall be detailed on construction plans.

8. The finished floor shall be 3500 psi. concrete, six (6") inches thick reinforced with not less than 6"x6", W7 x W7 welded wire fabric with a four (4") inch sand base compacted to ninety-five (95%) percent density and thoroughly moistened (plastic vapor barrier shall be used) before pouring. The floor shall pitch two (2") inch per ten (10') foot to the building wall opposite the doors, shall be finished smooth. A floor drain trough for the full length of pump house floor four (4") inch wide and four (4") inch deep shall be installed six (6") inch from the building wall opposite the doors. This trough shall drain to a four (4") inch diameter C.I. pipe at the center of the trough length with a screened free fall gravity outlet to the outside. **Finish floor elevation shall be a minimum of twelve (12") inch above finish grade.**
9. Where the water system supply main exits through the pump house floor, there shall be a 24"x24" floor opening filled with pea gravel.
10. Removable roof hatches with Township approved lockable covers shall be provided through the pump station roof and ceiling. These hatches shall be designed to facilitate all well, pump and motor maintenance and sized accordingly. Hatches will be "Bilco" Security Services, or equal, with 3/16" aluminum cover and one (1") glass fiber insulation hinged perpendicular to the roof ridge. Latches shall be operable from the inside of the well house only.
11. Internal pump house ventilation shall be provided by closable, ceiling registers connected by minimum six (6") inch diameter sheet metal duct work to low profile, roof vents. Two minimum,

## CHAPTER FIFTEEN

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one per 4000 cubic feet of interior building size. In addition an approved through the wall propeller exhaust fan with a aluminum gravity damper in combination with an approved motorized aluminum air intake damper with blade edge and joints seals shall be provided in the vicinity of any planned chemical area. Approved storm proof aluminum louvers shall be provided on the building exterior at the fan and damper locations. The exhaust fan shall be sized to change the air within the well house six (6) times per hour.

12. Two “thru-wall” vents (minimum size 8”x16”) shall be installed six (6”) inches above the finish floor in the wall behind the hydro-pneumatic tank. “Thru-wall” bricks vents shall have cast iron grilles or 5/8” diameter steel rod guards. Insect screen, water stop and interior register with damper control. Two minimum, one vent per each 4000 cu. ft. of interior building space.
13. A one-half (1/2”) inch exterior grade, plywood or Oriented Strand Board (OSB) ceiling shall be provided at the top of the block wall and secured to the underside of ceiling framing with screws and adhesive. The ceiling section under the hatches may be readily removable on hinges with the insulation sandwiches between the ceiling and another layer of 3/8” exterior grade plywood. The generator room ceiling shall have a lay of one (1) hour fire rated damp proof drywall applied over the plywood ceiling.
14. Doors shall be 1-3/4” insulated with no cardboard fillers, minimum of 36”x80” size, of G60 galvanized metal flush type swing doors without louvers or windows, as manufactured by Fenestra, Inc., complete with frame, hardware, and threshold. Door frames shall be manufactured from G-60 galvanized metal with mortar-filled jambs. Doors shall be completely weather-stripped and weather-sealed with adjustable metal door sills. All doors shall open to the outside. Locks shall be provided by the Applicant and approved by the Township. Doors must have moisture drain holes in bottom. Hydraulic door closures with hold open arms shall be installed on all doors.
15. A one-half (1/2”) inch minimum expansion joint shall be installed completed around all concrete tank cradles, pump bases, and well house perimeter.
16. Splash pads, 4’x10’x4” with curbs three (3) sides six (6”) inches high (to direct flow) of 3500 psi. concrete, construction shall be installed outside of the pump house centered and extending ten (10’) feet from blow off pipe discharge end. Ground shall be swaled in such a fashion as to direct all flow away from building area with first six (6’) feet being formed from natural stone rip-rap. Air relief valve and pressure relief valve exterior discharges shall be directed way from pedestrian areas, and pressure relief valve discharge shall also be directed to a splash pad or paved area. Air relief valve shall discharge to the south or east of the building.
17. Adequate consideration shall be given to the quantity of water that may be discharged during maintenance, testing, or blow off. Suitable drainage shall be provided away from building.

## CHAPTER FIFTEEN

### SECTION 15-5 ELECTRICAL

1. All electrical work shall meet local, state, and federal requirements and shall conform to the State Construction Code current revisions.
2. All electrical equipment shall be as manufactured by Allen Bradley, Square D, ITE, BW Controls, Diversified Electronics or approved equal that has a local stocking agency.
3. When a back-up generator is not required as part of the original well house construction, a three-way (utility, off, generator) manual transfer switch shall be wall mounted inside the pump house. Also an Appleton receptacle (AJA 200 34250RS) for portable generator hook-up shall be installed whenever a generator is not provided. The generator receptacle shall be installed on an interior wall adjacent to the generator parking area. As 6"x6" through wall double doored access hatch shall be provided adjacent to the receptacle to permit passage of the generator cord. The access hatch doors shall be lockable from the interior of the well house only.
4. All distribution and control equipment shall be mounted in one location, as practical, to 4'x 8'x 3/4" sheet(s) of exterior grade, pressure treated plywood securely lagged to the wall three feet above the floor. All electrical equipment must be minimum of twenty-four (24") inches above finished floor level. A minimum of three (3') foot clear work space shall be maintained in front of all electrical equipment mounted to the plywood. All heavy electrical equipment such as transformers shall be lag bolted through the plywood into the block wall.
5. Each motor shall be controlled by a NEMA rated magnetic motor starter and fusible disconnect of proper size. The starter shall be provided with a built-in switch to provide "Manual", "Off" and "Automatic" control and shall be as manufactured by Allen Bradley with non-adjustable overload relays. All pump motors 40 h.p. and above shall have reduced voltage starting of the part winding autotransformer or delta-wye types only. This is to reduce generator size and cost. Allen-Bradley Smart motor controllers or a unit of equal design as approved by the Township are also acceptable where a slow start and stop are required.

Disconnect switches shall be as manufactured by ITE, or equal, and shall have auxiliary contacts to interrupt the motor control circuit. All motor fuses shall be Buss or equal dual element fuses.

6. Automatic alternating control of starting of pumps shall be provided by means of B/W Controls or approved equal. The electrodes for these controls shall be installed on the front of the tank with gate valves, and unions so electrodes can be removed for cleaning with the tank pressurized.
7. In general, all conductors or cable shall be 600 volt, ninety-eight (98%) percent conductivity copper with code types "THHN, or THWN" for control and code types "XHHW, THHN or, THWN" for power and type MTW for control panel wiring, insulated per National Board of Underwriters. All wire shall be run in rigid steel, hot dipped galvanized conduit below grade or in concrete floors, walls, block, etc. with necessary expansion joints provided. Electrical metallic tubing SCH 40 PVC or thin wall conduit may be used above grade except for building exterior where only rigid steel galvanized conduit and fittings may be used. Flexible liquid tight metallic

## CHAPTER FIFTEEN

conduit may be used where rigid conduit is impractical and shall be Sealtite or others approved by Underwriter's Laboratories. All motors shall be hooked up with a twenty-four (24") inches section of flexible conduit directly adjacent to the motor. Conduit for pump motors shall be case into concrete floor and brought up to motors. The generator connector shall be wired with type "G" cable to allow freedom of movement of the connector pins.

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8. All electrical panels, starters, and switches shall be identified by permanent one half (1/2") inch letters as to the equipment they serve and applicable voltage. All wiring shall be numbered, and a corresponding as-built electrical ladder diagram for all electrical shall be provided. The ladder diagram shall be complete showing all switches, relays, etc. per pump house installation. Attached to the electrical diagram shall be an equipment listing giving brand names and model or part numbers. Manufacturer's diagrams are not acceptable. Ladder diagram and list shall be provided on one 24" x 36" mylar sheet suitable for reproduction. The Contractor shall provide a copy of **all** operations manuals for **all** equipment bound in three ring binders to the Owner, the maintenance entity and the Township.
9. Two natural gas unit heaters with blowers shall be ceiling, swivel mounted in each pump house with BTUH rating adequate to maintain fifty-five (55°) degree F. minimum inside temperature at outside temperature of minus twenty (-20°) degrees F. Heating shall be controlled by a built-in low range thermostat (minimum setting of fifty (50°) degree F. must be possible) calibrated in <sup>a</sup> degrees. Unit heaters shall be all gas with electric spark ignitions. Generator room shall have <sup>k</sup> electric unit heaters with fans and built-in low range thermostats.
10. Lighting:
  - a. Inside: All building indoor lighting shall be with fluorescent open strip fixtures equipped with electronic ballasts and 2-F40 energy saving cool white bulbs in each location. Minimum six (6) in main building, two (2) in generator room. Generator room lights shall be switched at all entrance doors. Switches for the inside lighting shall be provided at all building entrances.
  - b. Outside: One (1) each 50 watt HPS fixture and lamp with photo cell at each building entry door, controlled through 3- or 4- way switch, as needed from inside of each door. Light fixtures will have vandal-resistant lens covers, Lexan or equal material. Lighting must conform to Township Zoning Ordinance Standards.
11. As a minimum, a duplex, wall-mounted 120 volt, 20 amp electrical duplex outlet shall be provided at or immediately adjacent to each pump, in the vicinity of hydropneumatic tank controls, at the control panel, and at each doorway. All utility outlets shall have ground fault protection.
12. Running time meter shall be installed in the electrical panel with readings available from the panel face for each pump. The read out should be in hours and tenths, Cramer 635K or equal.
13. A 120V AC electric clock shall be provided and mounted with the electrical equipment.

## CHAPTER FIFTEEN

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14. Each three (3) phase motor shall be protected by a phase monitor as manufactured by Diversified Electronics, Model #SLA 440-ALE.
15. A programmable time delay relay such as diversified electronics TDU-120 AKA or Omron H3CA-A shall be provided to delay pump motor start after pre-lube solenoid activation. Motors shall be protected from phase problems due to switch over from gen/normal power with time delay in transfer unit that will allow sufficient time for phase to stabilize before motors are restarted. Motors and pumps as a unit shall be mounted in a level manner.
16. A liquid level sensor such as “Flygt ENH-10” shall be installed inside the pump house to interrupt all electrical service from a water level 1’ – 0” above finished floor level. A liquid level sensor bypass shall be installed in the control panel. This will also shut down the generator unit.
17. The pump house shall be provided with a secondary lightning arrestor such as Square D SP-3650.
18. An electrical duplex outlet energized with the pump motor for each well shall be provided on the pump house wall opposite the electrical control panels for the operation of chemical injection pumps.
19. If the well house is required to be equipped with a permanent standby generator, it shall be sized and equipped to automatically operate all well pumps and all associated equipment during any electrical power failure. This will be a permanently mounted unit sized to operate all equipment and loads necessary to keep facility at 100% operation.
20. If required by the Township, the well house shall be equipped with a telemetering system approved by the Township Engineer.
21. An indicating pilot light for each incoming utility power leg shall be located on the control panel visible from the auxiliary power receptacle. The indicating lights shall be of the transformer type with low voltage lamps. Allen Bradley Model 800T or equal.
22. An automatic transfer switch/exerciser shall be provided for generator and shall be set up to exercise generator with or without load. Transfer switches shall be equipped with a means of preventing out of phase transfer of loads such as Programmed Transition or an in-phase relay.
23. Pilot devices shall be full size NEMA 13 with engraved nameplates. Indicator lights shall be pushed to test transformer type with low voltage lamps. Selector switches shall have standard operators and replaceable contact blocks. Allen Bradley 800T or equal.
24. Pressure switches shall be of the sealed mercury type as manufactured by Honeywell or approved equal and shall be type L404A for add air and low pressure alarm and type L404B for void air control.
25. Solenoid valves shall be NEMA 4 pilot operated with forged brass bodies as manufactured by ASCO or equal.

## CHAPTER FIFTEEN

### SECTION 15-6 MECHANICAL

#### 1. Pumps

- a. Pumps shall be capable of delivering water at 90 psi. Pumps shall be “Deming” deep well turbines or approved equal, 1750 RPM, with water-lubricated bearings open or semi open impellers. Clearance between impellers and bowls shall be adjusted by a nut on top of motor. Closed impeller pumps are not acceptable. The pumps shall be equipped with a close coupled shaft with anti-reversing ratchets. Manufacturer’s certified test curves and physical dimension sheets shall be furnished for approval. Pumps shall be subject to field testing to assure performance in accordance with specifications. Motors shall be G.E., Westinghouse, or U.S. with final horsepower requirements determined after analysis of manufacturer’s curves. No aluminum windings allowed in any motors.
- b. Stainless steel or nylon altimeter lines with direct reading altitude gauges, and air valves shall be installed at the elevation of the discharge pipe centerline for each well. The altimeter gauges on each pump shall be supplied with air by means of a nylon 3/8” O.D. 200 psi line, valved at hydro-preumatic tank and valved at altimeter gauge. This line shall be capable of providing sufficient air to drive altimeter line for accurate readings. A valved connection shall also be provided at each pump to permit the use of a hand operated pump. One hand-operated air pump shall be provided. This line is required on deep well vertical turbines as well as all submersibles. No tailpieces allowed on pumps. Pump bowl shall be set five (5’) feet above top of screen.
- c. A capped three (3”) inch observation pipe is required, mounted on a forty-five (45°) degree upward angle on each well casing. This cap shall contain a minimum one (1”) inch vent mounted with the screen pointed down; a brass foot valve minus the check flapper is suitable for this application. This shall protrude from the base a sufficient length to permit easy removal of the cap. This may not be under pipes or in the aisle-way.
- d. Sample cocks shall be installed at each pump and in discharge piping from storage tank. All sample cocks shall be one-half (1/2”) inch corporation stop with one-half (1/2”) inch ninety (90°) degree copper elbow attached. Chemical injection taps and necessary sampling points shall be provided for each well. The water main sampling tap shall be located ten (10’) feet beyond the pump house outside wall with a direct one (1”) inch corporation tap (no saddles allowed) to the water main. A one (1”) inch, type K copper line shall be run a minimum of five (5’) feet deep under the pump house foundation to a typical sample cock located three (3’) feet above the pump house floor.
- e. A permanently installed eye wash and separate sample sink shall be installed at each well house. Drains from these fixtures may discharge to the building exterior.
- f. Each pump shall have four stainless steel one-half (1/2”) inch diameter minimum (set six (6”) inch into pedestal) anchor bolts installed on concrete pump foundation. The well casing shall extend one inch above the concrete pump foundation. Each pump shall be grouted at pump base after installation.
- g. Submersible well pumps will be evaluated by the Township Engineer on a case by case basis.

## CHAPTER FIFTEEN

### 2. Pressure Tank

- a. The pressure tank shall have minimum 1/4" steel plate sides and 5/16" plate ends. All tanks shall have a minimum acceptable certified 150 psi test by manufacturer and shall be tagged with ASME code. The tank shall be lined with an epoxy lining, NSF approved for use in potable water supplies.
- b. A minimum of two 12"x16" manholes (one on side near end and one on side near opposite end) and sufficient taps for sight glasses, controls, relief valves, compressor, etc. shall be located in the front end of tank. **One (1) two (2") inch diameter capped opening shall be provided at the top of the tank.**
- c. A six (6") inch bottom drain and gate valve shall be located near the rear end of the tank in the bottom and piped to outside the pump house. No standpipes inside tank will be allowed. Tanks over 10,000 gallons shall have eight (8") inch drains.
- d. All openings in the tank including those required for sight glasses and controls, except the manhole, shall have a gate valve immediately adjacent to the tank. All pressure gauges shall have snubber valves in front of them. All pressure gauges shall be liquid filled with stainless steel case and brass movements. All valves three (3") and larger shall be flanged.
- e. A minimum four (4") Trerice pressure gauge, 0-150 psi range with gauge lock for pressurized gauge removal shall be installed in the top of the front face of the tank.
- f. A minimum of four (4) steel, properly sized saddles shall be provided on each tank. Saddles shall be set on reinforced concrete stub walls. Steel saddles shall be set on non-shrink grout on top of stub walls.
- g. An adequate air pressure relief valve shall be provided at the pressure tank. This shall be vented to the outside at ceiling height and a suitable muffler installed to reduce the noise level below 75 db (A). This relief valve shall be gate valved for removal from a pressurized tank. A typical setting shall be 10 psi above the high operating pressure, generally 80 psi. Void air pressure switch shall control a solenoid valve, which will open at high air level to void all excess air.
- h. An air compressor of adequate size shall be securely wall mounted above the floor, equipped with self unloader, as a Quincy compressor, with 3/4 h.p., 3-phase, 480 V.A.C., motor with minimum of 3 C.F.M. at 100 psi required ratings. Located 3-4 feet above floor.
- i. Generally, the operating pressure range shall be 60 psi to 80 psi. However, considerable ground elevation variation throughout the system will require the pressure range to be adjusted accordingly.
- j. Tank size shall be such that a minimum three (3) minute running cycle for the production well is provided. Calculations showing running cycle for the largest production well and corresponding tank water levels shall be provided for tank size to be approved. Tank sizing from the "Recommended Standards for Water Works", Great Lakes-Upper Mississippi River Board of State Sanitary Engineers is also acceptable. Controls for tank shall be wall mounted and not on tank face.

