RICHMOND TOWNSHIP
ENGINEERING AND CONSTRUCTION STANDARDS
A SUPPLEMENT TO LAND DEVELOPMENT ORDINANCE NO. 61

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RICHMOND TOWNSHIP
ENGINEERING AND CONSTRUCTION STANDARDS
A SUPPLEMENT TO LAND DEVELOPMENT ORDINANCE NO. 01-89

STANDARDS: FOR ENGINEERING DESIGN, FOR PREPARATION OF ENGINEERING PLANS AND SPECIFICATIONS, AND FOR CONSTRUCTION OF SITE IMPROVEMENTS

This supplement to the Township's Land Development Ordinance is published by the Township Engineer and will be updated, by formal amendment, from time to time. When Amendments are made, the Engineer will issue a numbered Addendum that indicates the change(s) made. Such Addendum will be sent to those individuals who are officially listed as purchasers of the original standards.

1. General Plan Submission Requirements

A. All plans submitted shall be on 24" x 36" white prints having blue or black lines and shall be neatly and accurately prepared. Judgment should be exercised in the design, layout, and presentation of proposed improvements.

B. Engineering plans shall have a maximum scale of one inch = fifty feet (1”=50’). Profile views shall have the maximum scale of one inch = fifty feet (1”=50’) horizontal and one inch = five feet (1”=5’) vertical.

C. All sewers and watermains shall also be shown in profile views. There shall be a separate profile view for each utility. Profile views shall indicate the size of pipe, class of pipe, slope of the utility, and control elevations of the utility. The existing and proposed grade lines shall be shown along the profile view of each utility. It shall be the responsibility of the design engineer to ascertain that the depth of the utilities does not interfere with any building service sewers or other utilities by maintaining a minimum of eighteen inches (18”) clearance at all crossings. The profile shall show and label all existing and proposed crossing utilities with the crossing clearance.

D. Any land development project requiring more than one sheet of plans must be submitted with a "General Plan" having a maximum scale of one inch = one hundred feet (1”=100’). The "General Plan" shall show the overall project layout (including building locations) and indicate the existing and proposed location of all site features as follows:

1. Existing and proposed street names and right-of-way (ROW) widths.
2. Lot or property identification numbers and dimensions or tract acreage.
3. Location of all existing and proposed structures or buildings.
4. Location and elevations of existing and proposed ditches, culverts, natural waterways, and County Drains.
5. All existing and proposed street names, lot or property lines, and property identification numbers.
6. All existing and proposed public and private utilities within the influence of the site.
7. All existing and proposed public and private easements within the influence of the site.
8. Existing and proposed 100-year floodplain and floodway limits and elevations.
9. Existing areas that are considered to be “wetlands” as defined by the Department of Environment, Great Lakes, and Energy (EGLE) and any proposed wetland mitigation areas.

E. Existing ground contour lines covering the site and at least one hundred (100) feet beyond the property limits shall be superimposed on the general plan of the site. Contour lines shall be shown at intervals as follows:

1. Where the general slope of the land is one percent (1%) or less, the interval shall be one (1) foot.

2. Where the general slope of the land is more than one percent, but less than five percent (1% - 5%), the interval shall be two (2) feet.

3. Where the general slope of the land is five percent (5%) or greater, the interval shall be five (5) feet.

F. The cover sheet shall include the following:

1. A signed Engineer's Certification.

2. A location sketch identifying the site and the nearest main crossroads.

3. A north arrow.

4. The legal property description of all parcels involved in the proposed project or improvements.

5. Richmond Township Standards Notes.

6. A minimum of two Benchmarks based on the North American Vertical Datum of 1988 (NAVD88).

G. All public utilities shall be located at least two (2) feet away from parcel or lot boundary lines and within the middle third of a publicly-dedicated utility easement. A minimum of ten (10) feet horizontal separation shall be provided between all adjacent utilities.

H. Any underground or overhead public utilities shall be located in the road (public or private) right-of-way (ROW) or in an easement adjacent thereto according to the following schedule:

SCHEDULE OF STANDARD UTILITY LOCATIONS

Existing and New Streets Location of Utilities from Centerline [1]

SUBJECT UTILITY	60' ROW (24' Pavement without curbs) [2]	60' ROW (28' Pavement with curbs) [2]	70' ROW (36' Pavement with curbs) [2]	86' ROW (36' Pavement with curbs) [2]	120' ROW (58' Pavement with curbs) [2]
Sanitary Sewer	36’ L	36’ L	41’ L	49’ L	50’ L
Storm Sewer	20’ L	20’ L	26’ L	27’ L	40’ L
Gas	16’ R	18’ R	21’ R	27’ R	35’ R
Hydrants	20’ R	20’ R	25’ R	25’ R	38’ R
Water Main	22’ R	22’ R	26’ R	26’ R	40’ R
Second Sanitary Sewer	--	--	41’ R	49’ R	50’ R
Second Water Main (or storm drain)	--	--	--	--	62’ L
DE -MBT (Underground)	--	--	--	--	45’ R
DE -MBT (Overhead)	31’ R	31’ R	44’ R	44’ R	61’ L/R
Curb Radius at Intersections	25'	25'	30'	30'	30'

Notes:

(1) L means Left; R means Right. In some existing streets where one or more of the utilities have been installed in a location other than described above, the location of remaining proposed utilities shall be determined by the Township Engineer with the concurrence of the Road Commission when appropriate. Where, in the opinion of the Township Engineer, these locations are not desirable or possible, suitable adjustments may be made.

(2) This is not a categorically approved width of pavement, but only an allowance assumed for purposes of this schedule.

I. Elevations shall be based on NAVD88 datum. The Township Bench Marks shall be used where available and a minimum of two (2) bench marks shall be indicated on the plans for each forty (40) acres of the project site area.

J. Finish grade elevations planned for each structure shall be indicated on either the plan view or the profile view.

K. A copy of the site boundary survey with computed control lines indicated, or a copy of the computed plat, if applicable, shall be submitted with the engineering plans.

L. Plans shall have all lettering a minimum height of one-tenth of an inch (0.1”) and be of such quality as to provide for clear and legible electronic scanning.

M. All plans submitted shall bear the seal of the Professional Engineer licensed in the State of Michigan responsible for the design.

N. The plans covering all of the required Site Improvements for a specifically designated area of the Developer's land shall be submitted as one package before any plan review shall commence. If the site is planned to be phased as indicated on the Approved Site Plan or Tentative Preliminary Plat, a full phase may be submitted for review. This phase must include all site improvements necessary for the full function of the phase, including those located within future phases.

O. The Design Engineer shall submit with the engineering drawings a completed Engineering Review Checklist for the site.

P. Record Drawings shall be provided by the Design Engineer / Developer per the current Township record drawings standards.

2. Site Grading and Storm Drainage Collection and Disposal

A. All sets of plans which include plans for storm sewers shall include the current Township Storm Sewer Standard Detail Sheets which shall be considered an inseparable part of the plans when said plans are approved.

B. A Site Grading and Storm Drainage Collection and Disposal Plan is required for all developments, except that if the building site is in a subdivision or other project for which a general site grading plan has been submitted and approved, no separate grading plan or permit will be required. A general enclosed storm drainage system (or a rear yard system in land subdivisions) shall be designed for all land development projects. If there are any upstream watershed drainage areas that need to be routed through the site, sufficient capacity shall be provided for fully-developed upstream drainage into the system.

