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Development Requirements and Procedures

A. General Plan Review Procedures:

1. The plan review and approval process consists of two phases, the Preliminary Site Plan and the Final Site Plan, both of which must be completed before construction can begin.

Detailed descriptions of the preliminary and final site plan review processes and requirements are subsequently described in Sections B and C. The platting process and requirements are prescribed by the Subdivision Control Act, Act 288 of the Public Acts of 1967.

A copy of the site plan application is included in the Appendix and is available online at www.villageofdexter.org. Original copies should be obtained from the Zoning Office for completion and submittal to the Village.

Preliminary Site Plan

The first phase includes submitting preliminary site plans, application, and fees to the Village of Dexter. The Zoning Office distributes the plans to the appropriate Village departments and outside consultants. These review agents do a conceptual plan review of the plan to verify that it meets zoning ordinances, basic Village standards, and is generally feasible. The conceptual plan review is conducted to ensure that the project can be serviced by sanitary and water utilities, that the necessary storm sewer and detention are proposed, and that the proposed road widths, paving grades and general grading of the site will meet Village standards. The Planning Commission reviews the comments and makes a recommendation to the Village Council to approve or deny the plans.

Final Site Plan

The second phase begins when the Village Council approves the preliminary site plan. The developer then submits final site plans that include detailed engineering plans and fees to the Village of Dexter. The Zoning Office distributes the plans to the appropriate Village departments and consultants who perform a detailed review of the plans. The Planning Commission reviews the comments and makes a recommendation to the Village Council to approve or deny the plans.

2. Once the Village Council has approved the site plan, the applicant must obtain all required permits before construction. The Village Engineer will advise the Village

regarding the required permits, (see Section E) and the amount of the initial inspection deposit. The Zoning office will issue an approved copy of the site plan and application. The applicant will take these copies to the Washtenaw County Building Department to obtain a building permit.

3. An applicant may, at the applicant's discretion and risk and with approval of the Community Development Manager, combine the two phases, Preliminary & Final Site Plans, in a single Combined Site Plan application for approval. The Community Development Manager shall have the authority to require separate preliminary site plan and final site plan submittals where, in its opinion, the complexity and/or size of the proposed development so warrant. An applicant submitting a site plan for Combined Site Plan review shall submit seventeen (17) complete sets of plans with the combined site plan application. Combined site plan submittal will not be accepted for any development consisting of two (2) or more phases.

B. Preliminary Site Plan Requirements:

1. The applicant seeking site plan approval from the Village of Dexter is strongly preparing the plans. It is important that the plan reflect the requirements necessary to assure passage through the Village reviews and approvals. Seventeen (17) complete sets of folded preliminary site plans will be required for the preliminary site plan application.
2. Once the applicant has reviewed the project with staff and prepared a complete preliminary site plan following these standards, a submittal to the Village Planning Commission is in order. All documents and fees required for Planning Commission approval must be received by the Village according to the Planning Commission calendar prior to submittal to the Planning Commission. A schedule of regular meeting dates is posted for public display at the Village Office.
3. When the completed plan has been received at the Village Zoning Office, it will be distributed to the staff and consultants for review and comments. Plans are reviewed to determine the practicality of the project and impact on services and surrounding properties. Compliance with Village standards and ordinances will also be reviewed. Special engineering design considerations may also be addressed. Any items deviating from the Village Standards and Details must receive written approval from the Village staff and Village Engineer, and be approved by the Village Council.
4. Upon completion of the review, the Village Engineer will return one set of plans to the Design Engineer with any necessary revisions and/or corrections noted on the plans and/or in a review letter. If necessary, directions will be given at that time as to how many plans must be resubmitted. The plan will be returned to the Design Engineer as often as is necessary to meet Village requirements.

5. The Village Zoning Office will assemble all comments and provide them to the Planning Commission for their review. The Planning Commission will recommend that the Village Council either approve or deny the plan. If the plan is approved by the Village Council, the applicant may begin preparing final site plans.
6. The preliminary site plan must conform to the requirements of the site plan application form as well as those items required on the preliminary site plan checklist.

C. Final Site Plan Requirements:

1. Before final site plan approval is granted by the Village Council, the plans must first be reviewed by the Zoning Office, the Village Engineer, the Village Planner, the Dexter Area Fire Department and the Village Planning Commission.
2. The final site plan must conform to the requirements of the site plan application form as well as those items required on the final site plan checklist. Deviation from the engineering standards is only allowed with approval from the Village Staff and Village Engineer.
3. Seventeen (17) complete sets of folded final site plans will be required for final site plan application. It is recommended that the applicant schedule a time to meet with the Village before for submitting any plans. All plans must be signed and sealed by a professional engineer registered to practice in the State of Michigan. A complete submittal requires an application and fees.
4. The Zoning Office will forward the plans to all staff and consultants that may have jurisdiction over a certain phase or area of the site for review. The review comments of these other departments will then be incorporated with the reviews from the planning and engineering consultants.
5. Upon receiving all staff comments, the Village Zoning Office will assemble all comments and provide them to the Planning Commission for their review. The Planning Commission will recommend that the Village Council either approve or deny the plan. When the plan is subsequently approved by the Village Council, the Zoning Office will issue an approved copy of the site plan and application. The applicant will take these copies to the Washtenaw County Building Department to obtain a building permit.
6. While approvals may be granted with contingencies on individual phases, partial approvals will not be given. All revisions on all phases must be made before final site plan approval.
7. Final approval will not be given by the Village until all required fees and inspection deposits have been submitted.

8. Three (3) copies of a detailed, itemized construction cost estimate for all water main, sanitary sewer, paving and drainage improvements must be submitted to the Zoning Office, and the Village engineer at time of plan submittal. The estimate must be sealed by the Design Engineer. The construction cost estimates will be used to determine the maintenance and guarantee bond amounts as outlined in Section H.
9. For platted subdivisions, a copy of the computed plat will be submitted with all subdivision plans, and all design calculations for the storm, sanitary sewers and water mains.
10. Before issuing final zoning compliance for an occupancy permit, record plans must be reviewed and approved by the Village. The record plans must be prepared and certified by a registered engineer. A grading certificate will also be required at this time. Please see the Record Drawing Requirement checklist for record plan requirements (see Appendix).
11. Any necessary state permit applications will not be submitted until final site plan approval is granted by the Village Council and the Village Engineer.
12. No construction work can begin until all permits including local, county, and state permits, have been secured. Copies of all required permits shall be submitted to the Village Engineer and the Village Zoning Office.

D. Construction Requirements:

1. The Village Engineer will provide inspection on all public utilities and improvements in the Village right-of-way. Wherever possible, inspection will be full-time on public water mains, sanitary sewers, storm sewers, and paving. Inspection will also be provided by the Village for sidewalks, approaches, taps to public water main and storm sewers, onsite paving, private storm sewer, and sanitary sewer.

Sanitary sewer taps and water main taps will be inspected by the Village of Dexter or the Village Engineer. Note that the Washtenaw County Building Department generally inspects the sanitary sewer lead from the main to the building and the water service from the curb stop box to the building.
2. Prior to commencement of work, a minimum of seventy-two (72) hours notice is required to ensure the presence an inspector representing the Village. Also, inspection deposits must be submitted to the Village prior to commencement of any work.
3. The contractor must obtain all of the required permits before starting construction. A pre-construction meeting should be scheduled at least 3 weeks prior to the anticipated start of construction. Applicants should work with the Village to

schedule pre-construction meetings at least 2 weeks prior to the meeting itself. The Village Engineer will notify all appropriate parties.

4. All public improvements must be field staked under the supervision of the engineer that prepared the plans. Staking must be according to the approved plans.
5. All construction must conform to the current MIOSHA safety standards.
6. At the time of final inspection for all public improvements, the owner or his contractor will provide all necessary labor and equipment to allow the Village to inspect the system.
7. Generally, one inspector will be assigned to a particular project and will be responsible for that project until its completion. The contractor and the inspector may arrange for day-to-day inspection. Any interruption or moratorium on the flow of work may result in a reassignment of that inspector to another project and require the normal forty eight (48) hour notice before work is resumed.
8. When the project is finished, a certification from the design engineer will be required indicating that all work has been completed according to the approved plans. As-built plans must be accepted by the Village prior to a substantial completion letter being granted. Electronic plan submittal requirements per the engineering standards must also be met prior to the issuance of the substantial completion letter.
9. Working hours (including running of any machinery) shall be restricted to Monday through Saturday, 7:00 am to 7:00 pm, or sunup to sundown; whichever is less. Construction operations beyond the time periods previously mentioned shall be permitted only after written approval from the Village Manager and/or Superintendent of Public Services.
10. The contractor shall keep public streets clean and free of debris at all times as required by Village Standards and the Soil Erosion and Sedimentation Control Permit issued by Washtenaw County.

E. Permit Requirements:

It is the responsibility of the applicant to obtain the appropriate permits for the site. All permits must be obtained and submitted to the Village and the Village Engineer prior to holding a pre-construction meeting. Permits that may be necessary are listed below.

1. Building Permit:

Before any construction can begin, a building permit must be obtained from the Washtenaw County Building Department. The applicant is required to submit a zoning compliance permit and an approved site plan when making an application for a

building permit. This permit will not be issued until plans have been approved by the Village of Dexter Council, the Village Planner and the Village Engineer.

2. Soil Erosion and Sediment Control Permit:

This permit is required prior to the start of any site improvements. Applications are available at the Washtenaw County Department of Environmental Services. A bond will be required in accordance with the Washtenaw County code.

3. Village Right-of-Way Construction Permit:

Anyone wishing to do work in a Village of Dexter right-of-way must apply for and obtain a permit from the Village. This includes, but is not limited to, driveway construction and reconstruction. The Village Right-of-Way Permit application is available in the Appendix or online at www.villageofdexter.org.

4. Michigan Department of Environmental Quality (Water):

Construction of a public water main requires the approval of the Village of Dexter and a construction permit from the Michigan Department of Environmental Quality (MDEQ) required under Public Act 399 (1076). The applicant will submit four (4) sets of plans and specifications, signed and sealed by the Michigan registered professional civil engineer responsible for the preparation of the plans and specifications. A permit application must be completed and, along with the water main basis of design for the proposed water main, be submitted by the proprietor's engineer. In addition, a tabulation of water mains consisting of their size, location, type and length will be prepared by the proprietor's engineer and provided on the cover of the plans prior to submitting the plans to the Village. The Village Engineer will transmit the plans to the MDEQ and request permit approval.

5. Michigan Department of Environmental Quality, (Sanitary):

Construction of public sanitary sewer requires approval of the Village of Dexter and a construction permit from the MDEQ as required under Part 41 of Act 451, Public Acts of 1994 (formerly Act 98). The proprietor will submit four (4) sets of plans and specifications signed and sealed by the Michigan registered professional engineer responsible for the preparation of said plans and specifications. In addition, a permit application must be completed and, along with design flow computations for the site, proposed sewers, and the existing outfall sewer, be submitted by the proprietor's engineer. A quantity list must be provided on the cover sheet of the approved plans. The Village Engineer will transmit plans to the MDEQ and request permit approval.

6. Washtenaw County Road Commission, (Roads):

All work within the road right-of-way under the jurisdiction of Washtenaw County requires a permit from the Washtenaw County Road Commission.

7. Washtenaw County Water Resources Commissioner, (Storm Drainage).

Connections to County Drains and Sewers:

a. A Washtenaw County construction permit is required for any connection to a county drain.

b. Connections to county drains and sewers in Washtenaw County road right-of-way:

- 1) Washtenaw County policy requires that proposed storm sewer connections to existing storm sewers in Washtenaw County right-of-way be maintained by the Village of Dexter under a drainage permit issued to the Village of Dexter by the Washtenaw County Drain Commission. The Village must provide the county with a council resolution under which the Village agrees to accept jurisdiction and maintenance responsibility for the storm sewer connection and authorize a Village official to sign the permit. *Numbered, lft, 1" hanging .25*
- 2) The Village of Dexter will require a letter of agreement from the developer stating that the Village will be reimbursed for any costs incurred in the maintenance of the storm sewer if it becomes necessary.

8. Michigan Department of Environmental Quality (Wetlands, Inland Lakes and Streams):

It is the developer's responsibility to obtain MDEQ permits as required under Part 301, Inland Lakes and Streams, and Part 303, Wetlands Protection, of Act 451, Public Acts of 1994.

9. Other Permits:

Other agencies from which the developer may need a permit will be designated on the approved plan. These permits are the contractor's responsibility and are required before construction.

Dexter Area Fire Department
Michigan Department of Transportation
Michigan Water Resources Commission
Washtenaw County Health Department
United States Army Corps of Engineers

F. Fees:

All review fees must be submitted to the Zoning Office before beginning any plan reviews. Likewise, all construction fees must be submitted to the Zoning Office before beginning

construction. An Inspection Fee Worksheet is provided in the Appendix. Inspection fees are subject to change depending on the length of time in construction and are included as a reference only. Check with the Village Zoning Office for fee updates.

Inspection Fees:

This is a cash amount to be deposited before construction to cover the costs of the Village inspection. The deposit is based on the amount of water main, sanitary sewer, storm sewer, paving and public sidewalks that require engineering inspection. An inspection deposit is calculated as provided on the form in the Appendix. All inspection deposits must be submitted to the Village prior to the pre-construction meeting. In the case when a pre-construction meeting is not necessary, as determined by the Village, inspection deposits must be made to the Village before the approval of the Preliminary Zoning Compliance.

The actual fee for Village inspection, which will be supplied on a full-time basis and shall be borne by the applicant, will be set by the Village of Dexter and may include an administrative charge if the inspection is contracted to non-Village employees.