## CHAPTER FIFTEEN

### 3. Piping

- a. Steel “Dresser” couplings with 5/8” minimum tie rods shall be used on discharge lines from both pumps and from the tank. Where uni-flange style pipes and fittings are used, tie rods ½” minimum diameter are required across all joints. Middle rings of dresser couplings shall be sandblasted and coated with coal tar epoxy suitable for use in potable water systems. Rigid victaulic style grooved couplings are also acceptable.
- b. Propeller type meters as manufactured by Sparling or Water Specialties with readings in gallons shall be installed on the discharge piping of each pump. A straight length of pipe recommended by the manufacturer shall be installed on each side of the meter. **One (1) blank plate/cover (to factory specifications) for each water meter in building shall be provided to allow for continued operation of plant while meters are out for repair.**
- c. Check valves shall have externally weighted arms, as manufactured by Apco or Valve and Primer, with brass trim. Check valves eight (8”) inch and larger shall have a soft style stop or anti-slam device. Globe style silent check valves may also be acceptable upon review by the Township Engineer.
- d. Underground water main shall be in accordance with the Township’s ductile iron water main specifications. Pump house water main shall be all flanged joint constructed of cement lined ductile iron class 53 pipe or ASTM A-53, Schedule 40 steel pipe. Ductile iron water main shall extend a minimum of ten (10’) feet outside the pump house foundation wall. One (1) fire hydrant shall be located in isolation area beyond the well house isolation valves.
- e. Pumping equipment, piping, and all appurtenances shall be arranged with a minimum of forty-eight (48”) inch clearance from walls, except minimum thirty-six (36”) inch clearance from backside of hydro-pneumatic tank to back wall. Clearance from floor to bottom of tank shall be a minimum of twenty-four (24”) inch and clearance from ceiling to top of tank shall be a minimum of eighteen (18”) inch, for tank maintenance. All four (4”) inch through eight (8”) inch pumping shall be kept at the same plane except blow-off lines to outside.
- f. A minimum two (2”) inch air relief valve for deep wells as Crispin D 210 or Apco Series 140 shall be provided between the check valve and pump. Minimum two (2”) air relief piping shall be sloped to an easterly or a southerly building elevation, at 7’-6” minimum elevation with a brass screen fitting pointing downward one foot from the pump house exterior wall. Air release shall have a defuser mounted to reduce slam.
- g. All blow-off lines and hydro-pneumatic tank drains shall have exterior pipe caps installed. Exterior pipe caps shall have four (4), minimum ¼” diameter holes for freezing protection. The water pressure relief line shall have a flap valve at discharge and outside of building.
- h. All gate valves on four (4”) inch diameter and larger piping shall be flanged and conform to AWWA C509, resilient wedge or AWWA C500, double disk. Valves shall have hand wheels with arrows indicating direction of opening, and all valves shall open counter-clockwise and have non-rising stems. Valves shall be as manufactured by East Jordan, U.S.. Pipe, American Flow Control, Mueller or approved equal.
- i. Vertical discharge piping through the floor of the pump house shall be tied with four 5/8” minimum diameter stainless steel rods designed to resist 150psi test pressure.
- j. Adequate pipe supports shall be provided on minimum ten (10’) foot spacing, under bends, under all valves, under heaving fittings or as required by the Township Engineer. Concrete

## CHAPTER FIFTEEN

pedestals shall be provided under check valves and water meters twelve (12") inch diameter and larger.

- k. A ½" copper tubing pre-lube system with gate valves shall be installed to the pressure side of the check valve for each well. Pump re-lube shall be activated 15 seconds to 2 minutes before pump motor start through a solenoid valve in the pre-lube piping.
- l. A Trerice, pressure gauge, 0-100 psi range, minimum four (4") inch diameter dial and snubber valve shall be installed by tapping the top of the pipe adjacent to each well before the check valve.

### 4. Painting

- a. The tank and all piping and blow-off lines shall be given one prime coat of 769 Damp-Proof Red Primer, one second coat of 960 Zinc Chromate Primer, and one third coat of color coded piping enamel as manufactured by Rust-Oleum Corporation.
- b. The floor shall be provided with a non-skid finish.
- c. The color coded scheme shall be:

Pressure Tank	Green
Water Piping	Blue
Water Valves	Red
Water Blow-Off, Piping	Orange
Air Blow-Off Piping	Gray

- d. The pump house interior walls and ceiling must receive prime and finish coats of paint. Paint color shall be semi-gloss white or light gray.

### 5. Well Isolation Area

- a. The well isolation area including access road if any shall be described in the Master Deed or recorded as an easement.
- b. No construction or buildings are allowed on isolation areas per state requirements. No sanitary or storm sewers may intersect the isolation area radius.
- c. The entire well isolation area shall be properly graded, minimum three (3") inch top soil provided, fertilized and seeded or sodded. The pump site shall be landscaped with bushes and/or trees to be compatible with the proposed development.
- d. A twelve (12') foot wide drive shall be provided with a minimum of eight (8") inch compacted 21AA aggregate road from the existing road to the pump house. This drive shall be properly drained and have a maximum grade of seven (7%) percent. Culverts shall be installed across all drainage ditches. A parking area shall be provided adjacent to pump house well maintenance hatches. Parking area shall match driveway specifications. A turn around shall be provided with sufficient space to permit a generator pulled by a stake truck to conveniently enter and exit the well isolation area, while parking the generator adjacent to the well house.

## CHAPTER FIFTEEN

- e. The drive shall be secured by a four (4") inch diameter post on each side with a minimum 3/8" cable ready for padlock. Posts to be set in 12" x 12" x 42" deep concrete bases.

### 6. On-Site Generator Requirements

If required to provide an on-site generator by MDEQ or the Township the following shall apply:

- a. The maximum dip allowed when equipment is activated will be ten (10%) percent. All data shall be supplied by company supplying unit. This data must confirm the engineering data supplied by project design firm.
- b. Entire unit must come with a full one hundred (100%) percent warranty for not less than five (5) full years from date of acceptance. Parts and labor inclusive.
- c. Only liquid cooled units are allowed. Each unit shall have a thermostatically operated block heater to maintain unit at starting temperatures. The critical ambient outside temperature shall be -20 degrees F.
- d. Generators may be natural gas or diesel driven as determined by the Township. Diesel driven units shall have a minimum seventy-two (72) hours of fuel in storage tank calculated at fifty (50%) percent load. Diesel units shall have an outer vat, surrounding steel storage tank, that will hold one hundred twenty-five (125%) percent of any spillage that could occur. This vat shall meet M.D.P.H. codes as well as any local codes and shall include a leak alarm sensor. The tank shall be sized to provide 24 hours of full load operation and shall be provided with fuel level indicator. A screened, two (2") inch outside fuel tank vent shall be provided. The fuel tank shall have a two (2") inch fill port.
- e. These units shall be equipped to automatically operate upon a power failure and shall be provided with a programmable exerciser that will have the capability of exercising with or without a load. A battery charger shall be supplied with each unit that is of the demand type. Units shall be equipped with critical silencing mufflers. Battery charger shall be permanently mounted and hard wired into unit.
- f. All louvers and shutters on generator air intake shall be mechanically operated, mounted on interior of building. The exterior of building shall be provided with fixed storm proof louvers with screens to prevent insects and bug infestation of room proper. These are to cover intake and exhaust louvers entirely.
- g. A complete instrument package shall be provided on engine monitoring board. All engine monitoring gauges shall be affixed to main generator unit or an adjacent wall within reach of unit. When available, gauges shall be supplied in lieu of lights. Minimum gauges package shall include engine temp. water temp., engine RPM, gen hz., oil pressure, voltage of battery, exciter voltage and current, auto/man operator switch, panel lights, latching type unit, trouble lights with acknowledge switch. Field circuit breaker and all normal systems operations shall be monitored in such a fashion that they will protect unit from failure. Overcrank, overspeed, and overrun circuitry for shut down.
- h. Maximum RPM on engine shall not exceed 2000 RPM. Gear boxes to reduce engine/to/generator RPM are not acceptable under any circumstances.
- i. Import units are acceptable only if a local distributor is available and that distributor has original equipment parts of entire unit in stock as well as factory authorized service and factory trained personnel on full time staff. Local distributor is defined as one in Greater

## CHAPTER FIFTEEN

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Detroit Metropolitan area. Distributor must also provide twenty-four (24) hour emergency service.

- j. Four sets of parts and service manuals shall be supplied and stored at pump house before unit is to be accepted, in addition to warranty documents and as built drawings.
- k. Load test will be conducted at Applicant's expense. This will consist of six (6) hours at full load. Applicant will supply manpower and all necessary fuels. This test shall be witnessed by a Township representative with not less than seventy-two (72) hours notification to Township authorized representative.
- l. Diesel fuel tanks, shall be turned over to Applicant full of fuel before final acceptance of facility will be given.
- m. All generator units shall be mounted on skid rails and shall have sufficiently large vibration isolators to put as little vibration to building floor as possible.
- n. Generator units shall be mounted no less than sixteen (16") inch above finished floor. Remainder of electrical equipment shall be mounted no less than twenty-four (24") inch above finished floor to bottom of panel or any other electrical device. Adequate room shall be provided to service unit including the draining of oil pans. Oil pans on engines shall be provided with a drain plumbed to outside perimeter of unit where oil can be captured in a container.
- o. The concrete floor beneath generator unit shall be sized and constructed to accommodate the weight and loading of proposed generator. Also, the generator floor should allow for utility piping.
- p. Adequate room shall be provided around generator to facilitate servicing the unit including the drawing of oil pans. Oil pans shall be provided with a drain plumbed to the outside perimeter of the unit where waste oil can be conveniently collected in a container.
- q. Unit-Mounted Radiator Cooling:
  - 1. Duct work should be as short, straight, and as unobstructed as possible. Static pressure of more than ½" (1.27 cm) water column on the fan from inlet or exhaust restrictions will reduce air flow to the point of limiting maximum power and/or ambient temperature at which overheating will occur, and will not be allowed.
  - 2. The connection from the radiator duct flange to the duct work shall be heavy canvas or similar flexible material to prevent noise and vibration transmission. In general, the outlet duct shall have an unrestricted area one-hundred fifty (150%) percent greater than that enclosed by the radiator duct flange. The inlet opening shall be at least as large and preferably fifty (50%) percent larger than the outlet. If screens, louvers, or filter are used in the inlet or outlet openings, the openings shall be increased in size to compensate for restriction. In general, when louvers are used, increased by fifty (50%), when insect screening is used, the opening area shall be increased by eighty (80%) percent; when furnace filters are used, the opening area shall be increased by one hundred twenty (120%) percent.
  - 3. Air inlet and outlet locations shall be chosen to prevent air re-circulation inside or outside the enclosure. Consideration should also be given to prevailing winds, facing inlets into the expected winds, and outlets on the down wind side where possible. Inlets and outlets shall be located where they will not be blocked by accumulated snow or any other obstruction. The bottom of any air intake or exhaust louvers shall be located not less than sixteen (16") inches above floor level to prevent snow intrusion.

## CHAPTER FIFTEEN

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4. Any temperature controlling louvers shall be designed so that inlet air is not restricted to the point that pressure inside the building is reduced. The generator room and well house shall be designed to permit the generator to be removed from the building without major building demolition.
5. Bringing large quantities of winter air into a building can waste building heat and even result in frozen water pipes in normally heated spaces. Thermostatic controls can eliminate such problems and allow recovery of engine heat to supplement the building heating system. For cold outdoor ambients, louvers to the exterior would close, with those to the interior open. Controls would be set to reverse the condition for warm outdoor temperatures.

### 7. General

It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations. All equipment shall be new, of current production by a national firm which manufactures the generator, controls, and transfer switch; and assembles the generator set as matched unit. The intent of this requirement is to provide the owner with one-source responsibility for warranty, parts and service through a local representative with factory-trained service personnel.

### 8. Submittal

Submittal shall include specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and other remote devices if included elsewhere in these specifications.

### 9. Testing

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer shall be responsible for design prototype tests as described herein: Components of the emergency system, such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes, which will not be sold, shall be used for these tests. Prototype test programs shall include the requirements of NFPA-110 and the following:

1. Maximum power (kw).
2. Maximum starting (kva) at 35% instantaneous voltage dip.
3. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MGI-22.40 and 6.40.
4. Governor speed regulation under steady-state and transient conditions.
5. Voltage regulation and generator transient response.

## CHAPTER FIFTEEN

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6. Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and full load.
7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
8. Three-phase line-to-line short circuit test.
9. Cooling air flow.
10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
11. Endurance testing.

### 10. Warranty

The emergency generator system shall be warranted by the manufacturer for five (5) years or 1,000 hours, whichever occurs first, from the date of the site start-up. Parts and labor included.

### 11. Products

- A. The standby generator set shall be rated continuous standby (defined as continuous for the duration of any power outage) 480 volts, 3 phase, 4 wire, .8 power factor, sized to accommodate the pump motor and building load requirements. Vibration isolators shall be provided between the engine-generator and welded steel base or between the base and the floor. Data required above shall be provided by the Developer as required for each specific well house.

Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-step load pickup.
2. Transient and steady-state governing.
3. Safety shutdown device testing.
4. Voltage regulation.
5. Rate power.
6. Maximum power.

Upon request, arrangements to witness this test will be made or a certified test record will be sent prior to shipment.

#### B. Engine

The engine shall deliver the required horsepower at a governed speed of 1800 rpm to accommodate the pump motor and building loads. The engine shall be equipped with the following:

1. Engine driven or electric fuel transfer pump, fuel filters and electric fuel shut-off valve.
2. Isochronous governor capable of 0.25% steady-state frequency regulation.
3. 12 or 24 volt positive engagement solenoid shift-starting motor.

## CHAPTER FIFTEEN

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4. 35-ampere minimum automatic battery charging alternator with solid-state voltage regulation.
5. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
6. Dry-type replaceable air cleaner elements.

Note: Engines requiring glow plugs will not be acceptable.

A unit-mounted radiator, blower fan, water pump, thermostat, and radiator duct flange (unhoused only) shall properly cool the engine with up to 0.5 inches water external static pressure on the cooling system.

### C. Generator

The alternator shall be salient-pole, re-connectable ten (10) lead, self-ventilated of drip-proof construction with amortisseur rotor windings, made from copper and skewed for smooth voltage waveform. The insulation material shall meet the NEMA standard (MGI-22.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092. Temperature rise of the rotor and starter shall be limited to NEMA Class F. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator with adjustable Volts-per-Hertz operation capable of maintaining voltage within + or -0.5% at any constant load from 0 to 100% or rating. The regulator shall be sealed from the environment and isolated from the load to prevent tracking when connected to SCR loads.

On application of any load up to the rated load, the instantaneous voltage dip shall not exceed ten (10%) percent and shall recover to + or -0.5% of rated voltage within one second.

The generator shall be capable of sustaining at least 250% of rated current for at least ten (10) seconds under a three (3) phase symmetrical short by inherent design or by the addition of an optional current boost system. The generator shall be capable of delivering the proper electrical power with a maximum instantaneous voltage dip of seven (7%) percent when loads are started as specified elsewhere or on the drawings.

A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished and shall not automatically reset preventing restoration of voltage if maintenance is being performed. This breaker shall protect the generator from damage due to its own high current capability and shall not trip within the ten (10) second specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition.