C. The site grading plan for all building sites shall be designed such that proposed and/or actual site grading is proper and that upstream drainage is not obstructed, and that downstream land will not be adversely affected by runoff from the property under design consideration. Before a Certificate of Occupancy for any building is issued, the site grading and drainage for each building must be approved by the Township. The Township shall require that a survey, drawing, and certificate, done by a Professional Engineer or Registered Land Surveyor licensed in the State of Michigan, be furnished by the Developer indicating that the work has been done in conformance with the approved site grading and drainage plan. It shall be unlawful for any person to interfere with, modify, or obstruct the flow of drainage water across any property in any manner different from the approved plan.

During periods of the year when weather conditions make site grading work unfeasible, a temporary Certificate of Occupancy may be issued, subject to the furnishing of a satisfactory bond, letter of credit, or cash deposit guaranteeing the completion of the work when weather conditions permit.

D. The fall of the land away from any building shall be a minimum of six (6) inches in the first twenty-five (25) feet (two percent 2%). From this elevation, the land shall be at a minimum slope of one (1) foot in one hundred (100) feet (one percent 1%).

The maximum slope of the land for the site, except for transitional ramps between useable site areas, shall be seven (7) feet in one hundred (100) feet (seven percent 7%). The sodded ramp slopes shall be a maximum slope of one (1) foot in four (4) feet (twenty-five percent 25%).

E. Unless otherwise approved by the Township, residential building sites shall be graded as follows:

1. A maximum difference of one-half (0.5) feet shall be provided between adjacent building brick ledge elevations.

2. Brick ledge elevations shall be a minimum of one and one-half (1.5) feet and a maximum of two and one-half (2.5) feet above the adjacent top of curb.

3. A minimum two (2%) percent or one-half (0.5) feet and a maximum seven percent (7%) or one (1) foot of fall, whichever is higher, shall be provided from the brick ledge to the adjacent side yard high point.

4. For units with non-stepped brick ledges, the side yard high point shall be located approximately fifty (50) feet from the ROW.

5. For units with stepped brick ledges, front and rear side yard elevations shall be shown at approximately twenty-five (25) feet and seventy (70) feet, respectively, from the ROW. The brick ledges shall be stepped from front to back with the side yard high point provided at the front side yard elevation.

6. Reasonable building envelopes or footprints shall be shown for each lot, ensuring that the side yard elevations correctly correspond to the front, center, or rear enveloped location as necessary.

F. Adequate soil erosion and sedimentation control measures shall be specified on the plans, and followed during construction, to conform to the requirements of Michigan Act 347, P.A. of 1972, entitled, "Soil Erosion and Sedimentation Control Act of 1972". Approval by the Office of the Macomb County Public Works Commissioner (OMCPWC) of the Soil Erosion Plan is required prior to approval of the engineering plans.

G. All buildings having foundation drains shall direct the flow of drainage water from such foundation drains into an enclosed storm drainage system structure. No building permit for any building having a basement shall be issued unless the plans for such building indicate a drainage water service sewer (drainage water) directly connects to an enclosed storm sewer structure. When the drainage water service sewer is planned to be connected to a storm sewer located in the road ROW, the Developer shall provide service extensions for each lot, from the public sewer to a point located twelve (12) feet outside of the ROW; and such service leads shall be installed prior to paving.

For residential developments, drainage water from basement drains or sump pumps shall be directed by a sump drainage pipe with a minimum six (6) inch diameter to a rear yard storm sewer structures. A minimum two (2) foot diameter structure is required for the most upstream storm structure within a sewer, provided the structure only accepts sump drainage. Minimum three (3) foot structures may be provided for all other structures that only accept sump discharge. Storm drainage shall be conveyed within a minimum twelve (12) inch diameter sewer from the rear yard catch basins to a storm structure within the ROW.

Unless the natural fall of the land being developed will not allow the following, lot grading and storm sewer systems shall be designed such that each lot drains to a catch basin structure at a rear corner of the lot. Rear yard swales shall be designed to carry surface drainage from the opposite lot corner to the storm structure. Therefore, lots shall be designed with alternating high points and low points with catch basins at rear corners ensuring that swales shall not convey water across lot lines.

Storm sewers shall be designated as premium joint where designed along lot lines within the influence of adjacent units or when fifteen (15) inch or greater diameter sewer is indicated.

H. Drainage water run-off from building roofs shall be directed to a point five (5) feet away from the outside walls of any building to a defined overland drainage course. Generally, roof drainage shall not be directed over impervious surfaces, including sidewalks. Unless an adjacent unpaved overland drainage course is available, drainage from building roofs within industrial and commercial sites shall directly connect to an enclosed storm sewer system at a storm drainage structure.

I. The longitudinal slope of any drainage swale shall be a minimum of one-half percent (0.5%). The maximum distance drainage water shall travel in a drainage swale without an intercepting yard catch basin shall be three hundred fifty (350) feet. Not more than one hundred (100) feet of drainage water travel shall be upstream of an angle point (deflection angle 45 degrees or greater) in the drainage swale. Proposed final grade elevations shall be indicated on the plans at each lot

corner in a subdivision, and at a maximum spacing of fifty (50) feet elsewhere.

Where required by the Township Engineer, a six (6) inch diameter perforated underdrain with geotextile wrap shall be provided for drainage with said pipe trench being backfilled entirely with pea gravel up to within four (4) inches of the grade line of swale.

J. Storm water runoff drainage systems shall be designed for a ten (10) year storm by means of the Rational Method formula: Q = CIA; where Q is the peak rate of run-off in cubic feet per second, A is the area in acres, C is the co-efficient of runoff for the drainage area, and I is the average rainfall intensity in inches per hour for a certain time of concentration. The rainfall intensity shall be determined by the formula I = 175/ (25+T); where T is the time of concentration equal to the time required for a drop of water to run from the most remote point of the watershed to the point for which runoff is being estimated. The design engineer shall use judgment in arriving at proper imperviousness factors, but in general the following factors are acceptable minimums:

1. Lawn areas - 0.1
2. Pavement and roof areas - 0.9
3. Overall area of single family residential - 0.35
4. Overall area of multiple housing family residential - 0.55
5. Overall area of commercial development - 0.90
6. Overall area for industrial development - 0.80

The Engineer shall submit a map outlining the various watershed drainage areas, including offsite upstream areas that drain to each inlet point used for design. The map shall be accompanied by storm sewer design computations showing the calculated flow, flow capacity of each pipe run, upstream / downstream inverts and hydraulic grades. The minimum acceptable size of a storm sewer downstream of any storm water inlet structure is twelve (12) inches in diameter.

For the design of storm sewers, Manning's formula shall be used for pipe sizing with an "N" factor of 0.013 for reinforced concrete pipe ("N" factor of 0.025 for corrugated metal pipe if corrugated metal pipe is allowed). Storm sewers shall be designed to provide a minimum velocity when flowing full of two and one-half feet per second (2.5 CFS) and a maximum velocity of ten feet per second (10 CFS).

K. In general, trunk storm sewers or any sewer that carries street drainage water shall be located within a public street ROW. Where public storm sewers are located outside of public streets, they shall be placed in a recorded public utility easement that provides for access to the storm sewer for repairs, connections, and maintenance by the Road Commission of Macomb County.

The minimum acceptable width of easements for storm sewers shall be:

12 feet wide	for sewers 21 inches and under in diameter
20 feet wide	for sewers 24 inches through 48 inches in diameter
30 feet wide	for sewers over 48 inches in diameter

Additional easement width shall be provided if in the MCDR or the Township Engineer’s opinion the depth of the sewer requires wider excavation for construction and maintenance.