At the conclusion of the work, if the total costs of the Village inspection are less than the amount deposited, the Village shall refund the remainder of the deposit. If the amount of the deposit is exhausted before work is concluded, the Village shall stop the work, until additional monies are deposited to the Village to cover the cost of remaining Village inspection.

G. Insurance:

The Contractor, or its subcontractors, shall not commence work until he has obtained the insurance required under this paragraph. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan. All coverages shall be with insurance carriers acceptable to the Village of Dexter.

1. Workers' Compensation Insurance: The Contractor, or its subcontractors, shall procure and maintain throughout construction until issuance of Final Certificate of Occupancy by the Washtenaw County Building Department, Workers' Compensation Insurance, including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

2. Commercial General Liability Insurance: The Contractor, or its subcontractors, shall procure and maintain throughout construction until issuance of Final Certificate of Occupancy by the Washtenaw County Building Department, Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than \$1,000,000 per occurrence and aggregate for Personal Injury,

Bodily Injury, and Property Damage. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractor, Coverage; (D) Broad Form General Liability Extensions or equivalent; (E) Deletion of all Explosion, Collapse, and Underground (XCU) Exclusions, if applicable.

3. Motor Vehicle Liability: The Contractor, or its subcontractors, shall procure and maintain throughout construction until issuance of Final Certificate of Occupancy by the Washtenaw County Building Department Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, with limits of liability not less than \$1,000,000 per occurrence, combined single limit, Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

4. Additional Insured: Commercial General Liability and Motor Vehicle Liability Insurance, as described above, shall include an endorsement stating that the following shall be **Additional Insureds**: The Village of Dexter, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof, and the Village Engineer and all employees.

5. Cancellation Notice: Workers' Compensation Insurance, Commercial General Liability Insurance, and Motor Vehicle Liability Insurance, as described above, shall include an endorsement stating the following: "It is understood and agreed that Thirty (30) days, Ten (10) days for non-payment of premium, Advance Written Notice of Cancellation, Non-Renewal, Reduction, and/or Material Change shall be sent to: Village Manager or Construction Project Manager, Village of Dexter, 8140 Main Street, Dexter, MI, 48130-1092.

6. Owners' and Contractors' Protective Liability: The Contractor shall procure and maintain throughout construction until issuance of Final Certificate of Occupancy by the Washtenaw County Building Department, a separate Owners' and Contractors' Protective Liability Policy with limits of liability not less than \$1,000,000 per occurrence and aggregate for Personal Injury, Bodily Injury, and Property Damage. The Village of Dexter shall be "Named Insured" on said coverage. Thirty (30) days Notice of Cancellation shall apply to this policy.

7. If any of the above coverages expire during the term of this contract, the Contractor, or its subcontractors, shall deliver renewal certificates and/or policies to Village of Dexter at least ten (10) days prior to the expiration date.

Policies will be made available to the Village of Dexter for examination as to their validity and any undesirable exclusion deemed improper by legal opinion rendered to the Village regarding it. Underground construction, where applicable, will be specified in the coverage. In the event that the insurance is canceled, operations will stop before the cancellation date and will not resume until evidence is provided that proper insurance is again in effect.

H. Bonds

Prior to the pre-construction meeting, the applicant shall submit a cash bond to the Village of Dexter for the completion of the record plans prior to final acceptance. The guarantee will be posted in an amount equal to 2% of the construction cost, with a minimum deposit of \$1000, to ensure completion of the record plans in a timely manner. If the record plans are not completed within 3 months of the date of substantial completion the bond will be cashed to complete the record drawings

A Performance Bond in the amount equal to the cost of construction of public improvements and those improvements connecting to the public right-of-way and utilities constructed as part of the project will be required prior to the pre-construction meeting.

Before the Village accepts any public improvements, final acceptance of the project will be issued and the applicant will post with the Village a two-year Maintenance and Guarantee Bond in the amount equal to one-half of the cost of the construction of public improvements.

The amount of all bonds (cash bond for record plans, Performance Bond and Maintenance and Guarantee Bond) will be based on either the signed contract for work or a sealed engineer's itemized estimate for the work approved by the Village Engineer. The contract and/or estimate shall include construction costs for all water main, sanitary sewer, storm sewer, paving and sidewalk work to be completed on site.

Engineering Technical Requirements

I. Topography

A. General:

1. A complete topographical survey is required for all sites. Existing offsite elevations must be given at a minimum of fifty (50) feet intervals abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. Onsite, intermittent elevations or defined contours (minimum contour interval of two (2) feet) are required to establish the existing site drainage.
2. All existing conditions will be indicated. Locations and elevations must be given on the following:
 - a. Existing drainage courses.
 - b. Upstream and downstream culverts.
 - c. All utilities including sanitary and storm sewer, water main, gas, telephone, and electrical. Inverts, castings and finished grades are required where applicable.
 - d. Sidewalks.
 - e. Finished grades of all adjacent buildings.
 - f. All easements.
3. A minimum of two (2) NAVD 88 benchmarks are required. All elevations shown on plan must be to NAVD 88.
4. Road topography will extend across the entire site with grades shown on both sides of the street for:
 - a. Property line.
 - b. Ditch centerline.
 - c. Top of bank.
 - d. Edge of shoulder.
 - e. Edge of pavement or top of curb.
 - f. Crown or centerline.
5. Property lines must be indicated by distances and bearings where applicable.

6. Existing and proposed right-of-ways of adjacent roads must be indicated.

II. Water Main

A. General:

1. When a public water main is proposed for construction, the Village of Dexter standard water main detail sheets must accompany the plans.
2. A quantity list itemizing all proposed public water main construction must appear on the cover sheet or the first sheet of the plan set.
3. Provide a five and one half (5 ½) feet minimum cover below existing roadway or ground at water main location. The cover provided over the water main shall not exceed eight (8) feet unless otherwise approved by the Village and the Village Engineer.
4. The installation of pipes placed in casings shall be consistent with the latest revision of AWWA C600. Water main jacking or boring or directional drilling will extend a minimum of ten (10) feet outside the edges of the pavement.

B. Sizes and Distribution:

1. The minimum size water main allowed in the Village of Dexter will be eight (8) inches. Six (6) inch mains may be used only for single fire hydrant leads having a maximum length of forty (40) feet. Ten (10) inch mains are not allowed. Maximum dead-end mains are as follows:
 - a. Four hundred and fifty (450) feet for eight (8) inch mains.
 - b. One thousand (1,000) feet for twelve (12) inch mains.
2. Reducers are not allowed to meet the dead-end requirements.
3. A twelve (12) inch water main may be considered as minimum for internal transmission on industrial and multiple sites, commercial, office and institutional, as determined by the Engineer.
4. Looping of mains will be required wherever possible. All mains must end with a gate valve and hydrant or blow-off.
5. No private services will be allowed from a six (6) inch hydrant lead or a water main more than sixteen (16) inches in diameter. Water services and valves shall be located outside of paved areas, and will not be allowed within a driveway.

6. Water main will need to be extended across the entire frontage of the site.
7. Water main will be placed outside the influence of the roadway (6' minimum) within the greenbelt wherever possible.
8. A minimum alignment separation of ten (10) feet must be maintained between any sewer and all water mains.

C. Valves:

1. Gate valve spacing will be regulated by providing the following provisions in case of a breakage:
 - a. No more than thirty (30) single-family units will lose service.
 - b. No more than thirty (30) multiple units will lose service.
 - c. No more than two (2) hydrants will be out of service.
 - d. No more than three (3) valves shall be closed to isolate the break.
 - e. Generally, on line valve spacing will be a maximum of eight hundred (800) feet for water main eight (8) inches in diameter. On water main twelve (12) inches or larger, valves will be spaced not more than one quarter (1/4) mile apart.
2. Gate valves will be located in the greenbelt, not in sidewalks or driveways.
3. All gate valves, except those at hydrants, will be installed in wells. Gate valves at fire hydrants will be installed with a three-piece adjustable valve box.
4. Valves and wells will be placed near the end of all dead end mains for future extension.
5. Plans will show finished grades of all gate well top of castings and hydrants.
6. Connection of new mains to existing mains will be provided with a tapping sleeve, valve and well. In general, disruption in water service will not be allowed for a new connection.

D. Automatic Fire Sprinkler Service Connections:

1. Hydrants are never to be placed downstream of any check valve used for automatic sprinkler protection.

2. Sprinkler systems are not a substitute for standard requirements for hydrants.
3. Special Requirements for Automatic Sprinkler Fire Protection Systems:
 - a. All sprinkler systems require double-check valves. If the system is treated with additives, then a reduced pressure principal backflow prevention device is required.
 - b. Sprinkler systems directly connected to public water supply mains and also having supplemental supplies of non-potable water, or being located within one thousand (1000) feet of a body of water, shall be isolated from the public water main by an approved backflow prevention device.
 - c. 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.
4. Fire Department Connection/Signage: The Fire Department Connection shall be a two and a half (2 ½) inch wye connection. A sign shall also be placed above the connection and shall be approved by the code official before installation. The sign shall be eighteen (18) inches by twelve (12) inches and shall be reflective steel with a white background and two (2) inch red lettering stating “F.D.C.”. The signage shall have a red border.
5. Height of Fire Department Connection: The height of the Fire Department connection shall be no less than three (3) feet and no more than four (4) feet. The measurement shall be made from the center of the connection to the finished grade.
6. Fire Department connections caps and covers: All new and existing buildings and structures that have a Fire Department Connection shall be equipped with a threaded cap for protection and a lockable “Knox” type threaded cap shall be installed.

E. Hydrants:

Hydrant location shall be determined as outlined in this section. Additional hydrants may be required depending on the specific use.

1. Hydrant Coverage:

- a. Detached single and two family dwelling units and buildings with less than five thousand (5,000) square feet and moderate to light fire loading require hydrants be placed in the street right-of-way so that no part of the building is more than five hundred (500) feet from a hydrant; or where the Dexter Area Fire Department requires placement of hydrants.

- b. All other developments, buildings and structures: No part of any building or structure shall be more than two hundred and fifty (250) feet from a hydrant, unless approval is given by the Dexter Area Fire Department, and/or the building has internal sprinkling system.
- c. The distance measured for laying hose to an on-site or off-site hydrant shall be measured along the shortest feasible exterior route required for the fire department apparatus to drive from the hydrant to any location of the building. Only public hydrants will be considered for the off-site use.
- d. If off-site hydrants are within fifteen (15) feet of vehicle access on the subject property, the access points must become an easement dedicated to the Village of Dexter. If access roads to hydrants cross property lines, fire lanes must be established.

2. Hydrant Placing:

- a. Where near a street intersection, hydrants shall be located within fifteen (15) feet from the intersection street right-of-ways.
- b. Hydrants shall be placed within fifteen (15) feet of the curb line or shoulder. The hydrant shall be placed a minimum distance of three (3) feet from the back of curb and five (5) feet from the edge of pavement. Placing the hydrant three (3) to five (5) feet from the roadway is preferred to allow access by fire department apparatus.
- c. Where a ditch lies between the hydrant and curb or shoulder, a culvert, minimum length twenty (20) feet, shall be installed in the ditch and placed to allow access to the hydrant and the hydrant shall be located within five (5) feet of a hard surface fire lane.
- d. Hydrants shall be located at least fifty (50) feet from the exterior wall of the building unless an alternative location is recommended by the Dexter Area Fire Department.
- e. Fire lanes capable of accepting fire department apparatus shall be provided adjacent to the hydrants.
- f. Hydrants shall be placed no closer than five (5) feet to walls, earth mounds, berms or other such obstructions.
- g. In all cases, hydrants shall be located in highly visible and accessible locations and be consistent with existing patterns when in accordance with these standards.

- h. Hydrants may be placed at low points or high points, as specified by the Village and Village Engineer, along length of the water main to allow for maintenance purposes.

3. Hydrant Connections:

Hydrants shall have two (2), two and a half (2 ½) inch diameter hose connections and one (1), four (4) inch Storz large diameter hose connection. Four (4) inch Storz connections shall have a locking device to prevent against disconnection. The Storz connection shall have a non-locking cap with a chain or cable connecting the cap to the hydrant. Hydrants will be designed to open in a counterclockwise direction, with five and one quarter (5 ¼) inch valve opening and six (6) inch diameter inlet. Hydrants shall face the centerline of the road with nut type caps with chains. Inside diameter of all connections will be National Standard Thread pattern. Hydrants must have a breakaway flange and be painted red.

4. Hydrant Protection:

Where a hydrant is placed in an area of vehicular traffic, four (4) inch diameter steel pipe bollards filled concrete shall be provided to protect hydrant from damage. The arrangement of pipe bollards and/or curbing in lieu of pipe bollards is subject to the recommendation and requirements of the Dexter Area Fire Department.

5. Hydrant Leads:

All hydrant leads shall not be less than six (6) inches in diameter. All hydrant leads shall be valved.

6. Hydrant Height:

All hydrants shall be no less than eighteen (18) inches and no more than thirty (30) inches above finished ground. The measurement shall be made from the center of the pumper outlet to the finished grade.

7. Hydrant Inspection, Testing and Maintenance:

Standards adopted by the American Water Works Association (AWWA) Manual, latest edition will be used for inspection, testing and maintenance.

8. Existing Hydrants:

Existing hydrants on public streets may be considered when locating additional hydrants to meet the standards. Storz connections shall be provided on existing hydrants. Existing hydrants on adjacent properties shall not be considered unless recommended by the Dexter Area Fire Department.