The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

## CHAPTER FIFTEEN

### D. Controller

Set-Mounted controller capable of facing right, left, or rear shall be vibration isolated in the generator enclosure. The microprocessor control board shall be moisture proof and capable of operation from -400 C to 850 C. Relays will only be acceptable in high current circuits.

Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:

1. Fused DC circuits.
2. Complete two-wire start/stop control, which shall operate on closure of a remote contact.
3. A speed sensing system and a second independent starter motor disengagement system shall protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then reengage the starter.
5. Cranking cyclus with fifteen (15) second ON and OFF cranking periods.
6. Overcrank protection designed to open the cranking circuit after seventy-five (75) seconds if the engine fails to start.
7. Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
8. Engine cool down timer factory set at five (5) minutes to permit unloaded running of the standby set after transfer of the load to normal
9. Three-position (Automatic – OFF – TEST) selector switch. In the test position, the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position, the engine shall start when contacts in the remote control circuit close and stop five (5) minutes after those contacts open. In the off position, the engine shall not start even though the remote start contacts close.

This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off position.

10. Indicating lights to signal:

- Not-in-auto (flashing red)
- Overcrank (red)
- High engine temperature/low coolant level (red)
- Overspeed (red)
- Air damper (red)
- Fuel tank leaking (red)
- Battery charger malfunction (red) \*
- Low battery voltage (red) \*
- Low fuel (red) \*

## CHAPTER FIFTEEN

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System ready (green) \*

Pre-alarm high engine temp. (yellow) \*

Pre-alarm low oil pressure (yellow) \*

Low coolant temp. (red) \*

\*Required to meet NFPA-99 or NFPA-100 Level 1 Regulations

11. Test button for indicating lights.
12. Alarm horn with silencer switch per NFPA-100.
13. Terminals shall be provided for each signal in #10 above for connection to remote monitoring devices.

### E. Instrumental Panel

A set mounted instrument panel shall include:

1. Dual range voltmeter, 3-1/2 inch, + or -2% accuracy.
2. Dual range ammeter, 3-1/2 inch, + or -2% accuracy.
3. Volt meter-ammeter phase selector switch.
4. Lights to indicate high or low meter scale.
5. Direct reading pointer-type frequency meter, 3-1/2 inch, + or -5% accuracy, 45 to 65 Hz scale.
6. Panel illuminating lights.
7. Battery charging meter.
8. Coolant temperature gauge (liquid cooled models).
9. Oil pressure gauge.
10. Running time meter.
11. Voltage adjust rheostat (+ or -5% range).

### F. Accessories

The following accessories shall be provided:

1. Overvoltage protection which shall shut down the unit after one second of 15% or more overvoltage.
2. Battery rack, battery cables, 12-volt battery(ies) capable of delivering the minimum cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537.
3. Gas proof, seamless, stainless steel, flexible exhaust connector(s) ending in pipe thread.
4. Flexible fuel line(s) rated 300 degrees F and 100 psi ending in pipe thread.
5. Engine exhaust silencer, coated to be temperature and rust resistant, rated for critical applications. Exhaust noise shall be limited to 85 dba as measured at 10 feet in a free-field environment.
6. Block heater of proper wattage and voltage, thermostatically controlled to maintain engine coolant at 90 degrees Fahrenheit (32 degrees Celsius) to meet the start-up requirement of NFPA-99 or NFPA-110 Regulations.

## CHAPTER FIFTEEN

7. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40 degrees C to +60 degrees C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Optional alarm circuit board to meet the requirements of NFPA-100 for low battery voltage, high battery voltage, and battery charger malfunction shall be provided.
8. 16 – light remote annunciator shall monitor all controller functions described in Article 10 of the controller section plus line power and generator power monitoring. An integral lamp test and horn silence switch shall be included that meets NFPA-110.
9. Diesel fuel systems shall include a steel or fiberglass fuel tank with fill pipe, vent pipe and a lockable fill cap, meeting all applicable requirements of the Environmental Protection Agency as well as state and local regulations. The fuel tank size shall be large enough to produce a 24 hour run minimum at 100% load.
10. Natural gas fueled systems shall include all required components and accessories including but not limited to the primary and secondary regulators, solenoid valve, fuel filter and supply line flexible connector, etc.

### G. Execution

The equipment shall be installed as shown on the plans, in accordance with the manufacturer's recommendations and all applicable codes.

### H. Site Tests

An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

1. Fuel, lubricating oil, and antifreeze (liquid cooled models) shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.
2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote annunciator, etc.
3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.
5. Labor, fuel, and load bank for 6 hour test shall be supplied at developer's/builder's expense.

## CHAPTER SIXTEEN

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### DESIGN AND CONSTRUCTION STANDARDS FOR WATER MAINS

#### SECTION 16-1 INTENT

This standard establishes the minimum requirements for design and construction of water distribution systems located within the Township.

#### SECTION 16-2 GENERAL

Springfield Township is a community that does not have a municipal water supply. Residents rely on individual or community wells and distribution systems. Until such time as a municipal system is established, all water systems shall remain private.

#### SECTION 16-3 DESIGN CONSIDERATIONS

##### 1. GENERAL REQUIREMENTS

- A. The distribution system in all developments requiring more than 600 feet of water main shall have a minimum of two (2) connections to a source of supply and shall be a “looped” system. Water mains are to be looped whenever possible. The water main design must provide for the average daily flow rate plus a fire demand of 1,250 GPM with a residual pressure of 20 psi at the most remote hydrant.
- B. Generally, water mains shall be installed on the opposite side of the road as the sanitary sewer where present. All water main easements shall be a minimum of twenty (20’) feet wide and shall be dedicated to the authority having jurisdiction over the system. A barrel to barrel horizontal separation of ten (10’) feet shall be maintained between water main and all sewers.
- C. Water mains shall preferably be constructed outside of paved parking areas, streets and drives.
- D. Easements for possible extensions for looped connections shall be provided to the property lines at locations designated by the Township. At the discretion of the Township, the Applicant may be required to extend a stub for future connection to the development property line or across the frontage of the property.
- E. The easement descriptions shall include hydrant leads and shall extend a minimum of ten (10’) feet beyond the hydrant. The easement documents shall contain a provision prohibiting the construction or locating of any aboveground structures within the limits of such easements.

## CHAPTER SIXTEEN

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- F. All water mains and appurtenances shall be manufactured in the U.S. No secondhand or salvaged materials or equipment will be permitted.
- G. All water mains on which fire hydrants are located shall be considered accessible (to the public in the event of a fire) mains and must have easements dedicated to the Township for access only. The Township will not maintain said water mains unless otherwise approved by the Township.
- H. Water main design, relative to pipe bedding and locations, shall reflect the proper selection of materials and construction method compatible with the field conditions. Areas which show unsatisfactory ground material for pipe bearing or possible chemical deterioration due to soils shall be avoided, or the pipe shall be suitably installed on adequately designed bedding and/or enclosed in protective wrap or coating.
- I. A tracer wire shall be installed and secured in place on all water main and appurtenances. A 12-gauge single strand copper wire shall be attached to the top of the main for the entire length of the main being installed. The wire shall be run to the top step of each manhole and tied off. When splicing wire, a knot shall be placed in the wire to relieve stress at the connection. A grease filled, underground splice kit shall be used for all connections.
- J. No building permits will be issued above the foundation for any development prior to the active service of the community mains and hydrants and adequate fire fighting equipment. No occupancy shall be allowed in any instance without the required mains, hydrants, and sprinklers being in active service.

### 2. WATER MAINS

- A. Feeder mains twelve (12") inches or larger in diameter shall be provided as required by the Township.
- B. In new developments, water mains shall be installed from boundary to boundary in abutting roads and interior streets, and at other locations as may be deemed necessary by the Township's Engineer for future extensions.
- C. Mains within new developments shall be eight (8") inches in diameter minimum, and larger as design dictates for residential and commercial developments. Water mains of twelve (12") inch diameter minimum size will be required for industrial developments.
- D. Hydrant water mains not exceeding seventy-five (75') feet in length shall be a minimum diameter of six (6") inches.

## CHAPTER SIXTEEN

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### 3. VALVES

- A. A tapping sleeve, valve, and well shall be provided at every connection to existing mains unless otherwise approved by the Township's Engineer. All such connections shall be provided so as not to disrupt the existing water service.
- B. In general, valves on cross connecting mains shall be arranged so that no single line failure will require more than 800 feet of main to be out of service. Valves shall be so arranged that any section can be isolated by closing not more than three (3) valves with a maximum of thirty (30) residential units being out of service.
- C. A valve shall be provided at every dead end where required, for future extension, by the Township.
- D. Valves shall generally be located far enough back from the intersection of street, right-of-way lines for the gate well structure to clear crosswalks.
- E. Valves shall be located so as to equally balance the number of services within each section of main between valves.
- F. Pressure Reducing Valves
  - 1. In systems where two or more pressure districts are to be connected for a "looped" supply, the plans shall include a pressure reducing valve near the point of connection to the higher pressure district to balance pressures across the new water system.
  - 2. A line gate valve shall be installed both upstream and downstream of each pressure reducing valve to permit isolation of the pressure reducing valve for maintenance or repair. If an alternate service ("looped" supply) to the water system is not available to permit repair on the pressure reducing valve with a complete shutdown of the system, then a bypass line of equivalent size pipe as the water main and an additional bypass gate valve and well shall be provided.

### 4. GATE WELLS

- A. A gate well shall be provided for all valves except for valves for hydrants and service leads under three (3") inches in diameter.
- B. The top of the base for each gate well shall be positioned at least four (4") inches below the bottom of the valve. A mortared brick or formed concrete support shall be provided from the floor to the valve.

## CHAPTER SIXTEEN

C. Riser sections shall be reinforced concrete sized as follows:

<u>Nominal I.D. of Main</u>	<u>Size of Well (I.D.)</u>
6" through 10"	5'-0"
Over 10"	6'-0"

- D. All pipe openings in gate wells shall be closed with brick and mortar in a manner that will make them watertight.
- E. Extension stems and stem guides shall be provided in each gate well wherein the valve operating nut is further than five (5') feet below the top of the gate well cover. Extension stems shall extend to within five (5') feet of the top-of-cover elevation.
- F. A one (1") inch corporation stop shall be installed in the water main on each side of the line valve in each gate well. When a corporation is outside a gate well, a bronze double-strap tapping saddle (service clamp) shall be installed.

### 5. FIRE HYDRANTS AND APPURTENANCES

- A. In general, hydrants shall be spaced to provide adequate coverage to all proposed structures, or as directed by the Township.
- B. Hydrants shall be located for double coverage, but in no case shall they be located closer than thirty-five (35') feet from a single-family residence or fifty (50') feet from other structures.
- C. Spacing of hydrants around commercial and/or manufacturing establishments shall be considered as individual cases and shall be determined by consultation with the Township.
- D. Fire hydrants shall be located at street intersections where feasible. Spacing between hydrants and gate wells shall be sufficient to facilitate roadside grading.
- E. A hydrant shall be installed at the end of every dead end main. A one (1") inch corporation stop with ten (10') feet  $\pm$  of copper or PVC service pipe attached shall be provided adjacent to the hydrant for the purpose of obtaining water samples when the nearest gate well is more than one pipe length away.
- F. Hydrants should be placed at high spots along the main for air release and at low spots along the main for sediment blowoff.
- G. In general, hydrants shall be located in the road right-of-way not more than ten (10') feet from back of curb or edge of pavement. The maximum distance to a hydrant from the centerline of the right-of-way of streets or roads having  $\frac{1}{2}$  right-of-way width greater than forty (40') feet (or from the centerline of the nearest roadway in the case of a divided

## CHAPTER SIXTEEN

highway) shall be thirty (30') feet. The location of hydrants with respect to the right-of-way line shall generally be 7.5 feet from the side lot lines extended.

- H. A six (6") inch gate valve with a three-(3) piece cast iron valve box (5 ¼ inch diameter screw shaft) shall be placed at each hydrant.

### 6. SPECIAL CROSSINGS

- A. Rail Road: Water main shall be installed within an encasement pipe specified by the railroad. Details shall include encasement pipe thickness and diameter, water main bedding, and complete pressure grouting with a flowable fill approved by the Project Engineer. A valve shall be installed on each side of the railroad.
- B. Stream or Regulated Wetland Crossing: Ball joint river pipe shall be used unless otherwise approved by the Township. A valve shall be installed on each side of the crossing.

### 7. WATER SERVICES

- A. The basis of design for size shall be considered using a flow rate of 20 gpm per residential dwelling unit. The basis of size other than for residential use shall be determined by the Developer's Engineer and submitted for approval by the Township prior to submittal of final site plans. Minimum size of service shall be one (1") inch.
- B. Water leads shall be less than 100 feet in length and for multiple type uses, the following minimum sizes shall apply:

<u>Number of Units Per Building</u>	<u>Water Service Size (Inches)</u>
4	1-1/2
12	1-1/2
16	2
24	2
32	3

- C. All service leads must be copper.

### 8. BACKFLOW PREVENTION

- A. All lawn sprinkler and irrigation systems shall be equipped with suitable backflow preventor in compliance with the Michigan Department of Environmental Quality where they are connected to a Community Water Supply System.
- B. Special requirements for Automatic Sprinkler Fire Protection Systems: Sprinkler systems directly connected to the community water supply mains only, with no other physical

## CHAPTER SIXTEEN

connections to or for any supplemental water supplies, will not require backflow prevention provided no antifreeze or other additives of any kind are used and the sprinkler system drains to the atmosphere.

- C. Sprinkler systems directly connected to public water supply mains and also having supplemental supplies of non-potable water, or being located within 1000 feet of a body of water, shall be isolated from the public water main by an approved double check valve assembly of back flow preventor such as those manufactured by Watts or Beco, or equal.
- D. Sprinkler systems directly connected to public water supply mains only which incorporate an elevated storage tank for fire protection only shall be isolated from the public water main by double check valves.

### 9. AUTOMATIC FIRE SPRINKLER SERVICE CONNECTIONS

- A. The Township will allow installation of unmetered fire service connection provided adequate provision is made to prevent the use of water from such fire service for purposes other than fire extinguishing.
- B. In no case should hydrants be placed downstream of any check valve used for automatic sprinkler protection. Where hydrants are necessary, separate mains shall be installed for fire sprinkler service and hydrant protection.
- C. Sprinkler systems are not a substitute for standard requirements for hydrants.

### SECTION 16-4 PLAN REQUIREMENTS

All construction plans shall be submitted to the Township for water main approval and shall contain, but not be limited to, the following information:

1. Dimensions to property lines, right-of-way lines, and buildings from the water mains.
2. Service line location and diameter shall be shown to all buildings other than single-family detached dwellings, including location of curb stop box.
3. The plans shall indicate the finish grades of all fire hydrants, gate well rims, hydrant valve boxes, and all other water structures.
4. Water main twelve (12") inches and larger in diameter shall be shown in profile as directed by the Township. The Township may also require profiles be shown where multiple utility crossings provide the potential for conflicts.
5. The elevation at the top of mains at all points of potential conflict with other utilities (for all water main regardless of size) must be shown.

## CHAPTER SIXTEEN

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6. Plans must show size, type, and class of pipe, with distances between fittings, valves, and other appurtenances. The plans must also include a list of quantities.
7. Detail Sheets:
  - A. Details and notes shall be included in the plan set as prepared by the Applicant's Engineer.
  - B. Detail sheets shall include specific and complete details for all water main appurtenances and structures to be included with the water main construction, and special or unusual mains or allied construction requirements.
  - C. Scales utilized for special details shall be selected to clearly portray intended construction and component or equipment arrangement. Scales used shall be clearly identified.

### SECTION 16-5 CONSTRUCTION STANDARDS

#### 1. CONSTRUCTION MATERIALS

##### A. Water Mains

1. Water mains shall be designed for 150 psi minimum pressure.
2. Ductile iron conforming to ANSI A21.51 (AWWA C151), Class 54 shall be used for all water main.
3. Ductile iron pipe shall be marked as required by ANSI A21.51 (AWWA151).

##### B. Joints and Fittings

1. Push-on type joints, when specified, shall be in conformity with the current ANSI A21.11 (AWWA- C111) standard specification, shall be "Tyton," "Super Bell-Tite," or approved equal. The bulb or main body portion of the gasket shall have a maximum compression set of twenty (20%) percent after 22 hours at 158°F s determined in accordance with ASTM Designation D-395, Method B. Two brass wedges shall be installed on either side of the barrel at each joint.
2. Mechanical type joints, when specified, shall be in conformity to the current ANSI A21.11, "Rubber Gasket Joints for Cast Iron Pressure Pipe and Pipe and Fittings." The bolts shall be of the high-strength, low alloy steel type.
3. Flanged joints shall conform to ANSI B16.1.