L. Where open drains are allowed for drainage water disposal, the Manning's formula shall be used for determination of flow depth and capacity. All open drains under the jurisdiction of Macomb County Office of the Public Works Commissioner or EGLE shall be designed to their standards, respectively. The design engineer shall provide calculations and plans showing the flow and capacity of the drain under a 100-year storm event over the upstream watershed for any open drain that conveys flow for the 100-year floodplain as designated on the Flood Insurance Rate Map (FIRM). Otherwise, all open drains shall be designed under a 10-year storm event.

M. Where possible, a minimum of three (3) feet of cover shall be provided from the finished road or earth grade to the top of any storm sewer. In some cases, it will be acceptable to allow the hydraulic gradient to be above the top of the sewer pipe. However, the design elevation of the hydraulic gradient line shall be indicated on the sewer profile view and hydraulic gradient lines shall be a minimum of one (1) foot below the surface at any location. In any event, hydraulic gradient lines shall be maintained within the pipe on any storm sewers considered to be trunk storm sewers.

N. Access manholes shall be provided along the storm sewer at the sewer's terminus and at every change of pipe size, change of grade, or change of direction. However, the maximum spacing between storm sewer manholes shall be as follows:

Diameter of Storm Sewer	Absolute Maximum Manhole Spacing
12” to 30”	350 feet
36” to 42”	400 feet
48” to 60”	500 feet
66” and larger	600 feet

Note: Height of elliptical pipe shall be used as the criteria for manhole spacing.

All storm sewer structures shall be designed with sufficient diameter based on the number, size and configuration of incoming and outgoing storm pipes. For sewers 42 inches and larger, radius pipe may be used at changes in pipe direction provided a manhole is installed on the straight pipe section immediately downstream. Catch basin leads may tap directly into sewers 42 inches and larger, except that taps shall not be made into a precast manhole tee section.

O. Catch basins shall not be constructed over a main sewer line to replace manholes in street sewers or trunk sewers outside of streets. Moreover, a manhole normally shall not be used as a storm water inlet structure. However, if a normal manhole location (outside of streets) coincides with a storm water inlet structure location and at least 75% of the upstream storm water inlet structures are catch basins (with sumps), the manhole may be used as a storm water inlet structure by placing a catch basin cover on the manhole.

No more than three (3) upstream catch basins will be allowed to discharge into any catch basin. Catch basins shall be a minimum four (4) feet diameter with a minimum two (2) foot sump.

P. Unless otherwise specified by the agency having jurisdiction (i.e. MCDR, OMCPWC, etc.), a prefabricated bar screen shall be installed on the end of all storm sewers eighteen (18) inches in diameter and larger which outlet into an open drain or detention basin. Openings of the bar screen shall be no more than six (6) inches on centers.

Q. In general, pavement type catch basins shall be located as follows:

1. At the radius return of street or drive lane intersections such that drainage may travel a maximum allowable distance of one hundred fifty (150) feet around a corner without an intercepting catch basin.

2. At all low points in streets and parking areas such that there is a maximum pavement drainage area for each structure as follows:

a) Low Point Catch Basins (streets) 10,000 SF/CB

b) Low Point Catch Basins (parking areas) 25,000 SF/CB

3. At intermediate points along the street or parking areas such that there is a maximum pavement drainage area for each structure as follows:

a) Intercepting catch basins (streets) 7,500 SF/CB

b) Intercepting catch basins (parking areas) 25,000 SF/CB

R. Yard type catch basins shall be provided at all low points in drainage swales. Intercepting yard type catch basins shall be provided such that a maximum of three hundred fifty (350) feet of swale drainage runs into one catch basin, other than a low point catch basin where seven hundred (700) feet (350 feet in each direction) of drainage is allowed.

S. Improved open drains are encouraged as an alternative to an enclosed storm sewer system where practical. When open drains are used, the easement width shall be sufficient to accommodate an adequately sized maintenance plateau (with a maximum slope of seven percent - 7%) on each side of the channel.

T. The side slopes of open drains shall have a maximum slope of one-foot vertical to four feet horizontal (1:4 or 25%), except that a low flow channel may have side slopes of one foot vertical to three feet horizontal (1:3 or 33%). Open drain side slopes shall have an established vegetation surfacing as soon as possible after construction. Native plantings, as listed in the current Macomb County Standards for Storm Water Management, shall be utilized where possible. In any event, sufficient measures shall be taken to conform to the erosion and sedimentation control requirements of applicable state or local ordinances.

U. An extension of the storm sewer system shall be provided to furnish an outlet for foundation drain service pipe for any buildings not otherwise serviced; such extensions shall have a minimum diameter of eight (8) inches if not containing surface drainage.

V. Unless otherwise permitted by the Township, OMCPWC, EGLE, MCDR and/or MDOT, any runoff generated by proposed impervious surfaces that will directly and fully discharge to an open storm water course, must be conveyed into a storm water Best Management Practices (BMP) structure for water quality treatment prior to being discharged from the site. Storm water BMPs shall be capable to reducing the Total Suspended Solids (TSS) by 80%. Structural BMP performance shall be verified by third party testing.

W. When, in the opinion of the Township Engineer and/or the jurisdictional agency there is inadequate drainage water outlet capacity, the developer shall be required to install a detention / retention basins or reservoirs. If this solution is deemed appropriate by the Township Engineer, the design and storage capacity of such detention basin shall be equivalent to a minimum of two inches (2”) of water over the basin's entire upstream watershed area and/or as required by the jurisdictional agency, whichever are more restrictive. Discharge from the detention basin shall be at a controlled rate such that the entire capacity of the basin can be discharged in about forty-eight hours. Additional requirements for storm water retention basins are as follows and/or the jurisdictional agency, whichever are more restrictive:

1. Channel Protection Criteria

   Unless otherwise approved by the Township Engineer, OMCPWC, EGLE, MCDR and/or MDOT, the maximum design rate or volume of discharge shall not exceed 0.2 cubic feet per second per acre (0.2 CFS / AC) for a 10-year storm. The Township Engineer may, at his discretion, determine that a lower rate is appropriate, when the required discharge rate exceeds drain capacity.

   The volume and manner of water discharged due to development of the site shall not create adverse impacts to downstream property owners and watercourses.

   It is the property owner’s obligation to meet this standard. Should a storm water

system, as built, fail to comply with the design rate of discharge, it is the property owner's responsibility to design and construct, or to have constructed at his/her expense, any necessary additional and/or alternative storm water management facilities to bring the system into compliance. Such additional facilities will be subject to the Township's review and approval.

2. Determination of Surface Runoff

The Rational Method of calculating storm water runoff as described previously is generally acceptable for sites less than 100 acres in size. For larger sites, due caution should be exercised. Other methodologies such as runoff hydro-graphs, may be required by the Township and/or the agency having jurisdiction for sizing the drainage systems on sites that are deemed potentially problematic. Acceptable alternative methods include:

a) US Army Corps of Engineers HEC-RAS
b) Soil Conservation Service UD-21, TR-20 and TR-55
c) US Environmental Protection Agency's Storm Water Management Model (SWIMM)
d) EGLE's Computing Flood Discharges for Small Ungaged Watersheds

All design rainfall events will be based on the Soil Conservation Service (SCS) Type II distribution.

Computations of runoff hydro-graphs that do not rely on a continuous accounting of antecedent moisture conditions will assume a conservative wet antecedent moisture condition.