9. Internal Sprinkling Systems:

Where an internal sprinkling system will be installed, an eight (8) inch diameter ductile iron water main must be provided to a hydrant within one hundred (100) feet of the Fire Department connection or where recommended by the Dexter Area Fire Department.

10. Water Supply:

Determining water supplies for firefighting purposes shall be determined by the Insurance Service Organization (ISO) formula ($F=18 C (A)^{1/2}$).

F. Construction:

Building permits will not be issued for wood frame construction above the foundation for any development before the required mains and hydrants are put into service. Adequate access for firefighting equipment must also be provided. No occupancy will be allowed without the required mains, hydrants, and sprinklers in active service.

G. Easements:

All public water mains must be in an easement or public right-of-way. Standard easement forms are available at the Village Zoning Office. The minimum easement width will be twelve (12) feet. The easement must be dedicated before the Village accepts the system.

H. Joints:

Approved restraint systems shall be provided at all bends of eleven and one quarter ($11\frac{1}{4}$) degrees or greater, behind tee outlets, at hydrant shoes, at plugs or caps, where necessary to prevent lateral movement of the pipe.

When joint restraints cannot be provided as shown on the standard details, concrete thrust blocks, as approved by the Village Engineer, will be provided. Thrust blocks will bear against undisturbed earth in all instances and will have sufficient bearing area to develop the full resultant axial thrust of the pipe at test pressure. Thrust blocks will be made of three thousand (3000) psi concrete and of adequate size and shape to resist all design working and surge pressures to which the main will be subjected. Harnessed joints and steel reinforced concrete anchorage will be required on pipes larger than sixteen (16) inches in diameter.

I. Meters:

1. Water Meters will be furnished by the Village of Dexter and shall be installed by the user under the supervision of the Village. The cost of one meter is included in the tap-in fee; additional meters shall be paid for by the user prior to installation and shall become Village property upon installation. The cost of any meter larger than one and one half (1 ½) inches shall be paid for by the user prior to installation and shall become Village property upon installation. Master meters for main line metering of industrial and commercial complexes shall be subject to Village approval.
2. Authorization must be obtained from the Village of Dexter to allow the use of a master meter in lieu of individual meters. Metering systems shall be reviewed on an individual basis and shall include such auxiliary equipment as deemed necessary by the Village of Dexter. The meter shall be installed in an approved vault or an approved heated and ventilated above-ground enclosure.

J. Testing and Sterilization:

(See Construction Specifications)

K. Back Flow Prevention:

Suitable back flow prevention devices shall be used as noted in the Cross Connection Rules Manual by the Michigan Department of Environmental Quality dated October 2008. The back flow prevention device shall be visible from above ground, unless otherwise approved by the Village.

L. Materials:

1. Water Mains:
 - a. Public water main shall be ductile iron water main. Ductile iron pipe will be manufactured according to the latest revisions of ANSI A21.51 and AWWA C-151. Pipe will be standard wall thickness Class 54 for pipe diameters of four (4) inches through sixteen (16) inches inclusive.
 - b. Pipe will be double cement lined and seal coated with approved bituminous seal coat according to the latest revisions of AWWA Specifications C-104 and ANSI Standard A21.4.
 - c. Pipe material and details for water main greater than sixteen (16) inches in diameter will be subject to the Village Engineer.

- d. All water main must contain tracer wire.
2. Joints:
- a. Joints for ductile iron pipe will be the push on type conforming to ANSI A21.11 and AWWA C-111 standard specification. Mechanical or flanged joints will be allowed for special applications, subject to the approval of the Village Engineer and the Village Public Services Superintendent. Sealing gaskets, retainer glands and lubricants for joints will meet the pipe manufacturer's specifications.
 - b. For connection to materials not specified herein, the contractor will submit shop drawings of such pipe and fittings to the Village Engineer and the Village Public Services Superintendent for approval.
3. Fire Hydrants:
- a. Fire hydrants will be East Jordan Iron Works model 5BR, Waterous or an approved equal conforming to AWWA C-502 improved hydrant specifications.
 - b. All hydrants will be constructed with a companion gate valve in a three-piece, adjustable cast-iron valve box.
4. Gate Valves and Wells:
- a. Gate valves for sizes six (6) inches through sixteen (16) inches in diameter, will be iron in body, fully bronze mounted, resilient wedge with non-rising stems opening counterclockwise with a two (2) inch square operating nut. Valves will conform to AWWA C-500, latest revision. Valves will be designed for a working pressure of 200 psi and a test pressure of four hundred (400) pounds per square inch (psi). The valves will be ordered with inlet and outlet connections compatible to the water pipe joint used on the system.
 - b. All gate wells will be concentric constructed of precast reinforced concrete sections according to Village standard details. Kor-n-Seal boot, or approved equal, to be placed when pipes extend through the gate well.
 - c. Gate well floors will be of three thousand five hundred (3500) psi reinforced concrete with at least six (6) inches protruding from the periphery of the well wall. The floor will be a minimum of six (6) inches thick.
 - d. Gate well covers and frames will be East Jordan Iron Works #1040 with Type "A" covers, or approved equal. Covers will have the word "WATER SUPPLY SYSTEM" in raised letters spaced in from the periphery of the cover.
 - e. Gate well valves will be at least six (6) inches above the floor or gate well and supported with either brick or formed concrete.

- f. Heat shrinkable manhole wraps to be placed on all gate wells.
- g. Tapping sleeves shall be stainless steel meeting applicable AWWA C223 standards and be NSF 61 certified.

5. Water Services:

- a. Water service line one (1) inch through two (2) inches in diameter will be domestic type "K" copper. All services larger than two (2) inches will be Class 54 ductile iron pipe.
- b. A minimum size of one (1) inch will be required for water service lines. Other allowable sizes are one and one-half (1-½) inches, two (2) inches, three (3) inches, four (4) inches and six (6) inches.
- c. Water service lines two (2) inches in diameter and smaller will generally be installed by the Village of Dexter Utilities Department. Water service lines larger than two (2) inches in diameter will be installed by an outside agency. Water service lines installed by an outside agency must have inspection and approval from the Village.

6. Fittings:

Fittings will have mechanical joints conforming to ANSI-A21.10 and AWWA C-110 standard specifications for ductile iron fittings. Push on fittings will only be allowed with the approval of the Village and Village Engineer.

7. Corporation Stop:

Corporation stops will conform to AWWA C-800 standard specifications. They will only be one (1) inch Ford with compression fittings with a set screw, or approved equal. Corporations larger than 1 inch will be as called for on the drawings.

Ball valves shall conform to AWWA C-507 standard specifications, and will be brass compression fittings with set screw.

Curb stop boxes will be Ford or approved equal conforming to AWWA C-110 standard specifications. They will have an arch pattern base for 1-inch or 2-inch curb valves with a one-piece lid.

III. Sanitary Sewer

A. General:

1. Public sanitary sewers are required when two or more connections are made to the same sewer. Village approval will be required for private service serving more than one building.
2. The extension of the sanitary sewers will be required across the entire frontage of the site.
3. All construction will conform to the current Village of Dexter Engineering Standards Manual.
4. Where public sewer construction is proposed, the Village of Dexter standard sanitary sewer detail sheets must accompany the plans.
5. A quantity summary itemizing all proposed public sanitary sewer construction and the basis of design must appear on the cover sheet or the first sheet of the plan set. Service Lead Schedule shall also be provided in the plan set.

B. Design:

1. Sewer design flow computations will be submitted to the Village Engineer for approval with a map of the area to be serviced. Developmental phases, present and future, with acreage and offsite areas contributing, will be shown with the number of lots or units included. A permit application for a sanitary sewer construction permit as required by Part 41 of Act 451, Public Acts of 1994 (formerly Act 98) must be completed by the design engineer and submitted for review and approval by the Village Engineer for submittal to the Michigan Department of Environmental Quality.
2. Sewer capacities (lateral and trunk) will be based upon one hundred (100) gallons per capita per day multiplied by the appropriate peaking factor. The sanitary sewer shall be designed in accordance with the Recommended Standards for Wastewater Facilities (RSWF), also known as 10 States Standards.
3. For residential developments of single homes, design population will be at least three and one-half (3.5) persons per prospective building. In developments for housing of other types, institutions, commercial, and industrial developments, studies will be conducted to establish equivalent population values. Existing and proposed Residential Equivalent Units (REU) must be calculated per the Village's latest Table of Connection Unit Factors and provided on the plans for Village review and approval.

4. Any new development that proposes to discharge wastewater in excess of those limits as defined in the Sewer Service Ordinance of the Village of Dexter, Code of Ordinances shall provide a detailed breakdown of the wastewater constituents to the Village that includes the amount and loadings for the various components. At a minimum, the developer shall provide BOD, CBOD, Suspended Solids, Phosphorus, Ammonia, and pH. Additional materials may be requested by the Village depending upon the developer's assigned user classification.
5. Public sanitary sewers will be eight (8) inches in diameter minimum.
6. Minimum design velocity for sanitary sewers will be two (2) feet per second with pipe flowing full. The eight tenths (0.8) depth flow line of sewers will be matched at manholes when changing sizes of sewers.
7. Flows shall be compared with existing downstream sewer capacity to assure that there is enough capacity available for proposed development.
8. Maximum design velocity for sanitary sewers will be ten (10) feet per second with the pipe flowing full

C. Sewerage:

Down spouts, weep tile, footing drains, sump pump discharges or any other conduit that carries storm or ground water will not be allowed to discharge into the building sewer or lateral sewer.

D. Grade:

1. The following table represents the minimum and maximum grade for public sanitary sewers. Note that these are minimum and maximum requirements and will generally be used only when topography requires it.

Size	Minimum Grade	Maximum Grade
8	0.40%	8.0%
10	0.30%	6.2%
12	0.22%	6.0%
15	0.16%	3.6%
18	0.12%	2.8%
21	0.10%	2.2%

2. All upstream dead end sewers will have a minimum last run grade of one (1) percent.

E. Manholes:

1. Manholes will generally be placed at three hundred (300) foot intervals, at every change of grade, direction, and pipe size and at each junction of sewers. The maximum distance between manholes will be four hundred (400) feet for sewers, thirty six (36) inches in diameter and smaller.
3. Whenever there is an increase in pipe size, the grade will match at a line eight tenths (0.8) of the diameters above the inverts
4. An allowance of one tenth (0.10)-foot in grade will be made for loss of head through a manhole of deflections of thirty (30) degrees or more
5. External drop connections are required where the invert of the outlet pipe is eighteen (18) inches or more below the inlet pipe invert. Internal drop connections will not be permitted
6. Chimney section must be sealed with a heat shrinkable manhole wrap.

F. Depth of Sewers:

1. Minimum depth of cover to top of pipe will be four (4) feet.
2. The minimum depth of invert below finish grade of the building to be served will be ten (10) feet unless otherwise approved. In addition, the sewer service is to be a minimum of eight and one half (8-½) feet below top of curb, unless otherwise approved. Deep setbacks or unusual conditions may require more depth.
3. The maximum depth to invert of any sanitary sewer will not exceed the depth recommended by the manufacturer for each size and class of pipe
4. Pipe will be laid on a carefully prepared Class B bed minimum consisting of porous sand extending from at least four (4) inches below the pipe to at least twelve (12) inches above the elevation of the top of pipe. Bedding shall be compacted to 95 percent of maximum unit weight.

G. Location:

1. Sanitary sewers will be located to provide unrestricted access for maintenance and inspection. A minimum alignment separation of ten (10) feet must be maintained between the sewer and all water mains. The water main and sanitary sewer will be on opposite sides of the street.
2. Sanitary manholes shall be placed in the greenbelt.

3. All public sewers must be in a public right-of-way or an easement. Standard Easement Forms are available at the Village Zoning Office. The easement size will vary individually as required for maintenance and access. The minimum sanitary sewer easement will be twenty (20) feet. The easement must be dedicated before the Village can accept the system for continuous maintenance and service.
4. A minimum alignment separation of ten (10) feet must be maintained between the sewer and all water mains.

H. Leads:

1. Service leads will be four (4) inches in diameter with a minimum slope of two (2) percent or six (6) inches in diameter with a minimum slope of one (1) percent.
2. Private sanitary sewer leads of excessive length, although not a public sewer may require inspection and testing. Each site will be considered individually by the Village.
3. Sanitary sewer leads shall be located outside of paved areas, and will not be allowed within a driveway. Maintain a minimum separation of 10 feet from the water service.

I. Profile:

1. The following information will be shown on the sanitary sewer profile:
 - a. Length of run between manholes.
 - b. Type and class of pipe between manholes.
 - c. Size and grade of pipe between manholes.
 - d. Top of casting and invert of all manholes and sewers at manholes.
 - e. Existing and proposed ground elevation along the route of the sewer.
 - f. Progressive numbering system on structures.
 - g. All utility crossings. Indicate porous backfill to twelve (12) inches above higher utility.
 - h. Special backfill areas, i.e. compacted sand backfill.
 - i. Provisions for infiltration testing.
 - j. Adjacent existing or proposed utilities plotted where parallel and may conflict with sewer leads.
 - k. All existing sewer inverts must be field measured and so noted on the plans.