## CHAPTER SIXTEEN

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4. Bell and socket joints shall be “Clow Bell Joint River-Crossing Pipe,” “Usiflex,” or equivalent, as approved by the Township’s Engineer.
5. Fittings shall conform to ANSI A21.10 (AWWA C110).

### C. Cement mortar lining

Ductile iron pipe and fittings shall be lined with cement mortar, twice standard thickness, conforming to ANSI A21.4 (AWWA C104).

### D. Pipe Coating

1. The inside and outside of all unlined pipes and the outside of all lined pipes shall be covered with a uniform coating of coal tar varnish or enamel applied hot. The coating materials shall be applied uniformly and shall be of a quality necessary to provide a firm, tenacious and tough coating which will not deteriorate when exposed to high or low temperatures and shall resist corrosion.
2. Two coats of cold-applied coat tar base paint may be substituted for the hot-applied enamel provided all other requirements of these Standards are met.
3. These coatings after drying 48 hours shall have no deleterious effect upon the quality, color, taste, or odor of potable water.

### E. Valves

1. Gate valves shall be iron body, fully bronze-mounted, double disc, parallel seat type, non-rising stem, opening counter-clockwise, and conforming to AWWA C-500 Standards, or resilient seat valves per manufacturer and AWWA C-515 Standards. All water main valves should be placed in wells, except hydrant valves.
2. Pressure reducing valves shall be hydraulically operated and of the self-contained differential piston type. The valve shall be flanged, with globe body, fully bronze-mounted, external pilot operated, with free-floating piston. The valve piston shall be of cast bronze provided with renewable leather cup and rubber seat securely held in place.  
It shall be possible to remove the piston or liner from the valve without removing the valve body from the water main line. Pressure reducing valves shall be Golden-Anderson Figure 45-D or approved equivalent.
3. The pilot valve shall be of the single-seated, balanced design type, globe body pattern. It shall be diaphragm operated and spring-loaded permitting convenient adjustment over a range no less than 30 psi. Pilot valves shall be 2 inch size, with screwed ends, Golden-Anderson Figure 43-D, or approved equivalent.

## CHAPTER SIXTEEN

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### F. Gate Wells

1. All such structures shall rest on an eight (8") inch thick MDOT 3500 psi concrete base. Precast reinforced concrete bases may be used if a uniform bearing is provided. The base diameter shall protrude a minimum of six (6") inches beyond the outside diameter of the well structure, unless precast concrete bases are used. If precast bases are used, they shall protrude a minimum of four (4") inches beyond the outside diameter of the structure.
2. Precast reinforced concrete sections shall, as a minimum, conform to ASTM C478.
3. Brick shall, as a minimum, conform to ASTM C32, Grade MS, or ASTM C55, Grade U-1.
4. Mortar for laying brick or pointing of joints, and for plastering outside of structures shall be composed of 1 part Type II masonry cement and 2-1/2 parts masonry sand.
5. Water for concrete and mortar shall be clean and fresh, free from oil, acids, and organic matter.
6. Steps shall be steel, encased with polypropylene plastic, equivalent to M.A. Industries, Inc., PSI for precast wells and PSI-B for brick wells.
7. Covers shall be East Jordan Iron Works, No. 1040, with Type A cover, per East Jordan Iron Works Catalog No. 8, or approved equivalent. Covers shall be supplied with raised letters thereon as directed by the Township. The combined weight of frame and cover shall not be less than 400 pounds.
8. Extension stems and stem guides shall be as manufactured by Traverse City Iron Works, or approved equivalent.
9. One-inch corporation stops shall be Mueller H-15000, or approved equivalent.
10. Bronze double-strap tapping saddles, (service saddles, service clamps) shall be Clow F 1280, or approved equivalent.
11. Radial concrete block shall be Grade V-I conforming to ASTM C139.

## CHAPTER SIXTEEN

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### G. Fire Hydrants

1. Fire hydrants shall be East Jordan Iron Works (EJIW) 5BR-250 Traffic Model and shall have the following configuration:
  - a. Two (2) - 2.5" diameter N.S.T. hose nozzles painted reflective yellow.
  - b. One (1) – 5" diameter Storz pumper nozzle.
  - c. 1.5" Pentagon operating nut.
  - d. Hydrant shall be left hand open.
  - e. Hydrant to be painted red.
  - f. Bonnet color based on flow per ISO.

### 2. CONSTRUCTION PROVISIONS

#### A. Utility Crossings:

A minimum of eighteen (18") inches clearance shall be provided between the water main and any existing underground utility, unless otherwise required by the Township Engineer.

Whenever a main is installed under any existing utility line such as gas buried electric power, telephone line, sewer or water, provisions shall be made to properly support or distribute any concentrated load to avoid settlement and possible failure of the lower main. Such provisions shall consist of concrete bedding of the main, complete concrete encasement, or some other method as shown on the plans. Water mains passing under sewers, in addition, shall be protected by providing:

A vertical separation of at least eighteen (18") inches between the bottom of the sewer and top of the water main.

Adequate structural support for the sewer to prevent excessive deflection of joints and settlement of the sewer above the water main, i.e., a concrete saddle under the pipe with a span length extending to undisturbed earth bearing.

That the water main be encased in concrete with a full length centered on the point of crossing.

#### B. Thrust Blocks:

Thrust blocks shall be constructed using MDOT Grade 30P concrete. Thrust blocks shall be placed at all 11-1/4 degree bends or greater, dead ends, tees, reducers, hydrants, and crosses and valves as required, unless restrained joints are called for. Area in square feet of concrete thrusting against undisturbed earth shall be computed by dividing the total thrust by the safe bearing load of the soil as follows:

## CHAPTER SIXTEEN

### SAFE BEARING LOADS AGAINST HORIZONTAL THRUST

Soil	Safe Bearing Load (Lbs. per Sq. Ft.)
Muck, Peat, etc.	0
Soft Clay	1,000
Sand	2,000
Sand and Gravel Cemented	3,000
Sand and Gravel Cemented with Clay	4,000
Hard Compacted Clay	5,000

In muck or peat all thrust shall be resisted by pile supports driven to solid foundations or by removal of muck or peat and replacement with ballast of sufficient stability to resist thrusts. In all cases, thrust block size and method of thrusting must be approved by the Township before placement.

#### C. Minimum Cover:

Minimum cover over mains shall be 5'-6" feet including crossings through ditch sections. When installed parallel to a ditch, mains shall have 5'-6" feet of cover minimum, as measured from the nearest point in the ditch cross section.

#### D. Construction of Gate Wells:

1. All valve structures shall be constructed of precast reinforced concrete sections (ASTM C478).
2. All brick, block, mortar and concrete work shall be properly cured and protected from freezing for a minimum of 48 hours. When the temperature is 40°F and falling, brick, mortar, and concrete shall be heated to a minimum temperature of 60°F.
3. A minimum of six (6") inches and a maximum of fifteen (15") inches height of brick shall be placed on the cone section of all precast structures.
4. The joint between a precast riser section and the base of the structure shall be set in a full bed of mortar. The butt section of the precast riser shall be full wall thickness in bearing on the masonry base.
5. Joints between precast riser sections, both inside and outside, shall be pointed with mortar.
6. All pipe openings in gate wells shall be closed with brick and mortar in a manner that will make them watertight. Water main in the wall shall be wrapped with 15 pound felt

## CHAPTER SIXTEEN

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or Caddilloc Wrap coated with DeWitt No. 10 mastic prior to closure of the pipe opening.

7. Where precast sections are used, the joints and lift holes shall be pointed and plugged, inside and outside, with mortar.

### E. Fire Hydrants:

1. A six (6") inch gate valve and a cast iron 3-piece gate box with 5-1/4 inch screw shaft shall be placed on each hydrant.
2. Hydrant leads shall have a minimum of 5'-6" feet of cover in all areas, including crossings through ditch sections.
3. Lucas tees shall not be used unless specifically authorized.
4. Hydrants shall be carefully plumbed, braced, and backfilled so they remain in plumb.
5. The pumper nozzle of each hydrant shall face the street centerline unless otherwise directed by the Township.
6. All grade, facing, and vertical alignment adjustments of hydrants shall be completed prior to pressure testing.
7. All hydrants shall be cleaned and painted with a red rust inhibitive, oil base paint such as "Rustoleum".
8. Prior to acceptance, the lubricant reservoirs in all hydrants having such construction shall be filled with a lubricant acceptable to the Michigan Department of Environmental Quality and recommended by the hydrant manufacturer.
9. Backfill around fire hydrants shall be carefully tamped in six (6") inch layers from the centerline of the lead main to a height of one (1') foot below finished grade. Care shall be taken to insure the hydrant remains plumb during backfilling. Excavated material shall then be used to backfill to grade.

### F. Pressure Tests:

No permanent connection to existing water mains shall be made before the newly constructed water mains have undergone a satisfactory pressure test as witnessed by the Township's Engineer. Temporary connections (jumpers) between existing water mains and the newly constructed system, which connections may be made for chlorinating and flushing purposes, shall include a back-check valve to prevent back-flow and possible contamination of the community water supply. Preliminary pressure testing of the mains shall be done by the Contractor to ascertain if there are any major breaks.

## CHAPTER SIXTEEN

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The Contractor shall pressure test sections of water main as directed by the Engineer. Pressure testing shall be made in increments of 2000 feet or less, unless otherwise authorized by the Engineer, and then only the allowable leakage for 2000 feet will be permitted.

Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants are not available at high points, the Contractor shall make the necessary taps to release the air and insert plugs after the test has been completed, or install corporation stops and leave them in place after testing.

The Contractor shall furnish proper appliances and facilities for testing and draining the main without injury to the work and surrounding territory. The Contractor shall be responsible for furnishing, and for the cost of, all water required for pressure testing. He shall test by filling the main with clean water under a minimum hydrostatic pressure of 150 lbs. per square inch. In no case shall the leakage in any stretch of pipe being tested exceed the following amounts in a 2 hour period.

6" pipe – 0.11 gallons per 100 linear feet

8" pipe – 0.15 gallons per 100 linear feet

12" pipe – 0.22 gallons per 100 linear feet

16" pipe – 0.29 gallons per 100 linear feet

If, as a result of leaking, draining, or flushing, streets, sidewalks, driveways, or parking area subbases become saturated, the material shall be removed or repaired by the Contractor, as directed by the Township's Engineer.

### G. Disinfection of Water Mains:

The Contractor shall disinfect all new water mains in a manner acceptable to the Michigan Department of Environmental Quality. If required by the Township, the Contractor shall disinfect the new system in increments.

Water samples, for bacteriological testing, shall be taken from the end of each main and at any other locations selected by the Township Engineer or governing agency. Samples shall be taken from corporation stops only, unless authorized by the Township Engineer. If mains dead end with no hydrant or gate well within one pipe length of the main terminus, the Contractor shall install a one (1") inch corporation stop with ten (10') feet ± of copper service pipe attached for purposes of obtaining water samples.

The Contractor shall flush out the new pipe lines until the water runs clear. This shall be done after the pressure test and before disinfection.

Bacteriological water samples shall be collected by the Township Engineer or his duly authorized representative.

## CHAPTER SIXTEEN

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Each valved section of the newly laid pipe shall be flushed separately with potable water. The Contractor shall be responsible for furnishing, and for the cost of, all water required for flushing and disinfection.

Two samples taken approximately 24 hours apart are required as a minimum. Analysis of each sample must be made by a laboratory approved by the Michigan Department of Environmental Quality.

If analysis of any sample indicates that the water is unsafe for human consumption, the disinfection, sampling, and analysis procedures shall be repeated until samples obtained on two successive days are found to be "safe."

H. A Suggested Method of Disinfection is as follows:

After satisfactory hydrostatic tests are obtained, the new system shall be chlorinated. A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied through a corporation stop at the beginning of the main. A slow flow of water shall be let into the main approximately at the point of injection of the chlorine solution at a rate such that the chlorine dosage of the entering water shall be at least 50 milligrams per liter. An open discharge shall be maintained at all extremities of the system, and the introduction of chlorine solution and water shall be continued until the dull dosage of chlorine reaches each outlet.

The chlorinated water shall remain in the system at least 24 hours, and at the end of that time, the chlorine residual at pipe extremities and other representative points shall be at least 25 mg/liter. If the chlorine residual is found to be less than 25 mg/liter at the end of 24 hours, further application of chlorine shall be made and the retention period repeated until the required 25 mg/liter residual is obtained.

## CHAPTER SEVENTEEN

### DESIGN AND CONSTRUCTION STANDARDS FOR SANITARY SEWER COLLECTION SYSTEMS

#### SECTION 17-1 INTENT

This Standard establishes the minimum requirements for the design and construction of sanitary sewer collection systems located within the Township.

#### SECTION 17-2 GENERAL

1. The Standards herein apply to the collection of sanitary sewage for transportation to a community or regional treatment and disposal facility.
2. A community or regional treatment and disposal facility refers to any facility which accepts sewage from more than one lot, unit, building, etc. This includes subdivision (community) sewer systems, mobile home treatment plants, public and private wastewater treatment plants, etc.
3. For the design and construction of a community treatment and disposal system (i.e. septic field or wastewater treatment plant), please reference Chapter 14 of these Standards.
4. Community sewage systems, including the collection, treatment, and disposal facilities are subject to the Township's "Community Sewer System Ordinance" (Ordinance No. 63).
5. The Township is generally a community, which relies primarily on individual or community onsite sewage disposal systems. It is considered unlikely that a public sewer system to serve the Township will be constructed in the future. All sanitary sewer collection and treatment facilities shall remain private and are to be maintained in accordance with the Community Sewer System Ordinance. However, the Township reserves the right to impose design and construction requirements in foresight of connecting individual sewage collection, treatment, and disposal facilities into a municipal system. These requirements may include, but are not limited to:
  - A. Extension of sanitary sewers, of a diameter determined by the Township, across the frontage of the property;
  - B. Providing stubs to property lines for future upstream connections;
  - C. Upsizing main lines to handle future flows;
  - D. Provide piped outlet from treatment/disposal facility to accessible point for future outlet connection;
  - E. Providing easements which allow the Township to access, connect, etc., to the onsite system.
6. At no time shall downspouts, weep tile, footing drains, or any storm water conduits be permitted to discharge to the sanitary sewer.

## CHAPTER SEVENTEEN

### SECTION 17-3 DESIGN CONSIDERATIONS

#### 1. Location of Sanitary Sewers

- A. Sanitary sewers shall generally be located on the opposite side of the street from any proposed water mains and within the road right-of-way.
- B. Easements for sanitary sewers not within the road right-of-way shall have a width suitable for proper access and maintainable width, centered upon the sewer. Such easements shall be deeded or dedicated to the owner (i.e., subdivision or condominium association) maintenance agency and the Township, with restrictions against the use or occupation of easements by the property owners and/or by other utilities in any manner which would restrict sewer maintenance or repair operations.

Easements for possible extensions shall be provided to the property lines at locations designated by the Township.

Within unplatted projects, sewers shall be installed parallel to the property lines, or building lines, with clearance distances to accommodate the full width of the proposed easement.

- C. Sewers shall preferably be constructed outside of paved parking areas, streets, and drives.
- D. Ten (10') feet of horizontal separation must be maintained between sanitary sewers, water mains, and storm sewers. The minimum vertical separation between all utilities shall be eighteen (18") inches

#### 2. Sewer Capacity

- A. Sanitary sewers shall be designed to serve all areas within the defined service area as determined by the Township, anticipating full development of such areas, with due consideration given to topography, existing natural features, established zoning, the adopted Township Master Land Use Plan, and any other documents published by the Township in this regard.
- B. For design purposes, population shall be based on a minimum of 3.5 persons per detached single-family home site, and 2.8 persons for each multiple-family dwelling unit. Submissions for review shall include a tabulation of occupancy (usage) types and the conversion of these into terms of equivalent single-family units. The area of the site, in acres, may be used to calculate dwelling units based on density allowed in the Zoning Ordinance. The adopted unit factors as published by the Oakland County Drain Commissioner shall be used to convert the different usage types to equivalent single-family units.
- C. For service areas with design populations of 500 or less, sewer design capacity shall be 400 gallons per capita per day, as specified under the Ten State Standards of the Great

## CHAPTER SEVENTEEN

Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers (GLUMRB).