3. Detention Systems

Unless otherwise permitted by the Township, OMCPWC, EGLE, MCDR and/or MDOT, all runoff generated by proposed impervious surfaces, must be conveyed into an open storm water storage facility for water quality treatment and detention prior to being discharged from the site. The following criteria will apply to the design of all storm water detention facilities:

a) In general, wet ponds and storm water 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.

b) Public safety will be a paramount consideration in storm water system and pond design. Providing safe detention is the property owner's responsibility. Pond designs will incorporate gradual side slopes, and vegetative and barrier plantings. Where further safety measures are required, the proprietor is expected to include them within the proposed development plans.

c) As a general rule, storm water management systems incorporating pumps shall be avoided. Exceptions to this rule will be considered only as a measure of last resort. The design engineer must demonstrate that no alternative system designs are technically feasible. Special requirements, such as the establishment of an operations/maintenance/replacement escrow account by the Developer, may be imposed to help defray special assessments that would be levied upon future property owners for maintenance of the system.

d) For basins with pumped outlets, the inlet pipe from the detention basin shall be submerged below the permanent water surface to prevent debris from entering the pumping station.

e) Generally, discharge from pump stations shall be made to an enclosed storm sewer outlet to reduce the erosion effects of pump discharge.

f) Pumping stations for de-watering of the detention basins shall include duplicate pumps with each pump capable of handling the design flow. The controls shall include a lead-pump start and stop, a lag-pump start and stop, and alternator for alternating the lead-lag pump, a high water alarm system with a light, horn, telemetry, and a safety all-pumps-off control. The pump controls shall be installed in a suitable weatherproof and vandal-proof enclosure. The pumps shall be connected to the outlet through a separate valve and/or junction chamber.

g) For platted subdivisions or site condominiums, detention basins and associated buffer strips shall be located on common-owned property and not on private lots or condominium units. For other types of developments where a detention pond is serving more than one property, an easement may be used in lieu of common-owned property.

h) Sediment Forebays (lower stage) or approved storm water quality improvement devices will be provided at the inlet of all detention basins to provide energy dissipation and to trap and localize incoming sediments. All storm water management devices shall maintain a minimum 80% TSS removal rate. Structural BMP performance shall be determined by independent third party testing.

   1) The Forebay will be a separate basin, which can be formed by gabions or a compacted earthen berm.

   2) The capacity of the Forebay will be equivalent to the capacity of a 1.5-year storm.

   3) A minimum of 16-foot wide paved maintenance access drive to the Forebay for heavy equipment shall be provided.

i) Vegetative Plantings Associated with Detention Facilities

   1) Basins and marsh designs will be accompanied by a landscaping plan that gives preference to native plant species as listed by OMCPWC in the Design Standards for Storm Water Management.

   2) A permanent buffer strip of natural vegetation extending at least 10 feet in width beyond the basin's top of slope shall be provided around the perimeter of all storm water storage facilities. Detention ponds located at the perimeter of a development shall be provided with an additional landscape buffer, at least 10 feet in width, along the common property line with adjacent parcels.

j) For safety purposes and to minimize erosion, basin side slopes will be a minimum of one foot vertical to twenty feet horizontal (1:20) and a maximum of one foot vertical to six feet horizontal (1:6). For all developments other than residential, all basins having side slopes steeper

than one foot vertical to six feet horizontal (1:6) will be permitted only with the installation of a six (6) foot fence completely surrounding the detention facility and a minimum ten (10) foot shoulder between the top of the slope and the fence. The fence may be chain link or other decorative types as approved by the Township. Gates shall be provided that are sixteen (16) feet wide with a double opening.

Detention basins requiring fencing shall not be located within setback areas adjacent to public thoroughfares unless they are designed architecturally and aesthetically for the specific site. The location and concept of these basins shall be subject to approval by the Planning Commission prior to the Engineering review.

k) For all residential developments, detention basins shall be unfenced with side slopes no steeper than one-foot vertical to six feet horizontal with a minimum ten (10) foot shoulder between the top of slope and easement or property line.

l) Anti-seep collars should be installed on any piping passing through the sides or bottom of the basin to prevent leakage through the embankment. Concrete rip-rap shall be provided at all pipe entrances to the basin. All pipe entering or leaving the basin shall have either a headwall or a flared end section at the end of the pipe.

m) All basins will have provisions for a defined emergency overflow, routed such that it can be picked up by the main outflow channel or enclosed storm drain while not discharging directly over the outlet pipe. Where possible, an overflow structure shall be designed to outlet into an adequately sized storm drain. The overflow shall be designed to accommodate a 10-year storm event over the basin's contributory watershed. There are two possible alternate methods:

1) Using an overflow pipe; the invert elevation of this pipe shall be set at or above the maximum storage elevation of the basin.

2) A low point overflow spillway; the low point of the basin shall be set at an elevation no lower than the maximum storage elevation of the basin. The spillway shall be constructed with concrete or reinforced earth designed to prevent erosion.

n) Adequate maintenance access from public right-of-way to the basin will be reserved. The access shall be a 16-foot wide paved driveway with a slope of seven percent (7%) or less, designed for the passage of heavy equipment, and will provide direct access to both the Forebay and the riser/outlet. Access easements will be required.

o) The placement of detention basins within a 10-year floodplain of a stream, creek, or lake is prohibited. For basin located within the 100-year floodplain, the design engineer must evaluate the hydraulic grade line through the storm drainage system and provide written evidence that the storm water will not result in a harmful interference to any proposed and existing structures or adjacent properties. Basins must not be located within the 100-year floodway.

p) The Township will not release the site development bond for storm drainage until proper vegetation as previously described is established in

the entire basin area except below the permanent water surface in accordance with the Township Standards and approved by the Township Engineer.

4. Detention Design Requirements

On-site management of storm drainage will be designed for control of flooding, control of downstream erosion, and improving water quality. Submission of flow calculations, cross-section, and other pertinent data will be required.

a) A minimum of one foot of freeboard (the difference between the maximum storage elevation and the low point in the watershed of the basin) will be required for all detention basins.

b) At a minimum, the volume of storage provided for flood control will be equal to or in excess of that required by the method outlined in “A Simple Method of Detention Basin Design” developed by Glen Yrjanainen, P.E., and Alan W. Warren for a 10-year frequency storm.

c) The volume and storage provided for controlling the “bankfull” flood will be equal to or in excess of the total rain from a 1.5 year, 24-hour storm. This can be determined by:

5160 x acreage x the relative imperviousness factor (C) = cubic feet

The release rate from the “bankfull” storage volume will be such that this volume will be stored not less than 24 hours or more than 48 hours.

d) The “First Flush” of runoff is defined as the first 0.5 inch of runoff over the entire site. The majority of this volume will be captured in the sediment Forebay, with the residual volume detained for a minimum of 24 hours. The volume of the first flush can be determined by:

1815 x acreage x the relative imperviousness factor (C) = cubic feet

e) Basin Inlet/Outlet Design

1) Engineered velocity dissipation measures based on discharge flow rates and velocities will be incorporated into basin designs to minimize the re-suspension of pollutants, and to create sheet flow conditions where feasible.

2) To the extent feasible, the distance between inlets and outlets will be maximizes. 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 sinuosity. If possible, inlets and outlets should be offset at opposite longitudinal ends of the basin.

3) The outlet shall be well-protected from clogging.

4) Riser Design

(a) The use of a perforated standpipe-type riser structure to assure an appropriate detention time for all storm events is required.

(b) Orifices used to maintain a permanent pool level should withdraw water a least one (1) foot below the surface of the water.

(c) Hoods or trash racks shall be installed on the riser to prevent clogging. Grate openings shall be a maximum of three (3) inches on centers.

(d) 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.

(e) The riser shall be placed near the pond embankment to provide for ready maintenance access.

(f) Barrels and risers will be constructed of materials that will reduce future maintenance requirements. Riser pipes up to four (4) feet in height shall be a minimum of 36 inches in diameter. Riser pipes greater than four (4) feet in height shall be 48 inches in diameter. Riser pipes will be constructed with concrete bottoms.