J. Materials:

1. Sanitary sewer pipe will conform to the following current American Society for

Testing and Materials Specifications. Allowed materials for public sewer pipe are as follows:

- a. Reinforced Concrete Sewer Pipe, ASTM Designation: C76. Class IV minimum.
 - b. Composite ABS plastic, PVC and Perlite concrete truss pipe material as manufactured by Metal Products Division of Armco Steel Corporation, or equal, will conform to the requirements of the latest revision of ASTM D-2680-74.
 - c. PVC pipe and fittings will conform to requirements of the latest revision ASTM D-3034 (SDR 26). Deflection of pipe will be limited to a maximum of five (5) percent.
2. Pipe joints will conform to the following requirements depending on the allowable type of pipe used:
- a. All joint will be premium gasket joints.
 - b. Modified Grooved Tongue (MGT) joints for pipe will have a rubber gasket snapped into a groove cast into the tongue. The modified groove or bell end of the pipe will be made smooth and will not have more than a three (3) degree slope for sizes eight (8) inches through twenty (24) inches or a two (2) degree slope for sizes twenty seven (27) inches through one hundred and eight (108) inches, tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer. MGT joints will be lubricated and coupled according to the pipe manufacturer's printed instructions.
 - c. Rubber gasket joints for pipe will follow the Tentative Specification for "Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible, Watertight, Rubber Type Gaskets," ASTM Designation: C-443, latest revision. The rubber gasket joints will be lubricated and coupled according to the pipe manufacturer's printed instructions.
 - d. Joints for PVC pipe will be the push on type. Push on type joints will conform to ASTM Specification D-3212, latest revision.
3. Manholes will be constructed of precast reinforced concrete sections according to the Village of Dexter standard details.
- a. Precast reinforced concrete manhole sections will conform to requirements of the American Society for Testing and Materials, "Standard Specification for Precast Reinforced Concrete Manhole Sections" ASTM Designation: C478, latest revision thereof.
 - b. Precast manhole joints will be MGT with rubber gaskets as described in Section J, Part 2.
 - c. Manhole steps will be reinforced polypropylene plastic #PS-2-PFS or approved equal.
 - d. Where manholes are outside pavements and sidewalks, final grade adjustments will be made with precast concrete grade adjustment rings. Brick construction will not be allowed except in paved surfaces. Grade rings will be a minimum of three (3) inches thick and reinforced with two (2) full circles of three

sixteenths (3/16) of an inch diameter steel reinforcing wire. Manhole casting frame and concrete adjustments rings will be secured to the precast cone section with a minimum of four (4) five eighths (5/8) inches in diameter cadmium coated threaded studs or bolts. The maximum allowable grade adjustments using grade rings shall be fifteen (15) inches. All joints in the assembly will be sealed with rubber "O" ring gaskets.

- e. Final grade adjustment for manholes in pavements and sidewalks will be made with brick and mortar. A maximum of three (3) courses of brick will be placed on top of the precast cone section.
- f. Manhole covers and frames will be EJIW #1040 with Type "A" cover or approved equal. Covers will be cast with the words "SANITARY SEWER SYSTEM" in raised letters spaced in from the periphery of the cover.
- g. Special approved wet area manholes with precast rubber gasket type pipe fittings and lock down rubber gasket type manhole covers such as EJIW #1040 ZPT, or equal, will be required in areas of high ground water table and where manholes are in or next to drainage ditches, low areas and floodplains. Details of this type manhole are included in the standard plan sheets.
- h. All sanitary manholes shall have a heat shrinkable manhole wrap placed from the top of the frame casting base over the adjustment rings and over at least half of the transition cone section of the manhole chimney.

K. Infiltration:

Infiltration rates for all sanitary sewers will not exceed one hundred (100) gallons per inch diameter per mile of pipe per twenty-four (24) hours. Infiltration tests will comply with the current testing standards and requirements of the Village of Dexter. An exfiltration test will be used instead of an air test when concrete pipe is used for sanitary sewer. Where groundwater is greater than two (2) feet over the top of the pipe, an infiltration test may be used instead of air testing.

L. Inverted Siphons:

In general, sanitary sewer siphons will be avoided and will only be accepted when no other feasible alternative exists and where there will be sufficient flow in the sewer so that maintenance will be held to a minimum. Pipes for inverted siphons will be a minimum of six (6) inches in diameter. There will be a minimum of two (2) pipes for each inverted siphon and a minimum velocity of three (3) feet per second.

M. Pump Stations:

1. There will be a minimum of two (2) pumps in a pumping station. The minimum size of discharge lines will provide adequate cleaning velocities and will conform to Michigan Department of Environmental Quality requirements.

2. All pumping station plans will be considered separately.
3. Provisions must be included for auxiliary power source and telemetered alarm system.
4. Pipe for force mains will be designed to withstand both internal pressures and external trench and live loads. Design computations will be submitted by the proprietor's engineer for review and approval.
5. The pipe will be ductile iron, or PVC pressure pipe. Ductile iron pipe will be cement lined. Joints and fittings will be equal to the requirements for pressure pipe used in the domestic water distribution system. Force mains will be pressure tested for water tightness to a test pressure equal to twice the total system head, but no less than fifty (50) psi held for a minimum one (1) hour period. Leakage will be limited to not more than twenty five (25) gallons per inch diameter per mile or pipe per twenty four (24) hours at required test pressure.

N. Building Sewers:

1. Building Sewers included with Sewer Construction:

Unless otherwise approved due to exceptional circumstances, construction of the building sewer, from public sewer to property line for each fronting parcel that the sewer is designed to serve, will be included with construction of each sanitary sewer. Building sewers will extend a minimum of ten (10) feet beyond the property line.

2. Wyes, Tees and Risers:

In sanitary sewers, where construction of building sewers to the property line is not required, a wye branch or tee inlet will be installed for each lot or building site. Where cover over sanitary sewer to finished grade is more than ten (10) feet, risers will be installed from wyes or tees to an elevation ten (10) feet below finished grade. Location of the wye or tee will be marked from the downstream manhole on the record sewer plans prepared. Where the water table is high, the riser will end at a depth of one (1) foot above the water table. When house leads are to be cut into an existing sanitary sewer, a tap will be made with the use of an approved saddle.

3. Size and Material of Sanitary Sewer Service Leads:

Ordinary house connections will be either four (4) inches or six (6) inches in diameter and will be constructed of ABS plastic solid wall pipe ASTM D-2751, latest revisions, or PVC pipe conforming to the requirements of the latest revision ASTM D-3034 (SDR 26). Larger building sewers may be constructed of materials permitted for sanitary sewers under the same conditions of depth.

Joints in building sewers, including fittings and stoppers for wyes, tees, risers and building sewer leads, will conform to the requirements of these specifications as stated in Section J of this chapter.

For maintenance, cleanouts shall be placed at locations where the service leads change direction.

4. Grade:

The minimum grade of building sewers will two (2) percent for four (4) inch sewers, and one (1) percent for six (6) inch sewers.

IV. Storm Sewer and Storm Water Treatment

A. General:

1. The Village of Dexter endorses the rules of the Washtenaw County Water Resources Commissioner's Office and encourages the use of their "Rules and Guidelines: Procedures and Design Criteria for Storm Water Management Systems" wherever possible. The Village also recognizes that use of their design criteria may not be practical under all circumstances. Certain areas of the Village, such as the Central Business District, do not offer the same opportunities for storm water management as in other areas. This decision will be made by the Village Administration and/or their consultants on a case-by-case analysis. The applicant is encouraged to address this issue with the Village Administration at the pre-application conference.
2. When storm sewer construction is proposed, the Village of Dexter standard storm sewer detail sheets must accompany the plans.
3. Underground drainage facilities will generally be required. All runoff onsite must be accommodated and discharged in a controlled manner. The minimum onsite pipe size is twelve (12) inches. All public systems will have a minimum pipe size of twelve (12) inches.
4. Compacted sand backfill consisting of MDOT Class II granular material compacted to 95% of maximum unit weight will be required in all trenches within a 1:1 influence of the roadway, pavement, sidewalk, bikepath, etc.
5. Sump pump discharge must be directed into the storm sewer via an enclosed system. As a minimum, a four (4) inch pipe will be used and will be allowed to discharge unrestricted.
6. Depth of sewer: The minimum allowable coverage over pipe is three (3) feet. Low head structures shall be utilized in locations where the cover over the top of the pipe is four (4) feet or less.

7. Washtenaw County Road Commission requires a maintenance agreement for connection to storm sewers in County roads.
8. Any work proposed to a County drain , including outletting to a County drain, will require review and approval from the Washtenaw County Water Resources Commissioner.

B. Structure:

1. Inlets at the upstream end of the system will be a minimum of twenty four (24) inches in diameter. Catch basins with an inlet pipe and all manholes will be forty eight (48) inches in diameter at a minimum. All structures must be a minimum of four (4) feet deep unless low head structures are utilized.
2. The first structure upstream from a public system within the confines of the private development will be a minimum forty-eight (48) inches in diameter and have a twenty four (24)-inch sump.
3. Manholes will be at:
 - a. All changes in alignment.
 - b. Points where the sewer changes size.
 - c. Points where the grade changes.
 - d. Junction of sewer lines, including connection from catch basins.
4. The maximum distance between manholes will be three hundred (300) feet for sewers thirty (30) inches in diameter and smaller; four hundred (400) feet for sewers thirty six (36) inches in diameter; and spacing for diameters greater than thirty six (36) inches will be considered individually.
5. Catch basins will be located as follows:
 - a. At all low points.
 - b. Five (5) feet away from the end of the intersection radius. No more than one hundred fifty (150) feet of street drainage will be allowed to flow around a corner.
 - c. A relief basin will be required at the highest end of the intersection radius where drainage is required to cross an intersection longitudinally.
 - d. At intermediate points along the street, drainage will be allowed to flow six hundred (600) feet maximum. The maximum street drainage into a basin is seven hundred (700) feet from two directions.
 - e. Where longitudinal grade exceeds one thousand (1000) feet, a double inlet structure will be required at the low point as necessary.
 - f. Head walls will be required where storm sewers enter open ditches or county drains.

C. Storm Sewer Design:

1. Storm sewers will be designed using the Manning Equation for pipes flowing full. Runoff will be determined using the Rational Method for a ten (10) year storm event with an intensity formula of $I = 175 / (T+25)$. The initial time of concentration (T) will generally be twenty (20) minutes maximum.
2. Storm sewer design computations must be submitted for review. The velocity will be a minimum of two and one half (2-½) feet per second and will not exceed ten (10) feet per second. The minimum and maximum gradients in percent slope for each size pipe listed will be as follows:

Pipe Size (inches)	Minimum Grade %	Maximum Grade %
12 inches	0.34	4.80
15 inches	0.26	3.60
18 inches	0.20	2.60
21 inches	0.16	2.20
24 inches	0.14	1.80
27 inches	0.12	1.50
30 inches	0.10	1.30
36 inches	0.08	1.00
42 inches	0.06	0.80
48 inches	0.05	0.70

3. The hydraulic gradient must be maintained within the pipe wherever possible and will be shown on the storm sewer profile. The gradient must be a minimum of two (2) feet below the top of all inlet structures.
4. Composite runoff coefficient can be determined for each individual drainage area and calculations for each drainage area must be submitted as part of the design computations. Composite coefficient design is based on the sum of the percentages of each drainage area covered by impervious and pervious areas multiplied by the respective coefficient, listed below.

a. Impervious (Improved) Areas: $C = 0.95$

b. Pervious (Unimproved) Areas: $C = 0.20$

5. Along with the storm sewer design computations, the design engineer must submit a storm district map showing all drainage districts within the development. The district limits must be overlaid on a proposed grading plan for the site. The design computation sheet will be sealed by the registered engineer who supervised the computations.
6. All upstream drainage must be accommodated onsite. Allowances for upstream area must be based on ultimate improvements and runoff.
7. Discharge must not be diverted onto abutting properties. The outlet must follow the existing natural drainage courses in the area.
8. Underdrains must connect to storm structures.
9. Footing drains will be discharged by sump pumps connected by underground piping (4-inch pipe minimum) to a storm sewer.

For new subdivisions and site condominiums, storm sewers will be extended where required to provide an outlet for sump pump lines for all lots. Exceptions to this rule may be allowed where soils and hydrology studies show that sump pumps discharging to the ground surface will not cause a drainage problem for the prospective homeowner or the adjacent lot owners.

Sump pump discharge lines will not discharge directly to street gutters.

D. Plan and Profile:

1. All public storm sewers must be shown in profile. For developments larger than one acre the private storm sewer must also be shown in profile.
2. The following must be shown in profile:
 - a. Length of run between manholes and catch basins.
 - b. Type and class of pipe between manholes and catch basins.
 - c. Size and grade of sewer between manholes and catch basins.
 - d. Top of casting elevations.
 - e. Inverts of all pipes at manholes.
 - f. Proposed and existing ground elevations along the route of the sewer.
 - g. Progressive numbering system on all manholes and catch basins.
 - h. All utility crossings.
 - i. Special backfill areas, i.e. compacted sand backfill.
 - j. Hydraulic gradient for the 10-year design storm.

E. Taps:

Connections must be made at manholes. Blind taps are not allowed.

F. Public Storm Sewer:

1. All public storm sewers must be in a public right-of-way or an easement. Standard easement forms are available at the Village Zoning Office. The easement size will vary as required for maintenance and access. The minimum storm sewer easement will be 12 feet. The easement will need to be dedicated before the Village can accept the system for continuous maintenance and service.
2. Any storm sewer that accepts runoff from abutting property or public right-of-way must be placed in a minimum twelve (12) foot storm sewer easement.