For service areas with design populations greater than 500, but less than 28,400, sewer design capacity shall be based on the following formula:

$$Q = 100 \frac{18 + P}{4 + P} \quad \text{where,}$$

Q = Design capacity in gallons per capita per day

P = Design population expressed in thousands

- D. The sewage system outlet must be investigated to determine if adequate capacity is available. The Township Engineer may be able to provide service area and available capacity in the downstream system.
3. Minimum pipe size for sanitary sewers shall be eight (8") inches nominal internal diameter or as required by the Township.
  4. Hydraulic calculations shall be based on Kutter's or Manning's formulas, with  $n = 0.13$ . Minimum design velocity shall be two (2') feet per second, and maximum design velocity shall be ten (10') feet per second, with pipe flowing full. The slope of the sewer between the last two manholes at the upper end of any lateral shall be increased to 0.60 percent or greater to obtain cleaning velocities.

### A. Allowable Pipe Slopes

<u>Pipe Diameter (Inches)</u>	<u>Minimum Slope (Feet per 100 Feet)</u>	<u>Maximum Slope (Feet per 100 Feet)</u>
8	0.40	10.00
10	0.28	7.00
12	0.22	5.30
15	0.15	3.90
18	0.12	2.90
21	0.10	2.32
24	0.080	1.92
27	0.067	1.64
30	0.058	1.44
36	0.046	1.12

1. Maximum flow velocity for full pipe flow shall be maintained by continuity of the 0.80 diameter depth above invert for pipe size increases and also with intersecting sewer grade raised to compensate for head loss due to direction change.

## CHAPTER SEVENTEEN

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2. Provide a drop of 0.10 feet in the downstream sewer invert for direction changes in excess of 30 degrees to compensate for velocity head loss of the incoming flow.

### 5. Allowable Types of Pipe and Pipe Joints

Composite ABS plastic and Perlite concrete truss pipe material as manufactured by Metal Products Division of Armco Steel Corporation, or equal, shall conform to the requirements of ASTM D-2680-74, or latest revision thereof.

Joints on truss pipe shall consist of ABS plastic couplings chemically cemented to the ends of the pipe being connected. Solvents and methods used in making the chemical bond shall be in accordance with manufacturer's printed instructions, and the installation technique shall conform to ASTM Designation: D-2321, or latest revision thereof.

PVC pipe and fittings shall conform to requirements of ASTM D-3034 (SDR 26), latest revision. Deflection of pipe shall be limited to a maximum of 5.0%.

Joints for PVC pipe shall be push-on type or solvent cemented joints in special applications as specified by the Township's Engineer. Push-on type joints shall conform to ASTM Specification D-3212, latest revision. Solvent cemented joints, where specified, shall conform to ASTM Specification D-2855, latest revision.

#### A. Materials and Certifications:

1. Armco Truss Pipe and Fittings shall be described under ASTM Designation D 2680-80, Standard Specifications for Acrylonitrile-Butadiene-Styrene (ABS) Composite Sewer Pipeline. Appendix XI of said specification shall be as modified by the bedding requirements outlined below.
2. PVC Pipe and Fittings shall be as described under ASTM Designation D 3034-81, Standard Specification for Polyvinyl Chloride Sewer Pipe and Fittings. Minimum wall thickness shall be SDR 26.
3. Solid wall ABS pipe for 6" house connection sewers shall be SDR 35 or SDR 23.5, conforming to ASTM Designation D 2751-80 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings. Solid wall pipe shall be installed in accordance with bedding requirements outlined below.
4. All pipe shall be certified by the manufacturer to meet the applicable ASTM specification requirements. Certification forms, together with a report of the test results, shall be provided the construction inspector with pipe deliveries and copies shall be forwarded to the Engineer or the Owner. Certification forms shall include project name, location, Contractor, and test lot number. Lot sizes shall be acceptable to the Engineer.

## CHAPTER SEVENTEEN

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5. All pipe and fittings shall be suitably marked to provide manufacturer's name or trademark, lot or production number, ASTM designation, PVC cell classification, SDR number, and nominal diameter. Fittings, however, need not contain lot number, cell classification, or SDR number. Pipe shall have a "home" mark.

### B. Bedding

1. Bedding for PVC, Truss or ABS solid wall pipe shall be in accordance with current specifications of ASTM D 2321, except (1) only Class I and Class II materials having a maximum particle size of 1-1/2" may be used, (2) embedment shall extend to minimum 12" above top of pipe, and (3) flooding or puddling shall not be used. It is essential that it be recognized that the successful use of flexible pipe requires bedding that provides unyielding side support and complete bedding contact under pipe haunches. Bedding material must be properly placed and compacted to provide lateral restraint against deflection in the pipe diameter. Pipe must be bedded to true line and grade throughout its length. Bell holes shall be provided where required.
2. Where unstable bottoms are encountered, the Contractor shall provide a foundation consisting of an approved graded processed angular stone or gravel to act as an impervious mat to prevent mitigation or vertical movement of unstable soils or bedding materials. Where trench sheeting, plates, or a trench box are used due to severe ground conditions, all voids to the side and below the top of the pipe caused by the sheeting, plates, or box withdrawal shall be completely filled or the supports left in place below the top of the pipe.
3. Concrete cradle bedding shall not be used where allowable trench widths are exceeded. In lieu of concrete cradle bedding, standard pipe bedding shown shall be provided to the full width between undisturbed trench walls or at least 2.5 pipe diameters on both sides of the pipe.
4. Due to potential damage to exterior walls of plastic pipe, particularly under cold weather conditions, if rocks, frozen material or large objects strike the pipe, the Contractor shall carefully avoid dumping any materials other than approved bedding sand or stone on the pipe until 12" cover is placed on it. Pipe walls and joints shall also be protected from abrasion and damage during handling, and shall be fully inspected just prior to placing in the trench.
5. Care should be taken during bedding compaction to avoid distorting the shape of the pipe or damaging its wall. Mobile equipment shall not be used over the pipe trench until 48" of cover has been placed.
6. House connections shall be made to wye fittings. Bedding for house connection sewers shall be equal to that of the main sewer bedding. Risers in deep and unstable trenches should be bedded in Class I angular stone to avoid settlement. Concrete shall not be used

## CHAPTER SEVENTEEN

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for bedding. End caps or plugs shall be braced or anchored to withstand air test pressures. Caps or plugs shall not be chemically welded in place.

### C. Cutting and Handling

Cutting of pipe lengths, where required, shall be performed by the use of tools or equipment that will provide a neat, perpendicular cut without damage to the plastic. All burrs shall be removed by the use of a file, knife, or abrasive paper. Spigot ends on cut pipe shall be beveled similar to factory beveling to prevent gasket damage.

Bowing or warping of plastic pipe can occur with temperature fluctuations. The Contractor shall store and protect the pipe to minimize bowing. Normal pipe lengths of 10'-0", 12'-6", or 20'-0" having deviations from straight greater than 1" shall not be used.

### D. Special Conditions:

1. The completed installation shall at no point have out-of-round pipe deflections greater than five (5%) percent. The Engineer shall have the option of requiring deflectometer or go/no-go gauging tests run prior to acceptance on pipelines where high deflections are suspected.
2. Air test requirements as specified by the Township Engineer shall be met. Flexible manhole joints shall be provided in all new manhole construction to maintain the flexibility of the pipe materials, concrete encasement of drop connections shall not be used. Where adapters to other materials are required, only approved adapters and joints may be used. Where connections are made to existing manholes, a rubber waterstop shall be used around the pipe.
3. Where unstable bottoms are encountered, the Contractor shall provide a foundation consisting of an approved graded processed angular stone or gravel to act as an impervious mat to prevent mitigation or vertical movement of unstable soils or bedding materials. Where trench sheeting, plates, or a trench box are used due to severe ground conditions, all voids to the side and below the top of the pipe caused by the sheeting, plates, or box withdrawal shall be completely filled or the supports left in place below the top of the pipe.
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## CHAPTER SEVENTEEN

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7. House connections shall be made to wye fittings. Bedding for house connection sewers shall be equal to that of the main sewer bedding. Risers in deep and unstable trenches should be bedded in Class I angular stone to avoid settlement. Concrete shall not be used for bedding. End caps or plugs shall be braced or anchored to withstand air test pressures. Caps or plugs shall not be chemically welded in place.

### E. Materials and Conditions

#### 1. Depth of Sewers

- A. Unless specifically otherwise approved, no sanitary sewer shall have less than five (5') feet of cover. In general, sanitary sewers shall have a minimum of eight (8') feet of cover below the finished road surface grade
- B. Unless otherwise approved, the top of any sanitary sewer shall be at least nine (9') feet below finished grade elevation at the building setback line of each fronting property which the sewer is designed to serve

#### 2. Building Leads

- A. Unless otherwise approved because of unusual circumstances, construction of building leads from the public sewer to the easement and/or property line for each fronting parcel which the sewer is designed to serve shall be included with the construction of each sanitary sewer.
- B. Where the construction of building leads to the property line is not required concurrently with the sanitary sewer construction, a wye branch or tee inlet with riser is required. Said tee, wye, or riser shall be provided with a watertight stopper or plug with type of joint used for the sewer pipe shall be installed for every lot or building site which the lead is designed to serve.
- C. Where depth of sewer from top of pipe to finished surface exceeds ten (10') feet, risers shall be installed from wyes and tees to an elevation ten (10') feet below finished surface.
- D. Minimum size for building leads shall be six (6") inch nominal internal diameter. Maximum length of building lead without a cleanout shall be one hundred (100') feet.

## CHAPTER SEVENTEEN

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- E. Minimum slope for building leads shall be one (1%) percent.
  - F. Joints for wyes, tees, and stoppers shall be of the same type as the joint used for the sanitary sewer pipe
3. Manholes
- A. Manholes shall be constructed at every change in sewer grade, alignment, and pipe size, and at the end of each sewer line. Maximum distance between manholes shall be 350 feet for sewers thirty-six (36") inches and smaller in nominal diameter.
  - B. Manholes shall be constructed of precast reinforced concrete sections.
  - C. A drop manhole shall be constructed whenever an inlet sewer pipe enters a manhole at an invert elevation eighteen (18") inches or more above the invert elevation of the outlet sewer pipe. Use of internal drop connections must be approved by the Township Engineer.
  - D. Where future connections to a manhole are anticipated, stubs or blind drop connections with watertight plugs shall be provided.
4. Special Structures and Appurtenances
- A. Preliminary Plans  

Preliminary plans for special structures and appurtenances required for sanitary sewer systems shall be submitted to the Township Engineer for review and comment prior to their inclusion in the construction drawings.
  - B. Inverted Siphons will not generally be allowed.
  - C. Sewage pumping stations shall have at least two pumps or ejectors, each sized to handle maximum design flow. For three or more pumps or ejectors, sizing of units shall be such that design flows can be handled with the largest unit out of service. Design features shall conform to the Ten States Standards of GLUMRB. When all pumps are operating, the pumping station shall not discharge flows which exceed the capacity of any downstream sewers.
  - D. Pipe for force mains shall be designed to withstand both internal pressures and external trench and live loads. Design computations shall be submitted by the proprietor's engineer for review and approval.

Pipe materials shall be cast iron, ductile iron, or PVC pressure pipe. Cast iron pipe and ductile iron pipe shall be cement lined. Joints and fittings shall be equal to the

## CHAPTER SEVENTEEN

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Township's requirements for pressure pipe used in the domestic water distribution system. Force mains shall be pressure tested for water tightness to a test pressure equal to twice the total system head but no less than 50 psi held for a minimum 1 hour period. Amount of leakage shall be limited to not more than 25 gallons per inch diameter per mile of pipe per 24 hours at required test pressure.

### SECTION 17-4 PLAN REQUIREMENTS

1. All construction plans shall be submitted to the Township for sanitary sewer approval and shall contain, but not be limited to, the following information:
  - A. Overall layout of the sewer system with manhole numbers and with direction-of-flow arrows.
  - B. District limits of service area.
  - C. Locations of all manholes and other sewer appurtenances and special structures.
  - D. Building leads, wye branches, or tee inlets to be constructed or installed concurrently with sewer construction, with locations at easement and/or property lines. Length, size, end of lead invert elevations, and amount of riser shall be shown on the plan for each building lead.
  - E. Dimensions to manholes and sewers to property lines, right-of-way lines or buildings.
  - F. Size, slope, length, type and class of pipe, and controlling invert elevations for each section of proposed sewer between manholes in profile view.
  - G. Limits of special backfill requirements.
  - H. Profile over centerline of proposed sewer, of existing and finished ground, and pavement surfaces. Existing profile shall be obtained from actual field survey data.
  - I. Location of existing or proposed installations crossing the line of the sewer or otherwise affecting sewer construction in profile view.
  - J. Location, by station, of every proposed manhole, with manhole number, invert elevation of all inlet or outlet pipes, top of casting elevation, and manhole type in profile view.
  - K. Location, by station, of all building leads, wye branches or tee inlets, to be constructed or installed concurrently with proposed sewer construction in profile view.
  - L. Cover elevations of all manhole covers shall be shown.
  - M. Required risers, with control elevations.
  - N. Invert elevation at property line for building leads to be included with sewer construction.

## CHAPTER SEVENTEEN

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O. Manholes shall be identified by numbers assigned consecutively and increasing in direction opposite to direction of flow in each sewer.

P. Each Plan and Profile Sheet shall include a tabulated list of quantities appearing on that sheet.

### 2. Detail Sheets

A. Detail sheets shall include specific and complete details for all sewer appurtenances and structures to be included with the sewer construction and special or unusual sewer or allied construction requirements.

B. Scales utilized for special details shall be selected to clearly portray intended construction and component or equipment arrangement. Scales used shall be clearly identified.

### SECTION 17-5 CONSTRUCTION STANDARDS

#### 1. Wyes, Risers, and Building Leads

A. All connection branches in the sewer pipe shall be securely and completely fastened to, or formed in, the wall of the pipe during manufacture. All pipes containing such connection branches shall be installed with the main sewer. Wyes for vacant property shall be installed opposite the center of the frontage unless otherwise indicated. The final location of the wye shall be determined by the Township Engineer at the time of construction. All wyes that are installed with building leads shall include an approved stopper.

B. Building lead risers of the same strength as the sewer to which they connect shall be installed on deep sewers, to a depth of ten (10') feet below finished surface elevation, unless otherwise authorized by the municipality. All risers that are installed without building leads shall include an approved stopper.

C. The ends of leads shall terminate with an approved stopper at the property line or easement line unless otherwise noted. The ends shall be marked with a 4" x 4" pressure treated post placed vertically from the pipe invert to two (2') feet above the ground surface. The portion above ground shall be painted with a florescent paint.

#### 2. Connections

A. A proper channel shall be constructed within the existing manhole or other structure at which the connection is to be made to direct the flow to the existing outlet in a manner which will tend to create the least amount of turbulence. Any portion of the existing structure which would interfere with such construction shall be removed.

B. When connections are made with sewers or drains carrying fluids, special care must be taken that no part of the work is built under water. A flume or dam must be installed and pumping

## CHAPTER SEVENTEEN

maintained, if necessary, and the new work kept dry until completed and any concrete or mortar has set up.

- C. The contractor shall install a suitable bulkhead to prevent construction water, sand, silt, etc., from entering the existing sewer system. Such bulkhead shall be left in place until such time as the governing agency authorizes its removal by the contractor.
- D. Wherever existing manhole structures or sewer pipes are to be tapped, the tap is to be made by core drilling. No break connections will be permitted. The pipe (stub or saddle) to be placed in the opening with a core-and-seal type “boot” shall be cast flush with the inside wall of said structure. Voids outside the pipe barrel, placed in the pipe opening, shall be sealed with an approved nonshrinking grout. A concrete collar shall then be poured twelve (12”) inches thick around the pipe and extended a minimum of twelve (12”) inches beyond the outside wall surface of the manhole with the remainder of the pipe cradled in concrete.