(g) Riser outlets must include a simple oil/water separator consisting of a “T” or elbow-shaped pipe.

(h) Where feasible, a drain for completely de-watering the pond should be installed for maintenance purposes.

(i) Outlet Design

(1) All outlets will be designed to be easily accessible for heavy equipment required for maintenance purposes.

(2) Discharging at the “crest” of slopes will not be permitted.

(3) Backwater on the outlet structure from the downstream drainage system shall be evaluated when designing the outlet.

5. Wet Detention Basin Design Requirements

a) Storage Volume Requirements

For a gravity outflow 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.

At a minimum, the volume of the permanent pool should be at least:

2.5 x 0.5 inch* x runoff coefficient x site drainage area

* 0.5 inch represents the mean storm event. This was determined by adding the total precipitation rainfall recorded at Detroit Metro Airport from 1977 to 1987 and dividing by the total number of storm events. Storms below 0.2 inch of precipitation, snowfall, and snowmelt were omitted.

b) Detention pond configurations will be designed as follows:

1) Surface area to volume ratio should be maximized to the extent feasible.

2) In general, depths of the permanent pool should be varied and average between three and six feet.

3) A minimum length to width ratio of 3:1 should be used unless structural measures are used to extend the flow path.

4) Ponds should be wedge-shaped, narrower at the inlet and wider at the outlet.

5) Irregular shorelines are preferred.

c) Plantings within the detention pond shall be installed according to the current Macomb County Public Works Commissioner Procedures and Design Standards for Storm Water Management.

d) A shelf, a minimum of four (4) feet wide at a depth of one (1) foot below the permanent water surface, shall surround the interior of the perimeter to provide suitable conditions for the establishment of aquatic vegetation and to reduce the potential safety hazard to the public.

e) In-line detention basins are strongly discouraged in all circumstances and are prohibited on watercourses greater than two (2) square miles upstream. In-line basins are also prohibited if the waterway to be impounded traverses any area outside of the proposed development.

6. Storm Water Wetland Systems

Background

Storm water wetlands are defined as constructed systems explicitly designed to mitigate the storm water quality and quantity impacts associated with development. This is accomplished by temporarily storing storm water runoff in shallow pools that creates growing conditions suitable for emergent and riparian wetland plants. The runoff storage, complex micro-topography, and emergent plants in the storm water wetland together form an ideal system for the removal of urban pollutants. Because of their water quality benefits, the use of storm water wetlands will be considered.

As a general rule, storm water wetlands should not be located within delineated natural wetland areas.

The design of an effective and diverse storm water wetland requires a sophisticated understanding of hydrology and wetland plant ecology. Therefore, a qualified professional with specific wetland expertise must oversee wetland design, construction, re-construction, or modification. A reference for the design

of storm water wetlands is “Design of Storm Water Wetland Systems” by Thomas R. Scheuler and published by the Metropolitan Washington Council of Governments. Plantings shall be installed according to the current Macomb County Public Works Commissioner Procedures and Design Standards for Storm Water Management.

a) Storm water wetland systems must be designed to perform in conformance with all standards for storage volume and discharge rate established in these rules.

b) For developments with storm water wetlands systems requiring maintenance, the developer will provide for the monitoring of wetland plantings and replacement as needed for a two-year period after construction.

7. Floodplains

It is the responsibility of the developer to demonstrate that any activity proposed within a 100-year floodplain will not diminish flood storage capacity. A hydraulic analysis study to determine the 100-year floodplain shall be submitted for review and approval to the Township and all other agencies having jurisdiction. Compensatory storage will be required for all lost floodplain storage.

8. Safety Considerations

Drainage system components, especially detention ponds, will be designed to protect the safety of all persons coming in contact with the system. The following criteria will apply:

a) All wet detention basins will have a level safety ledge at least four (4) feet in width and one (1) foot below the invert of the outlet pipe water depth, and other design and landscaping features as may be needed to provide for protection of the public.

b) Signs may be required to alert residents to use limitations (i.e. Warning against as swimming, ice skating, etc.) of any storm water basin. Warnings may also be required in the Master Deed documents.

9. Operations & Maintenance Requirements

All developments requiring storm water storage facilities shall satisfy the following operation and maintenance requirements:

a) In the case of a platted subdivision, the Declaration of Covenants and Restrictions shall state that all property owner(s) within the Subdivision assume ownership of the facility and are responsible for its operation and maintenance. The Developer shall establish a Special Assessment District (SAD) to reimburse the Township for any expenses incurred for operation and maintenance of said facility due to lack of action by the subject property owner(s). The Final Plat shall note all easements necessary for the operation and maintenance of the entire facility including access driveways.

b) In the case of a site condominium, the Master Deed shall state that the Condominium Association assumes ownership of the facility and is responsible for its operation and maintenance. The Developer shall execute an Operation and Maintenance Agreement to reimburse the

Township for any expenses incurred for operation and maintenance of said facility due to lack of action by the subject Condominium Association. The Developer shall also dedicate all easements necessary for the operation and maintenance of the entire facility including access driveways.

c) For all other developments, the tributary property owner(s) who are contributing improved run-off shall assume ownership of the facility and be responsible for its operation and maintenance. The property owner(s) shall execute an Operation and Maintenance Agreement to reimburse the Township for any expenses incurred for operation and maintenance of said facility due to lack of action by the subject property owner(s). If the facility is to serve more than one property, the Developer shall dedicate all easements necessary for the operation and maintenance of the entire facility including access driveways.

d) Maintenance plans will be submitted with all construction plans and included in the restrictive deeds, Master Deed and maintenance agreement with the Township for all developments and site condominiums and will include the following information:

1) The maintenance plan shall include the components of an estimated annual maintenance budget itemized in detail by task. The financing mechanism shall also be described.

2) A copy of the final approved drainage plan for the development that delineates the facilities and all easements, maintenance access, and buffer areas.

3) A listing of appropriate tasks defined for each component of the system described, and a schedule for their implementation. The following areas will be covered:

(a) Maintenance of facilities such as pipes, basins, BMPs, channels, outflow control structures, pumps, etc.

(b) Debris removal from catch basins, channels, pumps and basins.

(c) Dredging operations for both channels and basins to remove sediment accumulation.

4) The party responsible for performing each of the various maintenance activities described.

5) A detailed description of the procedure for both preventative and corrective maintenance activities. The preventative maintenance component will include:

(a) Periodic inspections, adjustments and replacements;

(b) Record-keeping of operations and expenditures.

6) Provision for the routine and non-routine observation of all components within the system described:

(a) Wet weather inspections of structural elements, (including observation for sediment accumulation in detention basins) shall be conducted at least annually, with as-built plans in hand. These shall be carried out by a professional engineer or certified storm water operator reporting to the responsible agency or owner.

(b) Housekeeping inspections, such as checking for trash removal, shall take place at least annually.

(c) Emergency inspections on an as-needed basis, upon identification of severe problems, shall be carried out by a professional engineer or certified storm water operator.

7) A description of ongoing landscape maintenance needs. Landscaping shall consist of low maintenance and/or native plant species. The viability of plantings will be monitored by the applicant for at least one year after establishment and plantings will be replaced as needed. The Township shall not be responsible for any landscape maintenance.

8) Provision for the maintenance of vegetative buffers by homeowner's associations, conservation groups or a public agency. Buffers will be inspected at least annually for evidence of erosion or concentrated flows through or around the buffer.