G. Materials:

1. Storm sewer pipe will conform to the current ASTM "Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe," ASTM C-76 for circular pipe, or C-507 for horizontal elliptical pipe, latest revision. Reinforced concrete pipe shall be a minimum grade of CL-IV. Public sewer shall be reinforced concrete pipe. If other materials are proposed for use, the proprietor will furnish the load carrying design analysis for the pipe for the proposed depth conditions.
2. Pipe joints will conform to one of the following requirements:
 - a. Modified Grooved Tongue (MGT) pipe will have a rubber gasket snapped into a groove cast into the tongue. The modified groove or bell end of the pipe will be made smooth and will have not over a three and one half (3 ½) degree slope for sizes twelve (12) inch to twenty four (24) inches, or a two (2) degree slope for sizes twenty seven (27) inches to one hundred eight (108) inches, tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer. MGT joints will be lubricated and coupled according to the pipe manufacturer's printed instructions.
 - b. Rubber gasket joints will follow the "Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets," ASTM Designation: C-443, latest revision. Rubber gasket joints will be lubricated and coupled according to the pipe manufacturer's printed instructions.
3. Manholes will be constructed of precast reinforced concrete sections according to the Village of Dexter standard details. Concrete block will only be allowed in special circumstances with approval from the Village and Village Engineer.
 - a. Precast reinforced concrete manhole sections will follow the requirements of the ASTM "Standard Specification for Precast Reinforced Concrete Manhole

- Sections," ASTM Designation C-478, latest revision. Wall thicknesses will depend on depth and will be subject to the approval of the Village Engineer.
- b. Brick for casting adjustment, or concrete block for manhole, inlet, and catch basin construction will conform to the requirements of the Michigan Department of Transportation "Standard Specifications for Construction," Section 403.03, latest revision. Wall thicknesses will depend on depth and will be subject to the approval of the Village Engineer.
 - c. Precast manhole joints will be as described in Section I, Item 2 of this chapter.
 - d. A maximum height of eighteen (18) inches is allowed for total chimney height. Chimney is defined as top of precast structure to top of casting.
 - e. Manhole covers and frames will be EJIW #1040 with Type "B" cover or approved equal.
 - f. Chimneys must be wrapped in heat shrinkable manhole wrap.

4. Catch Basins:

- a. Catch basins will be constructed of precast reinforced concrete manhole sections, according to the Village of Dexter standard details.
- b. Catch basin and inlet frame and covers will be EJIW No. 5080 or equivalent when in pavement edge or gutter line.
- c. Catch basin and inlet frame and covers will be EJIW No. 1040 Type M cover or equivalent when in paved areas other than edge gutter line.
- d. Catch basin and inlet frame and covers will be EJIW No. 1040 with Type "N" cover or equivalent when in yard areas.
- e. Covers will be cast with the words, "DUMP NO WASTE! DRAINS TO WATERWAYS".
- f. All storm structure covers shall be inscribed with the message, "Dump no Waste, Drains to Waterways"

H. Storm Water Treatment:

1. Storm water treatment must be provided to manage the first flush volume, bankfull volume and 100-year reoccurrence interval event. In addition, infiltration must be provided onsite for either 1) the entire first flush volume or 2) the difference between the pre-settlement bankfull volume and post-development bankfull volume, whichever is greater.
2. Storm water treatment must be provided onsite. Acceptable means of storm water treatment can be achieved through the use of Best Management Practices, such as bioretention systems, porous pavement, infiltration trenches, detention/retention systems, etc. Any combination these options may be used to achieve the required storm water treatment.

3. Design:

a. Design shall follow the requirements of the Washtenaw County Water Resources Commissioner.

b. First flush volume to be calculated using the Rational Method.

$$V_{ff} = 1815 \times A \times C$$

c. The required storage volume will be equal to, or greater than, the volume computed for a one hundred (100) year frequency storm using the formulas provided below:

1. Definition of terms:

A = Contributing drainage area (acre)

C = Coefficient of Imperviousness

Q_o = Maximum allowable outflow per acre imperviousness (cfs/acre)

Q_a = Maximum allowable discharge rate

T = Storage time, defined as the interval of time at the instant storage begins until peak storage is attained (min.)

V_s = Maximum volume of water stored in the detention basin per acre imperviousness (cft/acre)

V_t = Maximum volume of water stored in the detention basin (cft)

2. Storage volume formulas for gravity orifice flow (variable rate discharge):

$$V_s = \frac{16,500 T}{T + 25} - 40 Q_o T$$

$$\text{Where } T = -25 + \sqrt{(10,312.5/Q_o)}$$

$$\text{And } Q_o = Q_a / (A \times C)$$

$$V_t = V_s \times A \times C$$

3. Storage volume formulas for pumped discharge (constant rate discharge):

$$V_s = \frac{16,500 T}{T + 25} - 60 Q_o T$$

$$\text{Where } T = -25 + \sqrt{(6875/Q_o)}$$

$$\text{And } Q_o = Q_a / (A \times C)$$

$$V_t = V_s \times A \times C$$

- c. The proposed storage volume on the site will be based on the total amount of contributing acreage, including all off site areas that flow onto the property.

4. Detention/Retention Systems:

- a. Sufficient detention volume must be provided so that the allowable discharge rate during the design storm is not exceeded. Discharge must be throttled to a restricted rate. The maximum allowable discharge rate is as follows:

- 1) Fifteen one hundredths (0.15) cubic feet per second per acre being drained.

$$Q_a = 0.15 \times A$$

- 2) Discharge approved by agency having jurisdiction over outlet, i.e., county drain office or county road commission (approval must be submitted).
3) Allowable flows designed into the outlet (previous calculations must be submitted).
4) Off-site flow into the Dexter Business and Research Park storm sewer system will be restricted to the following formula:

$$Q_a = \frac{12.5 \times A}{352}$$

- b. The detention basin must be constructed to drain entirely unless designed to retain a permanent water level that conforms to the aesthetics of a landscape plan relating to the surrounding landscape.
c. Any volume of water provided below invert of the gravity outfall pipe will not be considered as detention.

- 1) At a minimum, the volume of the permanent pool should be at least 2.5 times the first flush volume.

$$V_p = 4540 \times A \times C$$

- 2) In general, depth of the permanent pool should be varied and average between three (3) feet and six (6) feet.
3) A marsh fringe should be established near the inlet and around at least fifty (50) percent of the perimeter of the permanent pool.
4) A shelf, a minimum of four (4) feet wide at a depth of one (1) foot, will 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.

- d. The outfall from detention basins will be designed to operate by gravity. Where this is not possible, mechanical pumping is permissible, and such facilities are subject to the review and approval by the Village's Engineer.

Mechanical lift stations for detention basin discharge will be designed with a minimum of two (2) pumps, each rated at the allowable discharge rate and provided with an automatic control system to operate the pumps on alternating periodic cycles. The pump control system will also contain a manual override control. The developer will furnish all design data on the pumps and discharge force main including calculations and pump performance curves. The Village will not be responsible for the maintenance of the lift station at any time.

- e. Retention basins will only be considered in cases where no other available positive outlet for the storm water runoff from the property. Retention basins with no outlet will be capable of storing two (2) consecutive one hundred (100) year storm events, which can be determined by:

$$V_t = 33,000 \times A \times C$$

- f. All open detention/retention systems must be fenced if the side slopes exceed one vertical to five horizontal. The earthen side slope will be no steeper than one vertical to three horizontal. Fences will be a minimum of six (6) feet high with locking access gates eight (8) feet wide.
- g. The bottom of the detention/retention systems must be sodded. All detention/retention systems must be permanently stabilized with maintainable densely rooted turf.
- h. A minimum of twelve (12) inches of freeboard must be maintained with a positive, non-erodible overflow capable of handling a one hundred (100) -year storm.
- i. Minimum grade on the bottom of the detention basin will be one (1) percent.
- j. For underground detention, use crushed, washed, angular stone, such as MDOT 6A.
- k. Maintenance
 - 1) Subdivisions and Residential Sites: The proprietor must provide for continued maintenance of storm water treatment system(s), through acceptance of ownership and maintenance responsibility by the property owner, Homeowner's Association, or Washtenaw County Water Resources Commissioner. The Village will not accept ownership or maintenance responsibility of any storm water treatment system(s). The proprietor shall be responsible for the maintenance of the storm water treatment system(s) until all public utilities are dedicated and at least fifty one (51) percent of all homes have been constructed and sold.

- 2) Commercial, Industrial and Office Sites: The proprietor shall maintain the storm water treatment system(s) in proper working order at all times. The Village will not accept ownership or maintenance responsibility of any storm water treatment system(s).
 - 3) For all sites, a maintenance schedule must be submitted as part of the site plan review process. In addition, prior to final acceptance of the project, the property owner must enter into a storm water maintenance agreement with the Village.
- l. The proprietor must submit soil-boring logs to the Village Engineer, taken within the detention/retention system area to a depth of twenty-five (25) feet below existing ground or twenty (20) feet below the proposed bottom elevation. Information regarding seasonal groundwater elevations must also be provided.
 - m. A minimum of twelve (12) inches of freeboard must be maintained with a positive, non-erodible overflow capable of handling a one hundred (100) year storm.
5. In addition, the Village of Dexter promotes the use of Best Management Practices (BMP's) wherever possible. Some examples of BMP's include, but are not limited to, infiltration facilities, sand filters, bio-retention, dry swales, filter strips, etc. The following resources are recommended for the design of BMP's:

“Procedures and Design Criteria for Storm Water Management Systems”,
Washtenaw County Water Resources Commissioner. ,May 15, 2000.

Guidebook of Best Management Practices for Michigan Watersheds, Michigan
Department of Environmental Quality, 1993.

Southeast Michigan Council of Governments (SEMCOG). Low Impact
Development Manual for Michigan: A Design Guide for Implementers and
Viewers. Michigan, SEMCOG: 2008.

V. Paving and Right-of-Way Improvements

A. General:

1. All paving will conform to the current standards and specifications of the Village of Dexter, the Michigan Department of Transportation (MDOT) Standard Specifications for Construction, current edition, and the latest edition of the AASHTO guidelines outlined in A Policy on Geometric Design of Highways and Streets.
2. Any paving and/or right-of-way improvement should refer to the latest version of the Complete Streets Ordinance for design guidelines.
3. Any road improvements in the Washtenaw County right-of-way are subject to the review and approval of the Washtenaw County Road Commission (WCRC). A permit must be secured from the Village of Dexter and the WCRC for construction.
4. Any road improvements in the Michigan Department of Transportation (MDOT) right-of-way are subject to the review and approval of MDOT. A permit must be secured from the Village of Dexter and MDOT for construction.
5. Any improvements in Village of Dexter right-of-way are subject to the review and approval of the Village. A Right-of-Way Permit must be secured from the Village for construction.
6. Construction of new or reconstructed driveways connecting to an existing state, county, or Village roadway will be allowed only after an approved permit has been secured from the agency having jurisdiction over said roadway.
7. Cross-sections of all proposed pavement must be shown on the plans.
8. The minimum surface grade for asphalt paving will be one (1) percent. The minimum surface grade for concrete paving will be one half (1/2) percent. Pavement surface grades will not exceed six (6) percent.
9. Concrete curb and gutter will be required on all public roads unless otherwise approved by the Village.
10. Underground storm sewers will be installed with all paving that requires concrete curbs and gutters.
11. Where pavements are to be constructed over clay soils or other poorly drained soils and a granular subbase is used, an approved sub drainage system (i.e. underdrains, etc) will be installed.
12. Design standards of Washtenaw County Road Commission within the document, "Procedures and Regulations for Developing Public Roads", will apply for horizontal and vertical alignment of all roadways.

13. Adequate soil borings must be taken and analyzed by a professional engineering firm qualified to do such work at the locations of all proposed public roads. Copies of the report must be submitted to the DPW, the Village Engineer, and the Zoning Office.
14. Sufficient proposed grades must be shown on the plan to clearly show the drainage patterns.
15. Parking spaces, maneuvering lanes, and driveways will conform to the size and configuration of Village ordinances. Access to county roads shall be reviewed and approved by the Washtenaw County Road Commission.
16. Passing lanes, acceleration lanes, deceleration lanes, tapers and by-pass lanes will be required according to the most current requirements established by the Washtenaw County Road Commission.
17. Roads and driveways must be constructed in such a way as to allow for adequate turning and stopping sight distance.
18. Road signs shall be installed in phases. The first phase includes installation of intersection control signs (i.e. Stop or Yield signs) and street name signs. The second phase includes installation of the remainder of the proposed signs.

The first phase signs shall be installed after the utilities and the leveling course of asphalt have been constructed. The second phase is installed at project build out, after the final wearing course is placed. This process lends to less sign replacement due to damage during construction, provides users with an understanding of future road characteristics, and provides signage for emergency vehicles throughout construction.

B. Typical Road Cross Section:

The following minimum thickness requirements are based on adequate subgrade, subgrade drainage and average live loads. Each site must be examined individually and additional pavement thickness and/or base requirements may be necessary.

1. Residential Roads (private or public):

At a minimum, the following cross-section should be used for residential roadways.

a. Bituminous Aggregate Pavement

Contractor to use performance graded binder PG58 -28.

1. Subbase:

A six (6) inch compacted thickness of MDOT Class II granular material shall be placed for all roadways except where existing soils consist of granular material approved by the Village Engineer.

2. Aggregate Base Course:

A minimum eight (8) inch compacted thickness of 21AA crushed limestone shall be placed for all roadways. All materials shall be compacted to at least ninety-five (95) percent of maximum unit weight.

3. Prime Coat:

A prime coat of either MC-30 or MC-70 liquid curing asphalt shall be applied to the prepared subbase prior to application of any bituminous aggregate base course or leveling course.

4. Bituminous Base Course

A minimum two and one half (2½) inch thickness of MDOT 13A HMA Base Course shall be placed as a bituminous base course.