### 3. Construction of Manholes

Construction methods shall conform to the requirements of these specifications and current MDOT Standard Specifications for Construction with the following stipulations and exceptions:

- A. Pipe shall not extend into a manhole beyond the inside face of the manhole wall. Field cutting of pipe to be used at manholes shall be done in a neat, workmanlike manner, using methods approved by the Township’s engineer. Exposed ends of reinforcing steel shall be cut flush with the pipe end.
- B. The joint between a precast riser section and the base of the structure or the top of a concrete radial block riser section shall be set in a full bed of mortar.
- C. Radial block used (as shown on the detail drawings) for the lower riser section of manhole shall be laid in a full bed of mortar and shall be plastered on the outside with at least one-half (½”) inch of mortar in a manner that will completely seal the structure. Plastering shall be performed in conjunction with the laying of block. The laying of block shall never be more than two (2) courses ahead of the exterior plaster.
- D. Concrete placed inside the precast flexible-joint manholes to form the channel through the manhole shall not be placed between the pipe and the opening in the manhole base section so as to interfere in any way with the flexibility of the joint.
- E. A minimum of three (3”) inches and a maximum of eighteen (18”) inches of adjustment rings with gaskets shall be placed on the cone section of all manholes.
- F. All block, mortar, and concrete work shall be properly cured and protected from freezing for a minimum of 48 hours. When the temperature is 40°F and falling, block, mortar, and concrete shall be heated to a minimum temperature of 60°F.

## CHAPTER SEVENTEEN

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- G. After the concrete and/or plaster has set up sufficiently to avoid damage, backfilling shall be done in a manner that will not cause unequal pressure on the structure.
- H. Manhole assembly shall be in strict accordance with the manufacturer's recommendation. Particular care shall be taken to keep foreign materials from interfering with proper joint assembly. The bell and spigot surfaces shall be wiped clean. The surfaces (bell, spigot, rubber o-ring gasket) shall then be coated with a lubricating material to overcome the friction resistance when setting the precast sections home.
- I. All manholes shall be provided with waterproof lid frame and cover bolted to the cone section of the manhole with rubber o-ring gasket compressed between the frame and the top of the cone. The frame and cover shall be East Jordan Iron Works 1040 or equivalent. Lettering on the cover shall be as required by the governing authority.
- J. All lift holes and joints within precast manholes shall be plugged and pointed with mortar in a manner acceptable to the Township Engineer.
- K. Manhole structures which are to be left open overnight shall be securely enclosed with suitable fencing and have adequate lighted barricades, unless otherwise approved by the Township Engineer.
- L. All manholes shall be supported on a firm, stable foundation. The foundation shall remain stable during backfilling and subsequent operations. Undercutting and the placement of compacted granular material to stabilize the structure is to be completed at the direction of the Project Engineer.
- M. All manholes shall be constructed of precast reinforced concrete. Riser sections shall have integral base and cone sections, unless otherwise approved by the Township's Engineer.
- N. Cone sections shall be eccentrically constructed unless otherwise specified by the Township's Engineer.
- O. Manholes for pipe sizes thirty-six (36") inch diameter and smaller shall be manufactured and constructed as "precast flexible-joint sewer manholes," unless otherwise directed by the Township's Engineer.

#### 4. Miscellaneous Material:

##### A. Materials

##### 1. Masonry Units

Concrete brick shall conform to the requirements of ASTM C-55-75, Grade N-1 and concrete block shall conform to the requirements of ASTM C139-73 with the following exceptions.

## CHAPTER SEVENTEEN

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- a. All concrete masonry brick or block shall have a minimum compressive strength of 5500 psi at 28 days. The proportion of cement in the concrete mixture used to make brick or block shall be not less than 564 lb/c.yd. of concrete. The mixture shall contain 6% ( $\pm 1-1/2\%$ ) engrained air. The maximum water adsorption shall not exceed 5 lbs/c.ft.
- b. Block Shape - The blocks shall be solid curved blocks with the inside and outside surfaces curved to the required radii. The blocks shall have tongue and groove or other approved type of joint at the ends so that the units interlock to form a strong, rigid structure. Curved blocks shall have the inside and outside surfaces parallel.
- c. Block Size - The nominal dimensions of the block shall be 18 inches maximum for length, 8" maximum for depth (height), and 6" maximum for width (thickness). The length shall be measured along the chord on the convex face of the block. The tolerances of ASTM C 139-73 shall apply. Where the specified wall thickness on the standard plans is twelve (12") inches, a multiple block wall of two six (6") inch wide blocks is permitted. All blocks in one structure shall be of the same height dimension. The blocks shall be designed for length so that only full length or half length blocks are required to lay the circular wall of any one course. Blocks intended for use in the cones or tops of manholes or other structures shall have such shape as maybe required to form the structure as shown on the plans with inside and outside joints not to exceed 1/4 inch in thickness.

### 2. Mortar

Mortar for unit masonry shall conform to the requirements of ASTM C-270 Type M with the exception that it shall be composed of 3 parts sand and one part a mixture of 50% portland cement Type 1A and 50% masonry cement and shall have a minimum entrained air content of 12%. Use of mortar for manhole reconstruction shall be limited to within one hour after the water is added to the dry mix.

### 3. Concrete Grade Rings

Concrete grade rings shall have a minimum compressive strength of 4,000 psi at 28 days. Concrete grade rings shall be reinforced and shall be in conformance with ASTM C-478.

### 4. Elastic Joint Seal

The exterior joint between the manhole frame and the brick block or grade ring adjustment section (chimney) shall be sealed by using any of the following materials or approved equal:

- a. Polyurethane joint sealant
- b. Butyl rubber joint sealant

## CHAPTER SEVENTEEN

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### 5. Elastomeric Sealant

The exterior of the frame/chimney section shall be sealed by using Butyl rubber sealant (Trowelable Grade). Elastomeric sealant used shall be chemically compatible with the elastic joint seal utilized according to manufacturer's recommendations. Contractor shall use compatible primer as required to obtain acceptable bonding under cold, wet, or other adverse conditions.

- a. The Contractor shall raise the elevation of the existing manholes as shown on the plans. Only those manholes, as directed by the Township Engineer shall be raised. The manholes to be raised shall be done so by adding a sufficient number of bricks and mortar courses or grade rings to obtain the desired elevation

The Contractor shall raise the elevation of the existing manholes as shown on the plans. Only those manholes, as directed by the Township Engineer shall be raised. The manholes to be raised shall be done so by adding a sufficient number of bricks and mortar courses or grade rings to obtain the desired elevation.

It shall be the responsibility of the Contractor to replace any portion of the manhole, which was damaged during excavation and removal of cover, frame or chimney.

During construction the Contractor shall take precautions to keep dirt, brick, water, tools, and any other deleterious materials out of the existing structure. Any materials that are dropped into the structures shall be promptly removed.

The exterior, seal material shall be applied in accordance with the manufacturer's recommendations and shall conform to any AWWA requirements for waterproofing and sealing. Safety regulations and precautions recommended by the manufacturer and OSHA shall be strictly observed.

### 6. Pipe Joint Assembly:

Compression joints and couplings shall be assembled in strict accordance with the manufacturer's recommendations. Particular care shall be taken to prevent foreign materials from interfering with proper joint assembly. The mating surfaces (bell and spigot) shall be wiped clean. The surfaces shall then be coated with a lubricating material to overcome the friction resistance when thrusting the pipe home.

### 7. Manhole Materials and Appurtenances:

All materials under this specification shall conform to the requirements of Section 5.14.02 MDOT Standards for Construction and Oakland County Department of Public Works Standards and Specifications for Sanitary Sewer Construction except as otherwise specified herein.

## CHAPTER SEVENTEEN

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- A. All manholes shall contain a bottom precast section of flexible-joints and shall consist of a base integrally cast with a riser section. The base shall be a minimum of eight (8") inches thick and contain reinforcement at least equal to, and which shall be adequately tied to, the reinforcement in the riser section.
- B. The joint between the pipe and a section of a precast flexible-joint manhole shall be a mechanically compressed joint such as the Res-Seal, Link-Seal, Press Wedge II, or Kor-N-Seal flexible rubber manhole joint. The joint shall be capable of meeting infiltration requirements and shall permit a deflection of at least six (6) degrees in all directions as measured from the centerline of the pipe.
- C. Precast reinforced concrete sections shall conform to ASTM C478. Joints between precast sections shall be modified tongue and groove type using O-ring synthetic rubber gaskets.
- D. Concrete and radial block shall conform to ASTM 139 and shall be Grade N-1. Brick shall be Grade U-I conforming to ASTM C55.
- E. Water for concrete and mortar shall be clean and fresh, free from oil, acids, and organic matter.
- F. Mortar for laying block, pointing of joints, and plastering outside of structures shall be composed of one (1) part Type II masonry cement and two and one-half (2-1/2) parts masonry sand.
- G. The frame and cover shall be as noted on the plans. Lettering on the cover shall be as required by the governing authority.
- H. Manhole steps shall be steel, encased with polypropylene plastic, equivalent to M.A. Industries, Inc., PS-1 or PS-1B, as appropriate.
- I. Resilient connections between manhole and pipe shall conform to ASTM C443 and ASTM C923, except that only synthetic rubber gaskets shall be permitted. Natural rubber will not be acceptable.
- J. Threaded studs, washers, and nuts shall be cadmium coated.
- K. Rubber O-ring gaskets shall conform to the requirements of ANSI/ASTM C443, except that the gaskets shall be synthetic rubber only. Natural rubber gaskets are not acceptable.
- L. Concrete cast-in-place shall be 3500 psi.
- M. Manhole steps shall be reinforced polypropylene plastic No. PS-2-PFS, manufactured by M.A. Industries, Inc., of Peachtree, GA, or approved equal, or E.J.I.W. No. 8500, or approved equal.

## CHAPTER SEVENTEEN

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- N. Where manholes are located outside of pavements and sidewalks, final grade adjustments shall be made with precast concrete grade adjustment rings; brick construction will not be allowed except where located in paved surfaces. Grade rings shall be a minimum of three (3") inches thick and reinforced with two (2) full circles of 3/16" diameter steel reinforcing wire. Manhole casting frame and concrete adjustment rings shall be secured to precast cone section with a minimum of four (4) 5/8" diameter cadmium coated threaded studs or bolts. All joints in the assembly shall be sealed with rubber o-ring gaskets.
- O. Final grade adjustment for manholes located in pavements and sidewalks shall be made with brick and mortar. A minimum of three or a maximum of six courses of brick shall be placed on top of the precast cone section.
- P. Manhole covers and frame shall be East Jordan Iron Works No. 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.
- Q. Special approved wet area manholes with precast rubber gasket type pipe fittings and lockdown rubber gasket type manhole covers such as E.J.I.W. No. 1040 ZPT, or equal, shall be required in areas of high ground water table and where manholes are to be located in or adjacent to drainage ditches, low areas, and floodplains. Details of this type manhole are included in the standard plan sheets.

### 8. Channeling:

A proper concrete channel shall be constructed within all manholes to direct the flow to an outlet in a manner which will tend to create the least amount of turbulence (also refer to Section C entitled "Connections").

Concrete channels formed inside the precast flexible-joint manholes shall be placed so as not to interfere in any way with the flexibility of the joint.

### 9. Casting Adjustments:

Adjustments to manhole castings shall be accomplished prior to final acceptance by using precast concrete adjustment rings bolted to the cone section of the manhole with rubber o-ring gaskets compressed between each adjacent ring.

A maximum of fifteen (15") inches of precast adjustment shall be placed on the cone section of all precast concrete structures.

Manhole castings located within pavement areas shall be adjusted a maximum of fifteen (15") inches using four (4) cadmium coated 5/8" diameter threaded studs with adjustment support nuts for setting frame to correct grade as detailed on the plan. The void between casting and top of cone section shall be completely filled with stiff MDOT 30M or 30P concrete mix. A Caddilloc brand rubber wrap for water tightness shall be applied to the exterior of the adjustment after the

## CHAPTER SEVENTEEN

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concrete has taken its initial set and is resistant to damage, unless otherwise specified by the Township's Engineer.

### 10. Sanitary Test Manhole:

The first manhole upstream from point of connection to existing sanitary sewer system shall have an eighteen (18") inch deep sump which shall be filled with concrete and channeled upon successful completion of infiltration testing.

The outlet pipe from this manhole shall be plugged with a waterproof stopper to prevent discharge to the existing system until acceptance of the system by the Township. The requirement to provide a sump may be waived by the Engineer where testing is to be done by either low pressure air testing or exfiltration testing.

### 11. Shafts and Jacking Pits:

The Contractor shall furnish, construct, maintain and refill all shafts or jacking pits where required, and shall remove other temporary construction and equipment which he requires to carry out the work specified. The Contractor shall provide steel ladderways at least 20-inches wide in each shaft, with rungs 12-inches on center and include a safety cage. All buildings, fences and other appurtenant temporary structures shall be of neat suitable appearance and shall be so maintained until completion of the work.

### 12. Power and Lighting:

All power machinery and tools used in shafts and tunnels shall be operated by electricity or compressed air. No electric voltage in excess of 440 volts will be permitted. Transformers, if used, shall be mounted on platforms or in approved enclosure. The use of gasoline in power shafts or tunnels is prohibited.

All machinery and equipment used in tunnel headings or shafts under gaseous conditions shall bear the approval plate of the United States Bureau of Mines.

All tunnel work shall be lighted with electricity at the expense of the Contractor, a sufficient number of lights being provided to illuminate properly all parts of the work. All lighting circuits shall be thoroughly insulated and kept separate from power circuits. In gaseous conditions, all lamps shall be mounted in protected gas and vapor proof fixtures.

### 13. Ventilation:

The Contractor shall keep the tunnel air in a condition suitable for the health of the workers and clear enough for the surveying operations of the Engineer. A sufficient supply of fresh air for the safety and efficiency of workers and Engineer shall be provided at all times throughout the length of tunnels, especially at working places and in all places underground, and provisions shall be made for quick removal of gases. Whenever a 24-hour tunneling operation

## CHAPTER SEVENTEEN

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exists, the Contractor shall have attainable, within one hour's time, any spare piece of equipment or material vital to the tunnel operation.

### 14. Steel Liner Plates:

Care shall be exercised in trimming the excavated soil section in order that the steel liner plates fit snugly against undisturbed material. Excavation shall not be advanced ahead of the previously installed liner plates any more than necessary for the installation of the succeeding liner plate. The vertical face of the excavation shall be supported as necessary to prevent sloughing. At any interruption of the tunneling operation, the heading shall be completely bulkheaded. If soil conditions deem it necessary, tunneling shall be conducted continuously, on a 24-hour basis.

A shield shall be employed at the discretion of the Engineer when soil or other conditions indicate its need. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates. Detail plans sufficient to determine the adequacy of the shield, accompanied with design calculations, shall be submitted to the Engineer for approval and no work shall proceed until such approval is obtained.

A uniform mixture of cement and sand grout as herein-specified under "Jacking Pipe," shall be placed under pressure, behind the liner plates to fill any voids existing between the liner plates and the undisturbed material.

Grout holes tapped for no smaller than 1 1/2-inch pipe, spaced at approximately 3 feet around the circumference of the tunnel liners, shall be provided in every third ring. Grouting shall start at the lowest hole in each grout panel and proceed upwards simultaneously on both sides of the tunnel. A threaded plug shall be installed in each grout hole as the grouting is completed at that hole. Grouting shall be kept as close to the headings as possible, using grout stops behind the liner plates as necessary. Grouting shall proceed as directed by the Engineer, but in no event shall more than 6 linear feet of tunnel be progressed beyond the grouting.

### 15. Jacking Pipe:

Each jacking shaft shall be completely sheeted to provide proper support for the banks and adequate support for the reaction blocks. The shaft shall be constructed long enough to provide room for jacking head frame, reaction blocks and two sections of pipe. The width shall be sufficient to allow ample working room. The backstops or reaction blocks shall be placed absolutely perpendicular in all directions to axis of the pipe and the guide timbers carefully installed to the proper line and grade.

Jacking pressure must be applied by a pushing frame at right angles to the line to avoid breaking the pipe or forcing it out of alignment. The first section of pipe shall be equipped with a steel cutting shield placed over the upper two-thirds of its circumference and securely

## CHAPTER SEVENTEEN

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bolted to the pipe. A positive stop boring arrangement to prevent excavation ahead of the pipe shall be provided. Excavation ahead of the pipe shall not be permitted.