The provisions of this Section shall apply to the entirety of the facilities noted such as: detention basin, sedimentation basin and other pollution control devices, flow control devices, pump stations, force main and all appurtenances, bypass and overflow devices, fences, access driveways and any other appropriate item necessary for the operation and maintenance of the facility, as intended.

3. Street and Parking Lot Paving

A. All sets of plans which include plans for street and/or parking lot paving shall include the current Township Paving Detail Sheets which shall be considered an inseparable part of the plans when said plans are approved. All Township Standard Detail Sheets may be periodically amended and/or modified separately from, and without changing the effectiveness of, the main body of this Ordinance.

B. Paving for all streets located within dedicated public road ROW shall be designed and constructed in accordance with the currently adopted specifications of the Road Commission of Macomb County (MCDR). Paving for all internal streets and parking lots, including those privately owned and maintained, shall conform to the specifications of MCDR or the following specifications, whichever is the more demanding requirement:

1. Concrete pavement shall be plant mixed meeting the Michigan Department of Transportation (MDOT) current specifications for Portland Cement Concrete for Pavements over an approved base adequately designed for sufficient thickness and type to be compatible with the expected loading and sub soil conditions.

2. Bituminous pavement shall be plant mixed meeting the Michigan Department of Transportation (MDOT) current specifications for Hot Mix Asphalt Pavements and Surface Treatments over an approved base adequately designed for sufficient thickness and type to be compatible with the expected loading and sub soil conditions.

3. The thickness and widths of the street and parking area pavements shall be as indicated on the current Township Standard Paving Detail sheet.

4. The maximum allowable pavement slope shall be seven percent (7%).

5. The minimum allowable pavement grades shall be as follows:

a. Street and parking area gutter slope	0.5%
b. Street pavement cross-slope	2%
c. Parking area pavement cross-slope	1%

6. Whenever a change in the grade of two percent (2%) or more occurs, a vertical curve shall be provided with a length determined (to the nearest 50 feet) by the following formula: L = 1/2 (G1 - G2); where L is the length in l00 foot stations and G1 - G2 is the algebraic change of grades as a percentage.

7. All intersections shall be designed to allow for a minimum of one percent (1%) drop in elevation around the curb return.

8. Center line curve data (radius, deflection angle, and total arc length) for all street pavement curves shall be indicated on the plans.

9. The top of curb elevations shall be indicated every 50 feet on the profile view.

10. The minimum sight distances for all roads shall be 200 feet for local streets and 300 feet for collector streets.

11. When street centerlines have a deflection of more than ten (10) degrees, but less than seventy-five (75) degrees, the centerline shall have a curve with a minimum radius of 150 feet for local streets and 300 feet for collector streets. Between reverse curves, there shall be a tangent section of 50 feet for local streets and 200 feet for collector streets. For streets with deflections of 75 degrees or greater, the curvature requirements shall be determined

by the MCDR and the Township Engineer.

C. Edge drains shall be provided along the entire length of public and private roads and at low point catch basins in parking lots as shown on the current Township Standard Detail Sheets.

D. All street and parking lot pavement shall have concrete curbs designed per the current Township Paving Detail Sheets. Where the street pavement is a boulevard section, the island curbs shall be six (6) inch high roll curbs. A six (6) inch concrete curb shall be placed around the perimeter of all paved parking areas (including entrance drives).

E. A detail shall be indicated for all intersections, "eyebrows", and cul-de-sacs. The detail shall show jointing and detailed pavement surface grades, including gutters and tops of curbs. The scale of the detail shall be one inch equals no more than thirty feet (1”=30”). Cul-de-sacs shall not be more than six hundred (600) feet in length. Special consideration shall be given to longer cul-de-sacs under certain topographic conditions or other unusual situations. Cul-de-sacs shall terminate with an adequate turnaround with a minimum radius of sixty (60) feet for ROW, and the pavement outside the curb shall be sixteen (16) feet from the ROW line.

F. At the end of a stub street that will be extended in the future, a one-foot header and standard road end barricade and signage shall be provided in accordance with current MCDR and Richmond Fire Department standards. A temporary turn-around, designed in accordance with MCDR standards, shall be provided at the ends of all stub streets.

G. Where the Township Zoning Ordinance requires off-street parking, the design of the parking area shall conform to the requirements as indicated on the current Township detail sheets, which will be considered an inseparable part of these Engineering and Construction Standards. All parking lot layouts shall be designed to meet the current requirements of the Township. The following criteria shall be maintained in the design of all street and parking lot intersections:

1. Streets and parking lot drive lanes shall intersection at 90 degrees or closely thereto and in no case at less than 80 degrees.

2. Minimum clear sight distance at all intersections shall permit vehicles to be visible to the driver of another vehicle when each is 125 feet from the center of the intersection.

3. No more than two streets or drive lanes shall cross at any one intersection.

4. Except on major and certain collector roads, tee-type intersections shall be used where practical.

5. Drive lanes shall be 24 feet wide for two-way traffic and 20 feet wide for one-way traffic. Commercial approaches shall be 30 feet wide at the ROW line.

6. When the area is to serve three or more automobiles, the individual car spaces shall be marked by painted-on yellow stripes a minimum of three (3) inches wide. The stripe shall extend from the front of the parking stall space to a distance of twenty (20) feet (if curbs are proposed, the stripes shall extend 18 feet from face of the curb) The distance center to center of stripes, as measured perpendicular to the stripes shall be a minimum of ten (10) feet.

7. Parking bays shall have a standard width of 64 feet. However, a car overhang of two (2) feet will be assumed and the width between face of curbs may be reduced to 56 feet. Moreover, on the curb side of a multiple bay parking area, the two (2) foot overhang may be assumed for the purposes of reducing the pavement width of the outside bay to 62 feet. Where the parking area is adjacent to the project boundary line, the back of curb shall be located at least four feet from such boundary line.

8. When sidewalks are provided adjacent to the parking area curbs where car overhangs occur, such walks shall be a minimum width of seven (7) feet as measured from the face of the curb.

4. Water Supply and Distribution System

A. All sets of plans which include plans for water mains (public or private) shall include the current Township Watermain Detail Sheets which shall be considered an inseparable part of the plans when said plans are approved. All water mains shall be sized in accordance with the current Township Water System Master Plan.

B. All water mains shall be shown in a plan view. Water mains sixteen (16) inches or larger in diameter shall be shown in a profile view. Detailed water main profiles shall also be provided at major utilities or drain crossings for all water mains, or when otherwise required by the Township Engineer and/or agencies having jurisdiction.

C. The plan shall indicate the proposed finished grade elevations of all hydrants, gate valve, and/or other structures.

D. The type, capacities, location and layout of the water service pipes shall comply with all requirements of the Township, the Macomb County Health Department, and the State of Michigan. A building water service pipe shall be shown on the plans for each building in the project. Where water mains are planned along the roadways, the building water service pipe for each lot shall be extended (by the Developer) across the roadways prior to paving. Each service pipe shall be terminated with a curb stop and box that is located at a point two (2) feet outside of the road ROW or the lot line. A wood post or marker shall be provided to mark the end of all leads. Domestic and fire suppression lines shall be separate services.

E. The type of pipe and joints indicated on the plans shall be in accordance with the current Township Standard Detail Sheet.

F. All water mains shall be installed with a minimum cover of five (5) feet below finished grade. Where water mains must dip to pass under a storm sewer or sanitary sewer, the minimum acceptable crossing clearance shall be eighteen (18) inches. At all open drain crossings, a minimum clearance of five (5) feet between bottom of drain and top of watermain shall be provided. The pipe sections which are deeper than normal shall be minimized by the use of vertical bends (the maximum deflection allowed is 22.5 degrees) properly anchored with restrained joints through the bend and two pipe lengths beyond the last bend.