5. Bituminous Wearing Course

A minimum one and one half (1½) inch thickness of MDOT 36A HMA or MDOT 13A HMA Top Course shall be placed as a bituminous wearing course. A bond coat of either MS-2a or SS-1h anionic emulsified asphalt shall be placed between the all layers of bituminous mixtures.

b. Concrete Pavement:

1. Subbase

A six (6) inch compacted thickness of MDOT Class II granular material shall be placed for all roadways except where existing soils consist of granular material approved by Village Engineer.

2. Aggregate Base Course:

A minimum six (6) inch compacted thickness of 21AA crushed limestone shall be placed for all roadways. All materials shall be compacted to at least ninety-five (95) percent of maximum unit weight.

3. Pavement

A minimum seven (7) inch thickness of MDOT Grade P1 concrete shall be placed for all concrete residential roadways.

2. Mixed-use roadways (private or public)

At a minimum, the following cross-section should be used for mixed-use roadways. For Federal-Aid eligible roads or roads on a truck route, the proposed cross-section should be evaluated on a project by project basis.

a. Bituminous Aggregate Pavement

Contractor to use performance graded binder PG58 -28.

1. Subbase

A six (6) inch compacted thickness of MDOT Class II granular material shall be placed for all roadways except where existing soils consist of granular material approved by Village Engineer. If patches of organic material are encountered during construction, it must be removed and replaced with MDOT Class II sand.

2. Aggregate Base Course

A minimum ten (10) inch compacted thickness of MDOT 21AA crushed limestone aggregate shall be place for all roadways. All materials shall be compacted to at least ninety-five (95) percent of maximum unit weight.

3. Prime Coat

A prime coat of either MC-30 or MC-70 Liquid curing asphalt shall be applied to the prepared subbase prior to the application of any bituminous aggregate base course or leveling course.

4. Bituminous Base Course

A minimum three (3) inch thickness of MDOT 2C HMA Base Course shall be used as a bituminous base course.

5. Leveling Course and Wearing Course.

A minimum one and a half (1½) inch thickness of MDOT 3C HMA Leveling Course shall be used as a leveling course. A minimum one and one half (1 ½) inch thickness of MDOT 13A HMA Top Course wearing course shall be used. A bond coat of either MS-2a or SS-1h anionic emulsified asphalt shall be placed between the all layers of bituminous mixtures.

b. Concrete Pavement

1. Subbase

A six (6) inch compacted thickness of MDOT Class II granular material shall be placed for all roadways except where existing soils consist of granular materials approved by Village Engineer. If patches of organic material are encountered during construction, it must be removed and replaced with MDOT Class II sand.

2. Aggregate Base Course

A minimum six (6) inch compacted thickness of 21AA crushed limestone shall be placed for all roadways. All materials shall be compacted to at least ninety-five (95) percent of maximum unit weight.

3. Pavement

A minimum nine (9) inch thickness of MDOT Grade P1 concrete shall be placed for all mixed-use roadway construction with concrete pavement.

3. Non-Industrial Parking Lots

The minimum design standards for parking lot pavements shall equal those requirements established in Section VI.B.1 for Residential Roadways. Parking lots shall conform to the applicable standards as established by the current guidelines of the American with Disabilities Act.

4. Industrial Parking Lots

Parking lots for industrial uses will be reviewed by the Village Engineer on an individual basis with consideration given to intended use, type and volume of traffic and soil data furnished by the applicant. The minimum design standards for industrial parking lot pavements shall equal those requirements established in Section VI.B.2 for Mixed-Use Roadways. Parking lots shall conform to the applicable standards as established by the current guidelines of the American with Disabilities Act.

C. Curb and Gutter:

Concrete curb and gutter will be required for all public and private roadways and parking lot construction in the Village of Dexter. This requirement shall apply to all zoning districts in the Village with the following exceptions:

In Research and Development (RD) districts, private roadway and parking lots may be constructed without concrete curb except for the first fifty (50) feet beyond the radii of any approach connecting a private drive to a public right-of-way. In the absence of concrete curb and gutter, site improvements must be designed, engineered and constructed in such a

manner as to properly and completely collect and convey all on-site storm water runoff to approved points of discharge.

In areas where paved streets are currently uncurbed, it should be evaluated whether the the placement of curb and gutter is reasonable for the location.

Concrete curb and gutter for roadways constructed with bituminous pavements will be constructed to a configuration, dimension and material which comply with MDOT Standard Plan Curb and Gutter, either detail standard C4 or F4 or mountable D2, latest revision. The proposed curb and gutter shall match the adjacent curb and gutter into which it connects. Roadways constructed with concrete pavement shall be constructed with integral concrete curb and gutter.

Underground storm sewers will be installed with all paving, which requires concrete curb and gutter. The storm water runoff from all proposed site developments will be collected and treated on site or directed off site to approved points of discharge, as detailed in Section V of these standards. Where an approved point of discharge is not available to a site as determined by the Village Engineer, such necessary improvements will be constructed or installed so as to properly and safely dissipate or retain storm water runoff on site.

For locations where no curb and gutter is proposed, a 2-foot wide gravel shoulder consisting of six (6) inches of MDOT 21AA or 22A will extend along both sides of the roadway.

D. Typical Roadway Widths:

For typical roadway widths, the requirements set forth in the latest edition of the AASHTO guidelines outlined in A Policy on Geometric Design of Highways and Streets should be followed. For minimum allowed roadway widths, refer to the Village of Dexter's Road and Right-of-Way Improvement Policy.

E. Driveways:

1. Non-Residential Driveways: Driveways will conform to the standard driveway details, (see Appendix).
2. Residential Driveways, (Single Family)
 - a. Residential driveways will conform to the standard details, (see Appendix)
 - b. Concrete driveways must be six (6) inches thick from the back of curb to the property line. Concrete will conform to MDOT Grade P1.

- c. Bituminous driveways will consist of a minimum compacted thickness of three (3) inches of bituminous pavement placed in two lifts over six (6) inches of compacted thickness of aggregate base course. The bituminous mixture will conform to MDOT HMA 36A.
- d. Gravel Drives: Where the public road does not have a hard surface, the driveway may be constructed of 22A gravel without a hard surface. The gravel will be a minimum of six (6) inches compacted thickness within the road right-of-way and at least four (4) inches thick on private property.
- e. The maximum width of a driveway opening, at the roadway edge, will not exceed forty (40) percent of the overall lot frontage width or twenty-four (24) feet, whichever is less.
- f. Where two driveway openings are proposed for a single residence, the following condition must be met before the plot plan is submitted to the Village for approval:
 - 1). Minimum lot frontage: One hundred (100) feet
 - 2). Maximum opening: Forty (40) percent overall lot frontage; not to exceed a total combined width of forty-eight (48) feet; also not to exceed a maximum of twenty-four (24) feet for a single opening.
 - 3). Minimum between drives, (edge to edge): Forty-eight (48) feet.
- g. New driveways cannot be closer than two (2) feet from the property line.
- h. The driveway approach at the roadway edge cannot extend beyond the property line extended and create an encumbrance across the frontage of the adjacent properties.
- i. The driveway approach at the roadway edge must be in front of the house or garage.
- j. All ordinances applicable to the Village of Dexter, Washtenaw County, and the Michigan Department of Transportation, dependent upon jurisdictional responsibilities, must be complied with.

3. Shared Driveways (Residential).

- a. A maximum of two (2) homes shall be serviced by one (1) driveway. If permitted, the Fire Department shall have the authority to approve the driveway to ensure that emergency services can be adequately provided to both homes. Appropriate access easements must also be secured for

the driveway. Any road servicing more than two (2) residences shall be designated a private road, unless otherwise permitted by the village.

4. Driveway Inspection: Driveway approaches in the public right-of-way shall be inspected by a representative of the Village. Inspection and approval of the driveway must be obtained prior to and after placing the driveway regardless of the driveway material. For fees associated with driveway inspection, see Section F: Fees under Development Requirements and Procedures.

F. Sidewalks:

1. The following standards shall apply to sidewalk construction:
 - a. Sidewalks required for New Development:
Sidewalks shall be located in the right of way and one (1) foot from the ultimate Right of Way line.
 - b. Sidewalks added to streets with Existing Structures:
Recognizing that existing streets develop their own valued character over time, new sidewalks shall be located so as to preserve the character of the Village; continue reasonable use and enjoyment of the yard; and avoid disturbing existing landscaping.
 - c. The walk will be five (5) feet wide constructed of four (4) inches of MDOT Grade P1 concrete on compacted 4 inches of Class II sand. The walk must be continued through driveway sections where it will be increased in thickness to eight (8) inches of MDOT Grade P1 concrete on 4 inches of Class II sand on major thoroughfares, collector roads, and alleyways and six (6) inches of MDOT Grade P1 concrete on 4 inches of Class II sand in all other instances.
 - d. Curbs must be tapered to meet the walk.
 - e. Cross slopes on the sidewalk will be a maximum of two (2) percent toward the street. Proposed grades must be shown along property lines driveways, and intermittent locations along the length of the walk.
 - f. Sidewalks must be free of utility structures and valves. Any structures, hydrants, poles, etc., which are existing along the alignment of the walk, must be relocated at the expense and coordination of the developer.
 - g. All sidewalk construction will be according to the latest ADA guidelines and the MDOT standards for ADA ramps with detectable warning domes.

- h. New sidewalk ramps shall be constructed perpendicular to the centerline of the road across which the crosswalk is extending.
 - i. When a sidewalk ramp is replaced, the receiving sidewalk ramp must also be replaced.
 - j. Striping of crosswalks will be completed as determined by the Streets Administrator and/or the Village Engineer.
2. Sidewalk Inspection: When sidewalks are placed in the public right-of-way, a representative of the Village must be present to inspect the sidewalk installation. Inspection and approval must be obtained prior to and after placing the concrete. For fees associated with sidewalk inspection, see Section F: Fees under Development Requirements and Procedures.

G. Drainage in Right-of-Way:

- 1. Enclosures of existing drainage ditches across the frontage of the site will generally not be allowed. The DPW may, however, require the enclosure if adequate controls on pavements and shoulders cannot be maintained and the health, safety and welfare of the public is endangered.
- 2. Side slopes on open ditch drainage will be three minimum horizontal to one vertical. The ditch bottom will be two (2) feet wide. Open ditch drainage will be permitted only in existing right-of-ways that currently utilize open ditch drainage and where roads do not have curb and gutter.

H. Streetlights:

- 1. Ornamental streetlights are to be used within the boundary of the Downtown District Authority (DDA). Cutoffs shall be provided on each ornamental streetlight. Details for the ornamental streetlights and cutoffs approved by the Village can be found in the Appendix.
- 2. Ornamental streetlights shall be LED.
- 3. When an applicant proposes improvements to a property within the DDA boundary, ornamental streetlights shall be placed within the right-of-way along the road frontage as part of the improvements. The developer shall provide a connection to the closest available light or handhole on the side of the street on which the development is proposed. The work shall also include the installation of conduit across the entire frontage of the property to facilitate adjacent expansions. Once installed, the Village will accept responsibility of the streetlights as part of the dedication process.

4. Cable shall be 600V within 1-1/2" Schedule 40 PVC buried conduit. Conduit shall be provide a minimum of 2' cover and shall be placed behind the back of curb.

VI. Site Grading

A. General:

1. All proposed developments will be graded so that storm water runoff will be intercepted within the boundaries of the site. The runoff will then be treated on site or directed to an approved point of discharge. Open drainage ditches may be approved only where storm sewer systems are not feasible, as determined by the Village Engineer.
2. No storm water runoff from developed property will flow onto adjacent land. Filling and grading will not create a barrier causing entrapment of water on neighboring land.
3. The developer will 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 will be equal to the amount of runoff from the offsite land in the undeveloped state.
4. Each single-family lot will be graded to drain away from the house to swales constructed along the lot lines. Swales will discharge to a catch basin, roadway gutter, or other approved drainage course.
5. Grading plans will consider the desirable natural features and the character of the land that must be preserved where possible.
6. No filling will be allowed in any areas of land within a proposed subdivision or other type of development which lie either wholly or in part within the floodplain of a river, stream, creek, or lake unless under the terms of a permit granted by the Michigan Department of Environmental Quality.
7. Trees, stumps (removed due to grading operations), excess topsoil, surplus materials, construction debris, etc., will be removed from the site and properly disposed of. All topsoil within the limits of construction is to be stripped and stockpiled. No topsoil is to be removed from the site without approval from the Village Engineer.
8. Elevation representing the brick ledge, finished grade, and the first floor grade must be shown.
9. Proposed grading will meet abutting property line elevations. Differentials in grade must incorporate a minimum four horizontal to one vertical slope to the abutting property line.
10. Retaining walls are discouraged. Any wall separating a differential grade of more than eighteen (18) inches will be considered a retaining structure and will require a structural engineering design and review.

11. Asphalt surface parking lots and roadways will be graded to a minimum one (1) percent slope, except where concrete curb and gutters are to be provided. Where concrete curb and gutters are to be used, the transverse slope to the gutter will be a minimum of one (1) percent for parking lots and one-quarter (1/4) inch per foot for roadway crowns. Longitudinal gutter grades will be a minimum of one-half (1/2) percent for concrete curb and gutter. In general, pavement grades will not exceed six (6) percent.
12. All areas within twenty-five (25) feet of buildings will slope away from the building at a minimum slope of two (2) percent. All other areas will have a minimum slope of one (1) percent. The maximum allowed slope in lawn areas is 1 on 4.
13. All lawns or landscaped areas will drain to parking lots or swales. All swales must have a minimum slope of one (1) percent.
14. Catch basins will be placed at all low points in parking lots and swales.
15. Site grading will not be allowed until a Soil Erosion and Sedimentation Control permit has been obtained and all soil erosion and sedimentation control measures are in place.
16. A construction sequence shall be provided on the plans. Storm water management during construction shall be addressed.
17. Public utility construction can begin only after rough grading of the site is complete, as determined by the Village Engineer.