When excavating, voids outside of the pipe and disturbances of the surrounding material shall be kept to a minimum. Excessive voids shall be filled immediately with sand or other suitable material and thoroughly compacted.

The jacking operation shall be continuous insofar as possible to prevent seizure of the pipe. However if the operation is discontinued for any time, the excavation shall be safely supported with wood bulkhead and adequate blocking.

The casing shall be installed for the full distance between jacking pits. All void spaces between the casing pipe and the ground shall be filled by pressure grouting.

Grouting pressure shall be sufficiently high to fill all voids. Necessary grouting holes shall be installed as required to insure complete filling of void spaces. A grout pipe at least 2 inches in diameter with a control valve attached thereto shall be inserted and securely caulked to the grout hole or a half coupling welded to the casing pipe. Couplings shall be fitted with a threaded cast iron plug. Grout shall consist of mixture of Portland cement thoroughly mixed with mortar sand, with sufficient water to permit steady flow through the grout pipes. The mix shall be 2 parts of sand to 1 part of cement, but the proportions may be varied at the Engineers order even to the extent of enriching the mix to neat cement. If necessary to speed up setting of grout, approved admixtures of quick-setting cement shall be used as directed by the Engineer.

Following satisfactory pipe grouting operations, the grout pipe shall be removed from the grout hole after the grout has taken its initial set. The space occupied by the grout pipe shall be completely filled with stiff mortar and troweled smooth at the inner face.

### 17. Acceptance Testing:

All sanitary sewer systems shall be subjected to and successfully pass a preliminary infiltration, air, or exfiltration test, or a combination thereof in accordance with the following requirements prior to scheduling of a final acceptance test of the system with the Township Engineer and prior to removal of bulkhead as required in the section entitled, "Connections."

#### A. Infiltration Test

All sewers over twenty-four (24") inch diameter and all smaller sewers where the groundwater level is more than seven (7') feet above the top of the sewer, shall be subjected to an infiltration test.

Maximum allowable infiltration shall not exceed 250 gallons, per inch of diameter per mile of pipe per 24 hours for the overall project and all sewers being tested by the infiltration method shall be allowed to stabilize for a period of 24 hours with the test bulkhead in place.

## CHAPTER SEVENTEEN

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### B. Exfiltration Test or Air Test:

All sewers of twenty-four (24") inch diameter or less, where the groundwater level is seven (7') feet or less above the top of sewer, shall be subjected to either exfiltration tests or air tests, as determined by the Township Engineer.

### C. Exfiltration Test

For the purpose of exfiltration testing, the internal water level shall be equal to the external water level, plus seven (7') feet 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 twenty (20') feet. A prospective test that would exceed this twenty (20') foot limit should not be taken. The line under construction can be broken down into smaller sections so that the maximum head of twenty (20') feet will not be exceeded.

The actual exfiltration of leakage from the sewer line can be measured by recording the volume of water lost over a given period of time in a standpipe or pipes connected in the upstream and/or downstream manhole, or the upstream manhole can be used provided the test water level is below the bottom of the tapered section. It may be necessary to add a measured amount of water during the testing time interval to maintain water in the standpipe at the specified level so that the total volume of water lost would be based upon the amount of water added and the difference in elevation of water at end of testing converted to gallons. When the standpipe method is used, the time interval to record the difference in elevation of the water surface shall be a minimum of fifteen (15) minutes. When the upstream manhole method is used, the time interval shall be a minimum of two (2) hours.

A minimum of four (4) hours should elapse after the test section is filled with water to permit the escape of trapped air and to allow for maximum absorption. After such absorption and escape of air has taken place, water should be added to the specified test level, and the test begun.

### D. Air Test

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

1. The 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 air-tight 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 air 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 three and one-half (3-1/2") inches and a range of 0-10 PSIG. The gauge shall have minimum divisions of 0.10 PSIG and an accuracy of  $0.04 \pm$  PSIG.

## CHAPTER SEVENTEEN

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2. The sewer shall be pressurized for 4 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. At least 2 minutes shall be allowed for the air pressure to stabilize between 3.5 and 4 PSIG. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 PSIG or greater.
3. After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 PSIG, or such other pressure as is necessary to compensate for groundwater level.
4. 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 Air Test Tables (Section 17-5, No. 23).
5. Manholes on sewers to be subjected to air tests shall be provided with a one-half (1/2") inch diameter, galvanized, capped test pipe installed through the manhole wall and extending three (3") inches into the manhole at an elevation equal to the top of the sewer pipe. Prior to the air test, the groundwater elevation shall be determined as follows:
  - a) The test pipe in the downstream manhole shall be cleared by blowing air through it.
  - b) A length of clear plastic tubing shall then be attached to the end of the test pipe and extended vertically upward to or near the top of the manhole.
  - c) Groundwater will enter and rise in the tubing to the elevation of the groundwater level at the manhole and will be readily visible.
6. The air test pressure shall be adjusted to (1 ft H<sub>2</sub>O = .433 psi) to compensate for the maximum groundwater level above the top of the sewer pipe to be tested. After all tests are performed and the sewer is ready for final acceptance, the test pipe shall be plugged in an acceptable manner.

### 18. Test Results:

If a sewer fails to pass any of the previously described tests, the Contractor shall determine the location of the leaks, repair them, and retest the sewer. The tests shall be repeated until satisfactory results are obtained. Repair procedures must be approved by the Township's Engineer.

All visible leaks and cracks shall be repaired regardless of test results.

## CHAPTER SEVENTEEN

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### 19. Safety Precautions:

The air test can be hazardous under certain conditions. It is extremely important that all air plugs be properly secured and that care be exercised during the test and in the removal of plugs. A fifteen (15") inch plug with 4.5 pounds per square inch applied to it exerts almost 800 pounds of force. This is an example of the potential hazard that exists if plugs are not correctly relieved of air pressure before being removed. As a safety precaution, it is suggested that pressurizing equipment be provided with a 10 psi pressure relief device to reduce hazards and to avoid over-pressurization and damaging of any sewer lines. No persons shall be allowed in manholes during air testing.

All final acceptance tests shall be witnessed by a representative of the Township. Further, all final acceptance tests under the jurisdiction of the governing agency(ies) shall be witnessed by a representative of that agency.

### 20. Hydrostatic Tests of Force Mains:

Prior to acceptance, force mains shall be flushed, inspected, and hydrostatically tested as specified herein. The Contractor shall furnish all necessary personnel, temporary bracing, plugs, test pumps, and all other necessary apparatus for conducting the test.

Before applying test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at the points of highest elevation in the pipe and such openings subsequently closed, prior to test, with tight threaded brass plugs.

Test pressure shall be maintained at 100 pounds per square inch at the point of highest elevation in the test section by pumping water into the pipe for a period of two (2) hours and in all cases long enough to permit assurance of a satisfactory test. Leakage, as measured by the quantity of water pumped into the pipe to maintain 100 psi pressure during the test, shall not exceed a rate of 50 gallons per inch diameter of main per mile of pipe in 24 hours.

### 21. Test for Alignment:

All sewers shall be laid accurately to the line and grade shown on the approved plans. The sewers will be tested for alignment by shining a light through the pipe at a manhole and viewing the light from an adjacent manhole. Any section of sewer in which a light cannot be seen from one manhole to the next shall be corrected to the satisfaction of the Engineer to pass this test.

### 22. Television Inspection:

All sanitary sewers shall be televised. Under the work, the Contractor shall furnish all materials, labor, equipment and all else necessary for performing a television inspection of new sanitary sewers. Included will be any necessary cleaning and pumping of sewage or debris.

## CHAPTER SEVENTEEN

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The inspection shall be carried out under the direct supervision of the Township Engineer's representative with all television inspection being observed by the Township Engineer.

All television inspection shall be recorded on a videotape which shall be turned over to the Township Engineer. The recording must be made on a continuous running tape on which sound and video information can be recorded. The speed and electronics of the videotape shall be equal to that which can be played back on a standardized recorder of the electronics industry. The recording shall be made on VHS format tape.

The inspection shall involve the visual observation by closed circuit television. The inspection shall be performed at a rate of speed which will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment in line or grade, location of wye openings and any defects which may appear. Any items which, in the opinion of the Engineer, require repair shall be precisely located and described by a detailed statement of the condition.

As part of the television inspection, the precise location of each wye shall be noted in relation to the downstream manhole. These locations shall be entered on the wye location sheet supplied by the Contractor.

If the camera encounters a dip in the sewer such that water is standing above the springline of the sewer pipe, and if the camera lens becomes submerged because of the condition, the camera rig shall be withdrawn from the sewer and inserted from the other end as far as possible. At all times, backflooding into the reach from the adjacent section shall be prevented.

Two copies of all notes, wye locations and other pertinent information shall be made as a part of the television inspection. One set of this information shall be turned over to the Township Engineer upon the completion of the inspection of each line. The second copy of the information shall be held by the Contractor until completion of the project, at which time it shall be neatly assembled and turned over to the Township Engineer.

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## CHAPTER SEVENTEEN

23. Air Test Table:

**Length  
Of Line  
In Feet**                      **Minimum Holding Time in Seconds Required  
for Pressure to Drop from 3.5 to 2.5 psig  
Pipe Diameters**

	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"	30"	36"
<b>25</b>	4	10	18	28	40	62	89	121	158	200	248	356
<b>50</b>	9	20	35	55	79	124	178	243	317	401	495	713
<b>75</b>	13	30	53	83	119	185	267	364	475	601	743	1020
<b>100</b>	18	40	70	110	158	248	356	485	634	765	851	
<b>125</b>	22	50	88	138	198	309	446	595	680			
<b>150</b>	26	59	106	165	238	371	510					
<b>175</b>	31	59	123	193	277	425						
<b>200</b>	35	79	141	220	317							
<b>225</b>	40	89	158	248	340							
<b>250</b>	44	99	176	275								
<b>275</b>	48	109	194	283								
<b>300</b>	53	119	211									
<b>350</b>	62	139	227									
<b>400</b>	70	158										
<b>450</b>	79	170										
<b>500</b>	88											
<b>550</b>	97											
<b>600</b>	106											
<b>50</b>	113	170	227	283	340	425	510	595	680	765	851	1020

Note: To be used when testing one diameter only. For more than one pipe size in a test section, the minimum holding time shall be computed by the Engineer in accordance with ASTM Spec. C-828.

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## CHAPTER EIGHTEEN

### FRANCHISED UTILITIES (Electric, Telephone, Gas, TV)

#### SECTION 18-1 INTENT

The intent of this Standard is to supplement the requirements of private utility construction within developments required to submit final site plans to the Township.

#### SECTION 18-2 GENERAL

1. All procedures, design, and construction of utilities shall be in conformance with the requirements of the supplying utility company.
2. Plans of all proposed utilities, whether or not in public rights-of-way, shall be submitted by the utility company to the Township for review and approval prior to starting construction.
3. All existing and proposed utility information, including lines, poles, and surface equipment shall be shown on the final site plan.
4. Every effort shall be made to install all proposed utilities underground for their full length. Specific approval by the Township Board or its authorized representative shall be required for the placement of above ground utilities and shall be based on a showing of substantial hardship or practical difficulty with underground installation. Existing overhead utilities on site shall be relocated underground.
5. Surface equipment shall be located so as not to interfere with traffic flow, parking, building access, or access to fire hydrants.
6. Surface transformers, pedestals and similar equipment shall be screened from view and the screening shall be shown on the landscape plans.
7. Electrical, telephone, gas and cable lines, etc. may not share a common trench with sewer and water mains and shall maintain a minimum of ten (10') feet of separation from them.
8. If the utility company installs their utility after final grading has been completed, the utility company shall be responsible for restoring the area disturbed by their work to its original condition,. If the utility company fails to restore the disturbed area, it shall be the responsibility of the developer to complete the restoration.
9. The Developer is advised to submit plans to the utility companies for their review and approval prior to the start of construction.

## CHAPTER NINETEEN

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### DEFINITIONS

*AASHTO* - American Association of State Highway and Transportation Officials

*ADA* – Americans with Disabilities Act

*ANSI* – American National Standards Institute

*ASTM* - American Society of Testing and Materials

*AWWA* – American Water Works Association

*GLUMRB* – Great Lakes-Upper Mississippi River Board

*MDEQ or DEQ* - Michigan Department of Environmental Quality

*MDNR or DNR* - Michigan Department of Natural Resources, or its successors.

*MDOT* - Michigan Department of Transportation.

*MIOSHA* – Michigan Occupational Safety and Health Administration

*MMUTCD* – Michigan Manual of Uniform Traffic Control Devices

*NFPA* – National Fire Protection Association

*NPDES* – National Pollutant Discharge Elimination System

*OCDC* – Oakland County Drain Commission

*OCDPW* – Oakland County Department of Public Works

*OCHD* – Oakland County Health Department

*RCOC or OCRC* – Road Commission for Oakland County

*USGS* – United States Geological Survey

*Administrative policy* is the administrative guidelines to the Ordinance.

*Aggregate* (1) is a rock, stone, or other granular material, (2) means inert material that is mixed with Portland cement and water to produce concrete.

*Applicant* shall be the party or the parties who are submitting development or improvement plans for review and approval by the Township.

*Aquatic vegetation* shall mean plants and plant life forms which naturally occur in, at, near, or predominantly near water.

*As-built*s shall be revised plans showing the as constructed conditions of the site, including utilities, grading, detention, etc.

*Association* for a condominium development shall have the same meaning as “Association of Co-Owners” found in Act 59, Michigan Public Acts of 1978, as amended. For a subdivision or other development it shall mean an association of homeowners or property owners organized pursuant to deed restrictions and/or restrictive covenants in a particular development.

## CHAPTER NINETEEN

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*Base course*: The bottom portion of a pavement where the top and bottom portions are not of the same composition.

*Base flood* (100 year flood) shall mean the flood having a one (1) percent chance of being equaled or exceeded in any given year, or of a magnitude that may be equaled or exceeded once in any 100 year period.

*Base* shall mean a layer of selected, processed or treated aggregate material of planned thickness and quality placed immediately below the pavement and above the subbase or subgrade soil.

*Berm* means a landscaped earthen undulation which gently blends into surrounding terrain.

*Best Management Practices (BMP)* means structural, vegetative, or managerial measures, activities, which help to achieve soil erosion and sedimentation control objectives or enhance water quality.

*Bottom land* shall mean the land area of a lake, stream, or watercourse which lies below the ordinary high water mark and which may or may not be covered by water.

*Buffer strips* (1) are landscaped areas composed of living plant material, a wall or berm, or a combination thereof for the purpose of visual screening and/or noise reduction between conflicting land uses and/or between a thoroughfare and an existing land use. (2) are vegetative areas left in a native state or planted adjacent to water courses or storm water facilities which provide a transition between developed areas and these environmentally sensitive areas typically provided to provide soil erosion and sedimentation control (SESC) protection and enhance water quality.

*Building drain* is that part of the lowest piping of the wastewater drainage system of a building which receives the sanitary sewage from waste pipes, and other drainage pipes inside the perimeter walls of the building and conveys it to the building sewer or sanitary service leads, which begins approximately five (5') feet outside the building wall.

*Building sewer* (or sanitary sewer lead) is that part of the exterior sewer piping of a drainage system which continues from a building drain (approximately 5 feet outside the building wall) and carries the flow emanating from the building drain to the sewer.

*Channel* shall mean the geographical area within the natural or artificial banks of a watercourse required to convey continuously or intermittently flowing water under normal or average flow conditions.

*Check dam* means an earthen, stone, or manufactured structure placed perpendicular in a swale or channel or ditch which reduces water velocities. The design must follow very specific criteria.

*Cisterns* are underground tanks used for the storage of water for fire suppression.

*Clean-out* is a pipe through which cleaning equipment can be pushed to unplug a sewer.

*Clear cut* shall mean the removal of all existing vegetation and natural features on a site.

*Commercial Developments* are businesses or other such developments that are not intended for residential use.

*Community Sewer System* or "System" shall mean a facility for the transportation, collection, processing, treatment, or disposal of sanitary sewage which is owned by a non-governmental entity and which services or which is proposed to service more than one (1) structure.

## CHAPTER NINETEEN

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*Community Water System* shall mean a facility to obtain, treat, transport, and distribute potable water which is owned by a non-governmental entity and which services or is proposed to service more than one (1) structure.

*Compaction* is the densification of soil by mechanical means involving the expulsion of excess air.