G. Public water mains, other than hydrant leads, shall be sized in accordance with the current Township's Master Watermain Plan (minimum of eight (8) inches in diameter). All hydrant leads shall be six (6) inches in diameter, but if they are longer than one hundred (100) feet, they shall be eight (8) inches in diameter with a valve provided at the main. Where private water mains are allowed (e.g., Mobile Home Parks et al), those water mains to which hydrant leads are to be connected shall be at least eight (8) inches in diameter.

H. All valves, except hydrant valves, shall be installed in a standard valve well. Valves shall be located in the system such that not more than four (4) valves need be turned off to isolate any individual section of watermain. Moreover, sufficient valves shall be placed such that not more than thirty (30) dwelling units or service establishments are serviced between valves. Where possible, valves shall be located at street intersections five (5) feet beyond the intersecting street ROW lines with a maximum spacing of 800 feet. All dead end mains shall be valved near the end. Where possible, valves shall be located outside of paved areas, including parking lots. Hydrants shall be located within curbed islands; the singular use of bollards as a means of protection from vehicles

within a parking lot will not be allowed.

I. Hydrants shall be installed along the water main with a minimum spacing of five hundred (500) feet within residential areas and a minimum of three hundred (300) feet elsewhere. Additionally, all external portions of all buildings shall be within three hundred (300) feet from a hydrant. In multi-family, commercial, or industrial districts, additional hydrants may be required by the Fire Marshal. Hydrants shall be installed at the ends of all dead-end water mains. The spacing and locations of all hydrants and valves are subject to review and approval by the Township Fire Marshal

J. Where a public watermain or hydrant is not located in a public street ROW, the plan shall show an easement for the main and hydrants. On each side of all roads in new subdivision plats, a “12-foot-wide permanent easement for public utilities" shall be provided. The easement shall extend a minimum of six (6) feet each side of the water main and/or the hydrant. For Developments other than subdivisions, appropriate easements for public utilities (including water service curb stops) shall be provided.

K. No bends shall be proposed for water mains with a deflection angle greater than 45 degrees.

L. Where possible, the water main shall be located within greenbelt areas.

M. Water main shall be extended around the circumference of all cul-de-sacs such that all units will be served. Water service bores shall not be longer than 28 feet in length.

5. Wastewater Collection and Disposal System

A. All sets of plans which include plans for sanitary sewers shall include the current Township Sanitary Sewer Detail Sheets which shall be considered an inseparable part of the plans when said plans are approved.

B. For every sanitary sewer project, the plans shall indicate on the profile view (near the downstream end of the sewer) a manhole with a 12" deep manhole sump to be used for testing for infiltration. No sanitary sewer section having a leakage rate of more than one hundred (100) gallons per inch of pipe diameter per mile of pipe per 24-hour period shall be approved for connection to the Township Sanitary Sewer System. A temporary bulkhead shall also be provided at the connection to the existing sewer until testing is completed.

C. The minimum allowable size of a public sanitary sewer shall be ten (10) inches in diameter. For all areas, except for industrial use, the minimum allowable size of a building service sewer (or lead) is six (6) inches in diameter (for up to 12 dwelling units or capacity units or equivalent unites). A building service sewer (or lead) that services more than twelve (12) dwelling units (or equivalent) shall be a minimum of eight (8) inches in diameter. For industrial use, a minimum eight (8) inch building service sewer with an observation manhole shall be provided.

D. The following table of acceptable slopes for sanitary sewers shall be adhered to providing a minimum of two (2) feet per second and a maximum of ten (10) feet per second velocity:

Sewer Size	Minimum Slope	Maximum Slope
6"	1.00%	
8"	0.40%	
10"	0.30%	4.0%
12"	0.22%	3.0%
15"	0.15%	2.0%
18"	0.12%	1.5%
21"	0.10%	1.3%

24"	0.08%	1.2%

E. Sanitary sewage force mains shall be designed for a minimum velocity of two (2) feet per second and a maximum velocity of twelve (12) feet per second, unless otherwise approved. Force mains shall be shown in a profile view with grades and elevations indicated thereon. An air relief and cleanout assembly manhole shall be provided at high points and low points respectively. Access (cleanout assembly) manholes shall be provided along the force main at least every six hundred (600) feet.

F. A building service sewer shall be indicated on the plans for each building in the project. Where sanitary sewers are planned along roadways, the building service sewers shall be extended (by the Developer) at the center of each lot to a terminus that is located twelve 12 feet outside of the road right-of-way prior to paving. The design engineer shall provide an elevation schedule on the plans that indicates the proposed clearance for all storm sewer and water main crossings.

G. Manholes shall be provided along all sanitary sewers (8" and larger) at:

1. Points of horizontal deflection
2. Points where the size of sewer is changed
3. Points where the slope of the sewer is changed
4. At junctions with other sewer lines
5. At the upstream terminus of a sewer run
6. Along the sanitary sewer every 350 feet for 8” through 21” diameter
7. Along the sanitary sewer every 400 feet for 24” and larger diameter

All manholes shall be a minimum of four (4) feet in diameter and appropriately sized to accommodate inlet and outlet pipes, pipe orientation, drop assemblies or other section features.

H. At manholes where the size of the sewer changes, match the 0.8 diameter elevation points of the inlet and outlet sewer. At manholes where the horizontal deflection in the sanitary sewer is greater than 45 degrees, provide a minimum drop of 0.10 feet additional adjustment in the grade to allow for loss of head. Additional elevation adjustments may be made when conditions allow provided that when the invert of any inlet sewer is more than 18" above the outlet sewer, an interior drop assembly shall be provided within a minimum five (5) diameter manhole.

I. In general, sanitary sewers shall be located within a public street right-of-way. Sanitary sewers shall not be located within rear lot line easements, except in extremely unusual circumstances as determined by the Township Engineer. Where public sanitary sewers are located outside of public streets, they shall be placed in a recorded permanent public utility easement that provides for unlimited access to the sanitary sewer for repairs, connections, and maintenance. The minimum acceptable width of easements for public sanitary sewers shall be twenty (20) feet wide; Additional easement width shall be provided if in the Township Engineer’s opinion, the depth of the sewer requires wider excavation for construction and maintenance. Normally, the sanitary sewer shall be located within the middle third of the above designated easement width.

J. Public sanitary sewers shall be designed to have a minimum depth from finish grade elevation to top of sewer of 8.5 feet at local control points or 9 feet at locations where the sewer grade is parallel to the road grade. However, the sewer shall be designed deep enough to serve a standard depth basement for the type of building for which the land is zoned.

K. Each wye or terminus of building service sewer shall be plugged with an infiltration-proof plug having a joint similar to those of the main sewer. A wood post or marker shall be provided to mark the end of all leads.

L. The type of pipe and joints for sanitary sewers shall be in accordance with current Township Standards.

M. All plans including sanitary sewer shall provide a list of proposed sewer pipe and structure quantities, a Basis of Design completed in accordance with EGLE requirements for Wastewater System Construction, and a service district map delineating the initial and ultimate service areas of the proposed sanitary sewer.

N. All sanitary sewers shall be designed to have sufficient depth and capacity to provide adequate service for all upstream areas within its district as delineated on the current Township Sanitary Sewer Master Plan.

O. A minimum ten (10) feet horizontal separation shall be provided between all adjacent utilities. A minimum eighteen (18) inches vertical clearance shall be maintained at all storm sewer and water main crossings.