VII. Soil Erosion and Sediment Control

A. Sites Requiring Permits:

Soil Erosion and Sedimentation Control (SESC) permits shall be obtained from the Washtenaw County Water Resources Commissioner. Permits are required for sites as noted in the Washtenaw County Soil Erosion and Sedimentation Control Ordinance. No construction will be allowed until the SESC permit has been obtained.

B. Intent of Permit:

The purpose of this requirement is to ensure that no silt or sediment enters the public stream or watercourses. This is accomplished through sediment basins, filters, diversions, etc.

C. Plan Required:

1. A Soil Erosion and Sediment Control Plan is required for all sites that require a permit. This plan can be made a part of the site construction plans or may be a separate plan. Step-by-step requirements for controlling siltation will be detailed on the plan. No work, including site clearing, will be allowed until approved soil erosion and sedimentation control measures are in effect.
2. Accelerated erosion and sedimentation must be prevented during all phases of construction including:
 - Initial site clearing.
 - Utility construction.
 - Building construction.
 - Site paving.
 - Final site approval.

D. Inspection:

1. Inspection will be made periodically throughout construction on the maintenance and effectiveness of soil erosion control methods.
2. If inspection reveals that the controls are not being implemented, a cease and desist order on all site construction may be issued.
3. Temporary Soil Erosion and sedimentation control measures shall not be removed until directed by the Village Engineer.

NOTE:

THE EROSION CONTROL REQUIREMENTS MAY CONTROL THE PROGRESS AND SCHEDULING OF ALL CONSTRUCTION ON THE SITE.

VIII. Construction Specifications

A. General Requirements:

1. Payment of Fees: Performance Guarantee Bond and the inspection fee deposit must be paid before construction starts. Performance Guarantee standards are within Article 21 of the Zoning Ordinance. All benefit charges, trunk line and transmission charges, and tap fees shall be paid when the building has been constructed and is ready for connection.
2. Insurance: Certificates in accordance with the "General Requirements" Chapter of this document will be submitted to and approved by the Village before construction starts.
3. Preconstruction Conference: A preconstruction meeting will be held before the start of construction for all projects that involve site improvements of \$50,000 or more. The proprietor will arrange and schedule the meeting at least 3 weeks before the commencement of work. Those attending should include representatives of the:

- Proprietor
- Proprietor's Engineer
- Development Coordinator
- Contractors and Subcontractors
- Fire Department Code Official
- Village Engineer
- Village Manager
- Utilities Department
- Department of Public Works
- Community Development Manager
- Washtenaw County Water Resources Commissioner
- Washtenaw County Road Commission
- Representatives of Private Utilities Affected (electric, gas, phone, cable, etc.)

4. Inspection: An inspector must be present before any work is started on water mains, sanitary sewers, storm sewers, driveway approaches, sidewalk or detention/retention basins. The contractor or representative of the proprietor will notify both the Village and the Village Engineer at least seventy-two (72) hours before construction starts to arrange for inspection.

Any work installed without inspection will not be accepted by the Village and will not be allowed to connect to the system.

5. **Compaction Testing:** All density testing will be provided by the proprietor through the design engineer or an independent testing company to verify the compaction requirements to the satisfaction of the Village Engineer. This report shall be signed and sealed by a registered State of Michigan Engineer. A sieve analysis of the backfill material and copies of material test reports will be furnished to the Village Engineer for approval.
6. **Shop Drawings:** Shop drawings will be furnished to the Village Engineer two weeks before construction or installation of all special fabricated structural and mechanical parts of the system as determined by the Village Engineer. Operation and maintenance manuals will be furnished for all water booster pump stations, sanitary lift stations, and similar installations.
7. **Final Inspections and Acceptance:** Prior to acceptance of public utilities and right-of-way for use and maintenance by the Village, final inspections and all necessary tests of the system must be made. Any tests that fail will be redone after repairs have been completed. This will take place until the tests show satisfactory performance of the utilities. Any portions of the work found unacceptable will be repaired or replaced before acceptance.

Prior to final acceptance, a two (2) year maintenance and guarantee bond in the amount equal to one-half (1/2) the cost of the improvements (utilities, roadway pavement, sidewalks, curb and gutter, water main, sanitary sewers, storm drains, detention/retention systems, etc) will be posted with the Village by the proprietor.

Final acceptance will not be made until all improvements and other heavy construction on the site have been completed. Record drawings, CAD drawings, and GIS layers (requirements noted in the Appendix) must be submitted and approved by the Village prior to final acceptance.

For further requirements prior to acceptance and a description of the acceptance process, refer to the Village's policy, "Dedication of Public Streets and Utilities."

B. Water Main Construction:

1. **Pipe Certification and Inspection:** All pipe and fittings will be inspected when they are delivered to the job site. Certification papers showing that the pipe and fittings have been tested according to applicable specifications and that they meet project specifications will also be required. No cracked, broken or damaged pipe or fittings will be allowed.

Rejected pipe and fittings will be immediately removed from the job site by the contractor at no expense to owner.

Each piece of ductile iron pipe and related appurtenances will have its own weight and class designation conspicuously painted or cast on it. Class designations will be painted

on all other pipe materials. Where required, other designation marks will be painted on the pipe or fittings to indicate correct location in the pipeline in conformity to a detailed laying schedule.

Water main stored onsite must have capped ends to prevent infiltration of dirt, debris, etc.

2. Preparation of Trench Bottom and Backfilling: At a minimum, the trench will be thirty (30) inches wide. Trench depths will be as shown on the plans and will generally provide not less than five and one half (5 1/2) feet of cover from the top of the water main to the final surface grade above such mains. The bottom of the trench will be excavated neatly to required grade and filled with four (4) inches MDOT Class II sand thoroughly compacted by tamping before the pipe is laid. The bedding will be dug out at each bell end of the pipe to conform to the shape of the bell. Blocking under the pipe is strictly prohibited. After the pipe has been laid, sand bedding will be continued to a level twelve (12) inches above the top of the pipe barrel and mechanically tamped to 95% of max unit weight.

Backfill around the pipe will be under, around, and above the top of the pipe. Backfill will be placed in horizontal layers not more than six (6) inches deep and each layer will be thoroughly compacted using mechanical tampers or other approved means before the following layer is placed. If suitable earth is not available from the trench excavation, Class II sand will be furnished from offsite and placed and tamped as specified. The remaining backfill will be completed with the approved excavated material free of cobbles, frozen material or other deleterious or foreign material. Backfill will be thoroughly compacted to prevent settlement, and prior to acceptance of the work, the contractor will refill any trenches that have settled.

Trenches under the influence of road surfaces, pavement, sidewalk, curb, driveway will be backfilled with Class II sand. The material will be placed in six (6) inch layers. Each layer will be compacted by using suitable compaction equipment to at least ninety five (95) percent of maximum unit weight before the succeeding layer is started. Maximum unit weight will be determined by the current Method of Test for the Compaction and Density of Soil, AASHTO Designation: T-99, or by the Cone Density Method developed by the Michigan Department of Transportation (MDOT), as required.

Except at pipe joints and service connections, backfill to an elevation at least six (6) inches above the top of the pipe will be placed before the hydrostatic test. In no case will the test requirements be relaxed because the trench may have been backfilled.

3. Handling Pipe, Fittings, Specials, etc.: All pipes and castings will be unloaded and distributed along the line of work in such a manner and with such care as will effectually avoid damage to any pipe or special. Dropping the pipe or fittings directly from the truck will not be allowed. Care must also be taken to prevent abrasion of pipe coating. Wherever the coating has rubbed off, the part will be recoated as required by the nature of the pipe coating.

4. Installation of Pipe: The water main will be installed according to the published installation guide of the pipe manufacturer, except as otherwise specified in this document. Whenever the instructions given by the manufacturer vary with the provisions specified in this document, the laying standards provided in this manual will govern.

Proper tools for installing the pipe, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gages, etc., will be provided at the site of the work.

5. Defective Pipe and Fittings: No pipe or fitting that is known to be defective will be laid in the work. Any piece found defective after it has been laid will be removed by the contractor and replaced by a sound and perfect piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut will be square and ground smooth. The cut surfaces of ductile iron pipe will be painted with two (2) coats of approved asphaltum metal protective paint, where required by the Village Engineer.
6. Laying Pipe: The pipe will be carefully laid to line and grade and will have bearing over its entire length except at joints where the joint hole will be of such size as to give adequate room for working. The pipe will be laid with a minimum cover as shown on the drawings.

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

After a length of pipe is placed in the trench, the spigot will be centered in the bell of the adjacent pipe, the pipe shoved into proper position in the collar or bell and brought into true alignment, and there secured with sand bedding, carefully tamped under and on each side of the pipe.

7. Joint Restraint: All pipe deflections over eleven and one-quarter (11 1/4) degrees and all tees will be restrained, tied or harnessed in a manner acceptable to the engineer. The restraint will be applied to joints each way from deflection or tee an adequate distance to resist the axial thrust of the test pressure (See Restrained Joint Schedule below). Details of all proposed joint restraint, showing type and locations, will be submitted to the engineer for approval.

Restrained Joint Schedule

Pipe Diameter (in.)	Degree Bend			
	90	45	22 1/2	11 1/4
4"	21	9	4	2
6"	30	12	6	3
8"	39	16	8	4
12"	53	22	11	5
16"	74	31	15	7
20"	90	37	18	9
24"	107	44	21	10

Notes:

1. Lengths are shown in linear feet from the center of the fitting.
2. For plugs provide same as 90-degree bend.
3. For tees, provide same as 90-degree bend on the branch, plus min. 20 lft on each leg of the run, or as required by Village Engineer.
4. For reducers, use 45-degree bend.

Acceptable methods of joint restraint for ductile iron pipe will be provided according to one of the following methods:

- a. Restrained joint gaskets such as Field-Lok gaskets or other approved equal.
 - b. Mechanical joint retainer gland such as Mega-Lug, Romag, or other approved equal.
 - c. Stainless steel tie-rod system as approved by Village Engineer.
 - d. Concrete thrust blocks through sixteen (16)-inch diameter pipe, only upon approval of Village Engineer, and Super Lock or Lokfast above sixteen (16) inch diameter pipes.
 - e. Concrete encasement method of joint restraint for pipe twenty (20) inches in diameter and larger will be subject to the Village Engineer's approval.
8. Service Connections and Taps: Water mains will be tapped for corporation cocks where shown on the drawings or required for testing and sterilization of the completed water mains. For ductile iron pipe, the cocks will be threaded directly into the pipe.

9. Corporation Stop: Corporation stops will be one (1) inch Ford compression fittings or approved equal. Corporations larger than 1 inch will be as called for on the drawings.
10. Fittings, Valves, Hydrants and Adapters: Valves, fittings and hydrants will be installed using the current standards for joints being used for the project. Wherever adapters are required to properly connect proposed water main with existing pipe of other material or manufacture, the nominal inside diameter of the adapters will be of the same size as the nominal diameter of the pipe connected thereto. Adapters will also be furnished and used as required by the manufacturer for connection to fittings. Special machined faced parts will be provided where required to connect to existing mains.
11. Setting Hydrants: At points indicated on the drawings, a hydrant assembly will be installed consisting of a hydrant, six (6)-inch gate valve, a three-piece adjustable cast iron valve box, and all pipe necessary for a complete job. Valves will be located two (2) feet from the hydrant, as shown on typical setting detail on the standard drawings.

Each hydrant will be set plumb and braced firmly in this position. Connection of the hydrant to the branch will be made by means of mechanical joints, as herein specified under jointing. All joints between the hydrant and the main will be restrained by the same means as used for water main as specified under Section B, Item 7 of this chapter.

If hydrants are furnished with drain outlets, the outlets will be permanently capped or plugged. After the hydrant has been set, an additional one (1) foot of gravel will be spread and tamped around the hydrant. When this has been done, the remaining backfill will be placed and compacted, taking care at all times to avoid jarring the hydrant.

After hydrants have been set and tested, the part above ground will be painted with two (2) coats of first quality metal protective paint. The Village of Dexter Water Utilities Department will designate the color.

12. Hydrant Testing: Each hydrant assembly will be tested by the contractor. Final orientation of the hydrant must be completed prior to testing. The hydrant must be oriented toward the street. The test will consist of flushing the hydrant for a minimum of ten (10) minutes. During the testing period the six (6) inch gate valve will be closed and opened. The contractor will furnish the necessary hoses for disposal of owner-furnished water. A testing schedule and method of disposing of flushing water will be submitted to the engineer for approval. The contractor will coordinate the testing schedule with the local fire department and the Village of Dexter.
13. Connections to Existing Mains: Where shown on the plans, connection of existing mains to new mains will be done only after the new mains are shown to be sterile by results of the bacteriological analysis.
14. Flushing of Water Mains: Prior to disinfection and hydrostatic testing, the newly constructed water mains will be thoroughly flushed to remove all accumulated debris that may have entered the line during the construction. A polly pig, or approved equal

equipment, will be used to flush accumulated debris. How often the polly pig is run through the water mains will be determined by the debris discharging from the effluent. Several passes with the polly pig through the newly constructed system may be required before the main is acceptable. Procedures for using the polly pig, or approved equal equipment, will be per the manufacturer's specifications.