*Concrete* is a mixture of Portland cement, fine aggregate, coarse aggregate, and water, with or without admixtures.

*Contractor* means any person(s) under written contract with the landowner, owner, developer, or applicant to perform the described work.

*County agency* is an officer, board, commission, department, or other entity of county government.

*County drain* refers to drains established and/or constructed pursuant to the Michigan Drain Code, Act 40 of the Public Acts of 1956, as amended.

*County enforcing agency* refers to the Oakland County Drain Commissioners Office, as designated by the Oakland County Board of Commissioners.

*County* refers to County of Oakland, State of Michigan.

*Deposit* shall mean to fill, place, or dump.

*Designated Agent* is a person who has written authorization from the landowner, owner, development, or applicant to sign the application and secure a permit in the landowner's name.

*Detention Ponds* shall mean a facility designed for holding (or detaining) storm water runoff for a relatively short period of time and then releasing it at a controlled rate to the natural water course where it returns to the hydrologic cycle. The objective of a detention facility is to regulate the runoff from a given rainfall event and to reduce the impact on downstream drainage systems, natural or man-made.

*Developer* means a person, partnership, or corporation building one building, for occupancy by other than the owner, or creating or developing any parcel of land for any use other than agricultural or form thereof.

*Developer/Owner's Consulting Engineer* shall mean the licensed engineer who has prepared the site plan for review and approval.

*Development documents* shall mean: (a) for a condominium project, the master deed, Exhibit B Drawings, and bylaws provided by Act 59, Public Acts of 1978, as amended; and (b) with regard to subdivisions or other developments, deed restrictions and/or restrictive covenants.

*Development* (1) shall include a subdivision as defined by Act 288, Public Acts of 1967, as amended, a condominium pursuant to the provisions of Act 59, Public Acts of 1978, as amended, or any group of dwellings or structures which are proposed. (2) Shall mean any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations.

*Disturbed area* means an area of land subject to erosion due to the removal of vegetative cover and/or earth moving activities, including filling.

## CHAPTER NINETEEN

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*Diversion* means a ridge graded to divert water to a specific location. It is normally used to reduce the length of slope water runs over, thus reducing the erosive speed of the runoff.

*Drain Commissioners Office* is the Oakland County Drain Commissioners Office.

*Drain* is a either a County Drain or a private storm drain

*Drainage course* shall mean the location of existing surface water, i.e. lake, pond, river, stream, creek, wetland, etc.

*Drainage way* means surface or subsurface drains that remove excess surface water or ground water from land.

*Driveway approach* shall be that portion of a driveway located between the road right-of-way line and the traveled portion of roadway or between the driveway radii returns and the travel portion of the roadway, whichever is greater in size.

*Driveway* shall mean any area or portion of a premises, lot, parcel, or yard used or proposed to be used to provide a means of ingress, egress, access and circulation of vehicles and traffic to, from, and between any public or private street or road, principle, or accessory building, use or structure, loading spaces, or parking spaces or spaces.

*Dry hydrants* shall mean hydrants that are not connected to a municipal water system but rather use an underground tank or surface water source.

*Dwelling* shall mean a structure primary designated or used for residential purposes.

*Earth Change* is a human-made change in the natural cover or topography of land, including cut and fill activities, which may result in or contribute to soil erosion or sedimentation of the waters of the state.

*Easement* is the legal document executed to provide the right to use or control the property of another for designated purposes.

*Effluent* is the flow exiting a process.

*Encroachment* shall mean (1) any impact to a wetland or other natural feature, or (2) any unauthorized use, trespass, or alteration of areas designated on the plans for preservation, protection or not intended for such activities.

*Erosion control permit* means a permit issued at the Oakland County Drain Commissioners Office.

*Excavation* shall mean any breaking of ground.

*Existing Grade* means the vertical location of the existing ground surface or structure prior to excavating or filling.

*Expansion* shall mean any activity where by additional structures or users shall be added to an existing system.

*Filling* means the depositing or dumping of any matter onto or into the ground.

*Final Site Plan* shall be a plan showing all features of a proposed development, as required under the provisions of the Township Zoning Ordinance, including all engineering such as paving, grading, utilities, detention, etc.

## CHAPTER NINETEEN

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*Finished grade* means the final grade or elevation of the ground surface conforming to the proposed design.

*Fire suppression facilities* are any facilities that are used to assist the fire department in fire fighting.

*First Flush* shall mean the initial washing action that storm water has on impervious surfaces.

*Flood hazard area* means land which, on the basis of available floodplain information, is subject to a one-percent or greater chance of flooding in any given year.

*Flood or flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of inland or tidal waters; (2) the unusual and rapid accumulation or runoff of surface waters from any source; (3) the collapse or subsidence of land along the shores of a lake or other body of water as a result of undetermining cause by waves or currents of water exceeding anticipated cyclical levels, or suddenly caused by an unusually high water level in a natural body of water, accompanied by severe storm, or by an unanticipated force of nature, such as a flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseen event which results in flooding.

*Floodplain* (flood hazard area) shall mean land which, on the basis of available information, would be subject to inundation during a base flood event.

*Floodway fringe* shall mean the land area between the floodway and the boundary of the floodplain.

*Floodway* shall mean the channel of a river or other watercourse and the adjacent land areas which must be reserved in order to discharge the base flood.

*Franchised Utilities* shall mean utilities, such as electric, cable, gas, and telephone, which are not maintained by the Township or the County.

*Freeboard* is (1) the vertical distance between the high water surface elevation and the crest of a dam, top of a channel side or the lowest elevation of a detention/retention pond embankment. (2) The distance the water surface can rise before it overflows.

*GLUMRB* is the Recommended Standards for Sewage Works (Ten States Standards). Standards for use as a guide in the design and preparation of plans and specifications for sewage works. Prepared by the "Standards Committee" of the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers.

*Gully* means a deep cut formation in the soil that is the result of erosive water velocity.

*Headwall* is the entrance to a culvert or sluiceway.

*Infiltration* is the movement of water downward from the ground surface through the upper soil.

*Influent* is the flow entering a process.

*Lake* refers to the Great Lakes, and all natural and artificial inland lakes or impoundments that have definite banks, a bed, visible evidence of a continued occurrence of water, and a surface area of water that is equal to, or greater than, one acre, including any navigable tributaries. Lake does not include sediment basins and basins constructed for the sole purpose of storm water retention, cooling water, or treating polluted water.

## CHAPTER NINETEEN

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*Landowner* is the person who owns or holds a recorded easement on the property or who is engaged in construction in a public right-of-way in accordance with Sections 13, 14, 15, and 16 of Act No. 368 of the Public Acts of 1925, as amended.

*“Looped” Connection* shall mean a system that has more than one (1) connection to an existing system of streets, sewers, water mains, etc.

*Main or Trunk Sewer* shall mean a sewer to which one or more branch sewers are tributary.

*Material* shall mean soil, sand, gravel, clay, peat, debris and refuse, or any other substance, organic or inorganic.

*Mitigation* shall refer to the replacement of an existing feature such as vegetation, wetlands, etc. lost or destroyed during development.

*Mobile home* shall mean a structure that is transportable in one (1) or more sections, built on a permanent chassis, and designed to be used with or without a permanent foundation when connected to the utilities. It does not include recreational vehicles or travel trailers.

*Municipality* is the Charter Township of Springfield.

*Municipality’s Engineer or Township Engineer* is the staff engineer or professional engineer employed by the Township.

*New construction* shall mean structures for which the start of construction commenced on or after the effective date of this section.

*Non-point source pollution* means pollution that is washed off the surface of land and impervious surfaces.

*Off-Street loading space* shall mean a facility or space which permits the standing, loading or unloading of trucks, and other vehicles other than on or directly from a public right-of-way.

*Off-Street parking lot* shall be a facility other than for single or two-family dwellings providing vehicular parking spaces along with adequate drives and aisles for maneuvering, so as to provide access for entrance and exit for the parking of more than three vehicles.

*Open Drainage Facilities* are means of storm water conveyance, such as ditches and swales, that are above ground.

*Operation* shall mean the making of additions or deposits, performing any construction or excavation activity, removing, improving and/or developing land in any manner, or any combination thereof.

*Ordinary high-water mark* shall mean the line between upland and bottom land which persists through successive changes in water levels, below which the presence and action of the water is so common or recurrent that the character of the land is markedly distinct from the upland and is apparent in the soil itself, the configuration of the surface of the soil and the vegetation. On an inland lake which has a level established by law, it means the high established level. Where water returns to its natural level as a result of a permanent removal or abandonment of a dam, it means the natural ordinary high-water mark.

## CHAPTER NINETEEN

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*Owner* shall mean any person who has dominion over, control of, title to and/or any other proprietary interest in designated wetland and/or watercourse areas, or title to an obstruction, natural or otherwise, to wetland and watercourse properties.

*Parking space* shall be a permanently surfaced area of land adequate to carry out the off-street parking regulations of the Township of Springfield Zoning Ordinance No. 26, and an area for each motor vehicle complying with the Zoning Ordinance, exclusive of drives, aisles, and entrances given access thereto, and fully accessible for the storage and parking of permitted vehicles.

*Pedestrian Facilities* shall be sidewalks, safety paths, and nature trails designed and constructed for non-motorized uses.

*Percolation* is the movement of water through subsurface soil layers, usually continuing downward to the groundwater table.

*Permitee* means any person to whom a permit is issued pursuant to these rules.

*Planning Commission* is the Planning Commission of Springfield Township.

*Potable drinking water* is water that is suitable for human consumption.

*Private Roads* are those which are to be maintained and operated by the Owner, Condominium/Subdivision Association, or adjacent property owners.

*Public Roads* shall be those which are to be dedicated to the Road Commission for Oakland County (RCOC).

*Registered professional or licensed professional* shall be a registered professional engineer (P.E.), surveyor (P.S.), architect (R.A), or landscape architect (R.L.A.) who is registered in the State of Michigan and whose license is in good standing.

*Reinforcement* is steel bars or tie bars placed in concrete structures for additional support and strength.

*Remove* shall include to dig, dredge, suck, pump, bulldoze, dragline, or blast.

*Retention Ponds* shall mean a facility without the ability for gravity drainage whereby water is held for a considerable length of time for aesthetic, agricultural, consumptive, holding of storm runoff, or other uses. The water may never be discharged to a natural water course, but it is intended to be dissipated by plants, evaporation, or percolation into the ground.

*Right of Way (R.O.W.)* is the strip of land occupied or intended to be occupied by a street, railroad, electric transmission line, oil or gas pipeline, water main, sanitary or storm sewer, or other special use.

*Runoff* shall mean the surface discharge of precipitation to a watercourse or low area.

*Sanitary sewage or wastewater* shall mean wastewater discharged from homes, commercial establishments, and other structures, designated as sanitary flow because it is composed of used or spent water resulting from human use in so-called sanitary conveniences.

*Sanitary sewer* shall mean a pipe or conduit, with appurtenances, that carries liquid and/or water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of storm, surface, and groundwaters that are not admitted intentionally.

## CHAPTER NINETEEN

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*Sanitary sewer system* shall mean a facility for the transportation, collection, processing, or treatment of sanitary sewage.

*Seasonal* shall mean any intermittent or temporary operation which occurs annually and is subject to interruption from changes in weather, water level, or time of year, and may involve annual removal and replacement of an operation, obstruction, or structure.

*Sediment basin* is a naturally occurring or constructed depression used for the sole purpose of capturing sediment during or after an earth change activity.

*Sediment Forebays* are basins which pretreat water prior to outletting into a retention or detention basin which function to reduce incoming water velocities, and to trap and localize incoming sediments, therefore reducing pond maintenance.

*Sediment* is the solid particulate matter, mineral or organic, that has been deposited in water, is in suspension in water, is being transported, or has been removed from its site of origin by the process of soil erosion.

*Site Condominiums* are condominium projects wherein individual parcels of land constituting individual development sites are proposed for separate ownership and use, in a fashion similar to a subdivision.

*Site improvements* shall mean and grading, street surfacing, curb and gutter, sidewalks, crosswalks, water mains and lines, sanitary sewers, culverts, bridges, utilities, and other additions to the natural state of the land which increases its value, utility, or habitability.

*Soil erosion* is the wearing away of land by the action of wind, water, gravity, or any combination thereof.

*Soil Boring* is a geotechnical investigation and analysis of soil conditions taken from digging, augering, or other means of extracting soil from its place of origin.

*Stabilization* is the establishment of vegetation or the proper placement, grading, or covering of soil to ensure its resistance to soil erosion, sliding, or other earth movement.

*Steep slope* means a slope over 15% grade, which is characterized by increase runoff, erosion, and sediment hazards.

*Storm drain* is a conduit, pipe, natural channel, or human-made structure which serves to transport storm water runoff.

*Stream* is a river, creek, or other surface watercourse which may or may not be serving as a drain as defined in Act No. 40 of the Public Acts of 1956, as amended, and which has defined banks, a bed, and visible evidence of the continued flow or continued occurrence of water.

*Stripping* means any activity which removes the vegetative surface cover including tree removal, sod, clearing, grubbing, and storage or removal of topsoil.

*Structure* shall mean any walled and roofed building, a gas or liquid storage tank, or any facility that is principally above ground.

*Subbase* is the layer of aggregate placed on the existing soil as a foundation for the base.

## CHAPTER NINETEEN

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*Subcontractors* are workers hired by the general contractor for the purpose of completing a specific task.

*Subdivision* shall mean the partitioning or dividing of a parcel or tract of land by the proprietor thereof or by his heirs, executors, administrators, legal representatives, successors or assigns for the purpose of sale or lease for more than one year, or building development, where the act of division creates five (5) or more parcels of land, each of which is ten (10) acres or less in area; or five or more parcels of land, each of which are ten (10) acres or less, are created by successive divisions within a period of ten (10) years.

*Subdivision Association* shall mean an association of owners organized pursuant to deed restrictions and/or restrictive covenants in a particular development.

*Subgrade* is the portion of a roadbed surface that has been prepared as specified, upon which a subbase, base, base course, or pavement is to be constructed.

*Surface Drainage* refers to all water flow across the surface of land.

*Surface water* is any water including ponds, lakes, streams, rivers, drains, and wetlands.

*Swale*: (a) a low lying portion of land, below the general elevation of the surroundings; (b) a natural ditch or long, shallow depression through which accumulated water from adjacent watersheds drains to lower areas.

*Temporary soil erosion and sedimentation control measures* means interim control measures which are installed or constructed to control soil erosion or sedimentation until permanent soil erosion control measures are established.

*Time of concentration* is the time required for water to flow from the most distant point on a runoff area to the measurement or collection point.

*Township Board* is the Township Board of Trustees of Springfield Township.

*Township Planner* is the staff planner or community planner employed by the Township.

*Township* shall mean the Charter Township of Springfield, Oakland County, Michigan, acting through its duly elected Township Board.

*Treatment systems* shall be defined as methods and facilities used to cleanse wastewater before disposal.

*Upland* shall mean the land area adjoining a lake, stream, or watercourse, above the ordinary high-water mark, uses for which are essentially non-aquatic.

*Variance* means a modification of the literal provisions of the Ordinance granted by the Township Board or Zoning Board of Appeals in situations or under circumstances where permitted by law.

*Vegetative cover* means grasses, shrubs, trees, and other vegetation which hold and stabilize soils.

*Watercourse or waterway* shall mean any waterway or other of water having well defined banks, including rivers, streams, creeks, and brooks, whether continually or intermittently flowing, and lakes and ponds, or as otherwise shown on an official watercourse and/or wetland map.

*Water main* shall mean a facility for the transportation, and distribution of potable water.

## CHAPTER NINETEEN

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*Wetlands* shall mean land characterized by the presence of water or a frequency and duration sufficient to support and that under normal circumstances does support wetland vegetation or aquatic life and is commonly referred to as a bog, swamp, or marsh. A wetland will be regulated by the state if (1) it is greater than five (5) acres in size and located in a county with a population greater than 100,000, (2) is of any size and is contiguous (within 500 feet) of an inland lake, stream, or pond, or within 1,000 feet of the Great Lakes, or (3) is of any size if MDEQ determines that protection of the area is essential to the preservation of the natural resources of the state from pollution, impairment, or destruction.

*Zoning Ordinance* shall mean the Springfield Township Zoning Ordinance.

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