6. Other Site Improvements and Borrow Pits

A. Sidewalks and Driveways

1. Sidewalks shall have a minimum thickness of four (4) inches in pedestrian-only areas and a minimum thickness of eight (8) inches in areas where vehicular traffic will cross the walk. However, if driveways are thicker than eight (8) inches, when heavier automobile loads are anticipated, the sidewalk thickness shall match the driveway thickness.

2. Five (5) foot wide concrete sidewalks shall be provided along all public right-of-ways for the full length of the subject parcel. Sidewalks shall be located one foot inside the right-of-way and designed in accordance with the Township Standard Paving Detail Sheets. The location of all ramps and curb drops shall be shown in plan view. The width of the walk shall be a minimum of three (3) feet for other than public walks, but shall be subject to review and approval by the Township Engineer.

3. Driveways shall have a minimum thickness of eight (8) inches. However, where loads heavier than standard automobile loads are anticipated, the driveway pavement thickness shall be designed with a thicker section accordingly. The revised pavement design calculations shall be submitted to the Township for review and approval.

4. Construction joints with a half (0.5) inch premolded expansion filler shall be placed at maximum intervals of fifty (50) feet. Contraction joints shall be placed at a minimum interval of five (5) feet and a maximum interval of seven (7) feet, or equal to the width of walk, whichever is greater.

5. Sidewalks shall be constructed along a planned longitudinal grade line. The maximum longitudinal slope shall be six percent (6%). The transverse slope of the sidewalk shall be a minimum of two percent (2%) and a maximum of four percent (4%).

6. Concrete for sidewalks and driveways shall have a 28-day compressive strength of at least 3,500 pounds per square inch.

7. Ramps designed in accordance with the current American Disabilities Act (ADA) standards are required at all intersections with public roads, parking lot drive lanes, and any other changes in sidewalk grade. Ramps shall be shown on the engineering plans to be constructed with concrete and having detectable warning plates of a contrasting color to the surrounding pavement.

8. A minimum 10-foot buffer shall be provided between the sidewalk and the top of bank for any Drain crossing or detention basin.

B. Other Public Utilities

1. Unless otherwise approved by the Township Engineer, the installation of public utilities other than Township sanitary sewers, watermains, or storm sewers shall not be started until the finished grade has been established. The utility Company's contractor shall be required to restore the ground to the finished grade. The drainage water swales shall be restored to a workable condition at least as good as existed prior to construction. Furthermore, all land and/or other physical features affected by the construction of the public utility shall be restored to a condition at least as good as that existing at the time construction was begun.

C. Borrow Pits

1. Borrow pits may be allowed within a land development, provided the procedure and regulations cited below are complied with.

a. No borrow pits may be dug within fifty (50) feet of a building for which a building permit has already been issued.

b. As part of the land development's engineering plan submittal, the Developer's Engineer shall indicate the proposed elevations, depths, widths, lengths, slopes and locations of any borrow pits proposed for the development. The only acceptable locations for borrow pits are as follows:

(1) In Subdivision Developments: within the rear thirty (30) feet of any lot, but not within five (5) feet of any underground utilities.

(2) In Developments other than Subdivisions: a minimum of five (5) feet from any proposed building, pavement (including streets, parking lots, and sidewalks), and underground utilities.

c. In the case of platted subdivisions or site condominiums, borrow pits shall be fully described in Building and Use Restrictions to be recorded with the plat or Master Deed, to run with the land, so as to describe each lot therein affected by the borrow pit with the further restrictive covenant: "No structures, such as, but not limited to, houses, accessory buildings, or in-ground pools, shall be constructed on areas of certain lots unless footings for the same are placed on undisturbed soil, or to the satisfaction of the Township Building Department."

d. Borrow pit side-slopes shall not be steeper than seventy-one (71) degrees from the horizontal plane (i.e. not steeper than 1:3 slope). Additionally, the Developer and his Contractor are responsible for complying with all Michigan Occupational Safety and Health Administration (MIOSHA) requirements.

e. Borrow pits may not be excavated deeper than eight (8) feet below original undisturbed ground elevation.

f. Borrow pits shall be backfilled with clean earth (i.e. free from any debris, building materials, trees, other organic material, …etc.) as soon as possible after excavation.

g. When a borrow pit that is more than five (5) feet deep is left open for more than ten (10) days, the Developer shall install a five (5) foot high fence completely around the borrow pit and maintain such fence until the borrow pit is filled in.

h. No building permit shall be issued for any building within the land development until the following requirements are fulfilled:

(1) All borrow pits within the development are filled to within two (2) feet of original grade.

(2) The Developer has furnished a certification from his Engineer indicating:

(a) Actual elevations, depths, widths, slopes, and lengths as excavated.

(b) All borrow pits in the development are backfilled to within two (2) feet of original grade.

i. When the requirements of above paragraphs "h(1)" and "h(2)" have been fulfilled, building permits may be issued for buildings on sites not affected by a borrow pit. However, on those sites affected by a borrow pit, a building permit will not be issued until the Township Engineer has been furnished representative compaction tests for said building site, indicating that the complete borrow pit has been backfilled in layers (no greater than 12 inches deep) of earth fill compacted to a density that is at least eighty (80%) percent as dense as the maximum obtainable density for such backfill material. The soil borings and compaction tests shall be performed as directed of the Township Engineer. A site will be considered "affected by a borrow pit" if a borrow pit existed on the subdivision lot or unit or if a borrow pit is constructed within thirty (30) feet of a building on a non-subdivision site.

7. Construction and Construction Observation

A. All work covered under the Township's Construction Permit of Site Improvements shall be performed according to the approved plans and specifications and in accordance with the Township standards and requirements. By making an application for a Permit for Construction of Site Improvements, the Developer grants the Township the right to perform construction observation of any work covered under the permit and the developer shall correct, at his expense, any work that is discovered to be done in conflict with the approved plans and specifications or in conflict with the Township standards and requirements.

B. The Developer shall pay a fee to cover all costs of construction observation of work covered under the Construction Permit. The basis of the fee to be paid the Township shall be the actual cost to the Township plus an administration and overhead expense in the amount of 20% of such cost. Actual cost, as used herein, shall be considered the actual gross payroll or contract cost per hour times the number of hours expended.

C. The fee for construction observation as determined above shall be deducted from the amount of the construction observation deposit paid upon application for a Construction Permit. If the fee so determined exceeds the amount of the deposit, the developer shall make up such deficiency in deposit by paying forthwith, upon discovery, an additional deposit to cover the cost of construction observation until the job is completed and approved. Upon completion and final approval of the work, any money left in the construction observation deposit account will be returned to the developer.

D. The Township reserves the right to observe all work covered under the Construction Permit and intends to provide detailed construction observation for all of the following:

1. All of those types of construction where detailed construction observation requirements are covered in the Township Sewer and Water Ordinance;

2. All sanitary sewers (public or private) including connections thereto;

3. All water supply pipe (public or private) including connections thereto;

4. All open and enclosed storm drains (public or private) including connections thereto, except in the case of those storm sewers considered private storm sewers in mobile home parks that do not receive drainage water from premises other than the mobile home park site or those under the jurisdiction of the OMCPWC or the EGLE;

5. The site grading for any site;

6. All borrow pit excavation and backfilling. The expense for the observation of the borrow pit excavation and backfilling may include soil borings, density-compaction tests, laboratory analysis and/or engineering consultation expenses;

7. All sidewalk construction installed inside of outside of those rights-of-way that are dedicated to the MCDR;

8. All street and/or parking lot pavement installed outside of those rights-of-way that are dedicated to the MCDR;

The Township may provide construction observation that aims at verifying general compliance with the requirements of Township Ordinances for all other site improvements. But the Developer shall be responsible for installing all Site Improvements in accordance with Township Ordinances.