15. Sterilization of Mains: Testing standards shall meet AWWA C-651, latest revision. After pressure testing and before hydrostatic testing, all new pipelines will be flushed until the water runs clear. After flushing, liquid chlorine will be added to the water in the amount of eighty (80) parts per million (ppm). This will require the addition of the following quantities of liquid chlorine:

Size of Pipe	Pounds of Liquid Chlorine (100 percent) Per 100 Feet Length of Pipe
4 inches	0.043
6 inches	0.098
8 inches	0.174
10 inches	0.272
12 inches	0.392
14 inches	0.532
16 inches	0.695
18 inches	0.88
20 inches	1.096
24 inches	1.563
30 inches	2.445

After the main, or section of it, has been filled with chlorinated water, a minimum contact period of twelve (12) hours will be required with an average chlorine level of fifty (50) ppm, after which the main will be flushed with water from the distribution system until the chlorine residual of the water in the main is one half (1/2) part per million. The main will then be allowed to stand for twenty four (24) hours. At the end of this period, two samples each will be drawn from the main at two different locations on two successive days for bacteriological analysis at the Dexter Village water treatment plant laboratory.

If these analyses show the presence of harmful bacteria, the contractor will repeat the sterilization process until the mains are shown to be sterile by the results of the bacteriological analyses.

The contractor will furnish the chlorine and all necessary equipment for its application. The owner will supply the water. The contractor will arrange with the owner for bacteriological analyses. The contractor will dispose of high residual chlorine water by a method approved by the Village Engineer.

16. Hydrostatic Testing of Water Mains shall conform to AWWA C600 standard, latest revision. Prior to and during the hydrostatic test, the new main is not to be connected to the existing water system, except as specified herein. Temporary blow-offs, caps or plugs will be provided at the ends of the new main.

At the option of the authorized representative of the community having jurisdiction over the work, the contractor may test against closed valves providing the new main to be tested and the testing apparatus will have first been flushed and chlorinated according to accepted procedure. After chlorination and subsequent flushing, a sample of the water must show, by test the Dexter Village water treatment plant laboratory, safe bacteriological results. If the hydrostatic test is unsatisfactory, the contractor will cut the new main, install caps or plugs, pressure test, and rechlorinate without additional cost or charge.

The contractor will furnish all necessary personnel, temporary timber bracing, plugs, test pumps and all other necessary apparatus for conducting the test. The pressure gauge must read to the nearest 1 psi.

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

Test pressure will be maintained at one hundred fifty (150) pounds per square inch (psi) by pumping potable water into the pipe for at least one (1) hour for pipe sizes twelve (12) inches and under, two (2) hours for pipe sizes over twelve (12) inches, 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 one hundred fifty (150) psi pressure during the test, will not exceed the rate of fifty (50) gallons per inch diameter of main, per mile of pipe, in twenty four (24) hours.

Unless otherwise directed, each joint in the section of main being tested will be carefully examined while the main is subjected to full test pressure, and any joint showing visible leakage will be repaired as necessary to produce a tight joint. Any faulty pipe, fittings, gate valves, or other accessories disclosed by testing will be replaced with sound material. The test will be repeated as necessary until the specified requirements have been met.

If the authorized representative of the community having jurisdiction over the work directs the contractor to backfill the trench before the main is tested, and difficulty is experienced in obtaining a satisfactory hydrostatic test, the joints will progressively be

exposed and repaired in such manner as to provide protection to the pipe. Under no circumstances will the test requirements be waived or reduced because the trench is backfilled.

17. **Painting:** All iron pipe, valves, bolts, and any other portions of the water main exposed inside manholes or other structures will receive two coats of Inertol No. 49, Tape Coat TC Mastic, or approved equal material. If necessary, heat will be provided to maintain good drying conditions. All items to be painted will be dry and clean before they are painted. Any rust or scale will be removed by wire brushing or scraping before painting, if required.
18. **Pipe Placed in Casings:** Pipes will be placed in casing pipe in the locations shown on the drawings. These pipes shall be installed following the latest revision of AWWA C600.

For road crossings, all void spaces between the casing pipe and the carrier pipe will be filled with cement grout meeting the requirements of MDOT Standard Specifications for Natural Sand 2NS. Sand will be placed by flushing or other methods approved by the engineer. The contractor will furnish the engineer with information on the quantity of sand placed.

For railroad crossings, all void spaces will be cement grouted.

The annular space at the ends of the casing pipe will be bulkheaded with a minimum of eight (8) inches thick solid masonry with one half (1/2) inch fiberboard cushion between the masonry and carrier pipe.

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

19. **River Crossings:** River crossings will be made with a freely deflecting locked joint pipe. Pipe will be either ductile iron with bell ball type joints or reinforced concrete pressure pipe with bell bolt type of joints.

The pipe will be of the same class and grade as called for on the plans.

Ball Joint River crossing pipe may be installed by pulling or floating across the river. Bell bolt joint pipe must be laid on grade by coffer-damming the trench. The trench will be backfilled with clean washed stone.

C. Open Cut Sewers:

1. **General:** Sewers will be considered as pipes or conduits between the extreme ends of the project including branch lines.

All labor, tools, equipment and all materials necessary to excavate for, lay, join, backfill, and finish the sewer will be considered as part of the sewer construction.

Unless otherwise allowed under detailed specifications for a particular type of sewer or unless permitted by the engineer, construction will begin at the outlet end of the sewer and proceed upgrade.

2. Sewer Pipe: Sewer pipe will be of approved type and class designated for the specific locations or intended uses shown or noted on the contract drawings. Any deviation from type or class of pipe shown on the drawings will not be allowed, except upon receipt of written approval of the engineer.

Pipe joints will be of the approved type and/or brand called for on the contract drawings.

3. Cement Mortar Pointing: All pipe joints on sewers thirty six (36) inches in diameter and larger will be pointed on the inside with approved non-shrink cement mortar composed of one part cement and two parts sand. On bituminous mastic joints the compound will be removed to a depth of three-quarters (3/4) of an inch from the inside the joint and painted as described above.
4. Excavation: Excavation will include clearing the site of work and removal and disposal of all materials necessary to be removed in the construction of all the work..

Excavation will be of sufficient width and depth to provide adequate room for construction and installation of the work to the lines, grades, and dimensions called for on the plans. However, the width of a trench from the invert to a height twelve (12) inches above the top of the sewer barrel will not be greater than twelve (12) inches plus the outside diameter of the sewer barrel, except four (4)-inch through twelve (12) inch sewers the width of the trench may be thirty (30) inches.

If maximum trench width, as specified above, is exceeded, unless otherwise shown on the drawings, the contractor will install, at his own expense, concrete cradling or other bedding as approved by the Village Engineer, to support the added load of the backfill.

Where, through the contractor's construction procedure, or because of poor existing ground conditions it is impossible to maintain alignment and grade properly, or as directed by the Village Engineer, the contractor will, at his own expense, excavate below grade and replace with 6A aggregate or slag to ensure that the pipe, when laid, will maintain the correct alignment and grade.

Excavated materials will be temporarily stored along the trench in a manner that will not cause damage to trees, shrubs, fences or other property nor that will endanger the bank of the trench by imposing too great a load thereon.

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

When excavating for sewer lines, the excavation will always be finished to the required grade for an adequate distance ahead of the completed sewer but unless otherwise permitted by the engineer, not more than one hundred (100) feet of trench will be open at once before the completed sewer line.

Open cut excavations for shafts or other structures will be adequately braced and/or sheeted to prevent caving or squeezing of the soil. Tunnels will be sheeted and/or braced as necessary to enable the work to proceed with safety to the workers, the work, and neighboring structures.

All excavations will be completely dewatered before constructing the sewer or other structures. Adequate provisions will be made to prevent water from flowing through or over newly placed concrete or brickwork. Drainage will be carried to sumps from which the water may be pumped

5. **Test of Pipe:** The contractor will have tests of pipe and strength made by an independent testing laboratory. Tests of up to four (4) lengths of sewer pipe per hundred (100) lengths may be required to show compliance with the specifications. All pipe delivered to the job site will be accompanied with the manufacturer's certificate of compliance to the specifications.

The contractor will submit shop drawings or data sheets for all manhole castings, pipe to manhole connections, valves and backfill materials.

6. **Laying Pipe:** All pipes will be laid to the line and grade called for on the plans. Lasers shall be used to accurately position pipes. The finished work will be straight and will be sighted through between manholes.

Each pipe will be inspected for defects before being lowered into the trench. Inside the pipe and outside the spigot will be cleaned of dirt or foreign matter.

Construction will begin at the outlet end and proceed upgrade with spigot ends pointing in the direction of the flow. Pipes will be laid on a four (4)-inch through six (6) -inch sand cushions that will be carefully prepared so that the entire bottom half of pipe will bear against the cushion. If, through carelessness or other reasons, the subgrade has been disturbed so that refilling is necessary to bring pipe to grade, such refilling will be done with sand or gravel thoroughly tamped in place. Bell holes will be excavated so that the full length of the barrel will bear uniformly on the subgrade.

The pipes will be centered in bells or grooves and pushed tight together to form a smooth and continuous invert. After laying the pipe, care will be taken not to disturb its line and grade. Any pipe found off grade or out of line will be re-laid properly by the contractor.

Where pipe is laid in wet trenches or trenches with running sand, the contractor will provide and use mechanical means for pulling the pipe home in making up the joint and holding the pipe joints tight until the line is complete. Mechanical means will

consist of a cable placed inside the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding it in position.

Mechanical means will be used for pulling home all rubber gasketed pipe regardless of trench conditions where manual means will not result in pushing and holding the pipe home.

If maximum trench width specified under Section C, Item 4 of this chapter is exceeded, unless otherwise shown on the drawings, the contractor will install, at no expense to the Village, concrete cradling or other bedding as approved by the Village Engineer to support the added load of the backfill.

7. Backfilling: Backfilling of sewer trenches will follow closely behind the laying and joining of sewer pipe but only after completed section has been inspected and approved by the engineer for backfilling. Concrete sewers constructed monolithically in the trench will be backfilled only after the concrete has attained sufficient strength to sustain the entire load imposed by backfilling operations.

Sewer pipe will be laid on a minimum of a four (4)-inch thick sand cushion and backfilled with porous sand tamped in six (6)-inch layers to a height of one (1) foot above the top of the pipe. Care will be taken to fill all voids under and around the pipe. The remainder of the trench will be backfilled with approved excavated trench material (excluding blue or gray clay) or sand, free from large stones and lumps, and will be placed in twelve (12)-inch layers that will be thoroughly compacted in a manner that will prevent subsequent settlement. Backfill material will be deposited in the trench with care to not disturb the sewer and to equalize pressure on the sewer.

Where called for on the plans, special concrete cradle or other special bedding materials will be used to the depths specified and the remainder of the trench will be backfilled as described above.

Trenches under road surfaces, pavement, curb, driveways and sidewalk and where the trench is within the influence of the pavement will be backfilled with bank run sand meeting the requirements of "Granular Material, Class II," MDOT Specification 902.05. Material will be placed by the "Controlled Density Method, MDOT Specification 205.03.H.4 (a) or by other approved means.

Trenches to be constructed under future pavement, when called for on the plans, will also be backfilled with granular material, Class II, by the controlled density method or other approved means.

Attention is directed to the fact that backfilling and restoration of improvements in streets, roads or highways will be subject to regulation and inspection by the public authority having jurisdiction in each case, and that all such work must meet the authority's satisfaction.

If any inconsistencies exist between the appropriate public authority's backfill requirements and the requirements herein provided, the more rigid requirements will govern.

Trenches constructed in established lawn areas would be compacted to allow restoration with sod shortly after completing the backfill without appreciable settlement.

No backfill will be placed around manhole walls until forty eight (48) hours after the plaster coat has been applied to the outside walls, nor will backfill be placed around and over the top of concrete structures until the concrete has attained sufficient strength to sustain all the loads imposed by the backfilling operations.

8. Underground Installation of Flexible Thermoplastic Sewer Pipe:

a. General

The intent of this section is to require the installation of plastic pipe in accordance with ASTM D –2321 and the Recommended Standard for Wastewater Facilities, latest edition.

The pipe will be bedded true to line and grade with uniform and continuous support from a firm base. Blocking shall not be used to bring the pipe to grade. Properly placed and compacted backfill shall be required to provide lateral support.

The nature and particle size distribution of the material used in bedding, haunching and initial backfilling, as well as the manner and care with which it is installed are important factors in achieving satisfactory installation of flexible conduit. The amount of diametric deflection as well as the care with which the embedment material is placed under, around and over the pipe. Installation shall be in accordance with the plans, specifications, manufacturers recommendations and ASTM-D 2321.

b. Embedment Materials

Embedment materials listed herein include a number of processed material plus the soil classifications listed under the Unified Soil Classification System (USCS) (Test Method D-2487 and Recommended Practice D-2488).

Class I – Angular one-quarter (1/4) inch to one and one half (1-1/2) inch graded Stone, included a number of fill materials that have regional significance such as coral, cinders. Crushed stone, crushed shells.

Class II- Coarse sands and gravels with a maximum particle size of one and one half (1-1/2) inches, including various graded sands and gravels containing small

percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

c. Trench Construction

During preparation of the trench certain conditions may be encountered requiring special treatment in order to provide adequate bedding and foundation for the installation of flexible pipe. During construction of the trench it may be necessary to stabilize the trench walls or bottom. Some of the anticipated conditions are as follows:

1. Stable Trench Walls

The width of the trench at any point below the top of the pipe should not be greater than that necessary to provide adequate room for joining the pipe. And compacting the haunching and initial backfill. The trench width at the top of the pipe directly affects the soil load imposed on the pipe. Compaction of the foundation, bedding, haunching and backfill should extend to the trench walls in narrow trenches.

2. Unstable Trench Walls

Where an unstable or running soil condition is encountered in the trench, the contractor shall stabilize this condition before laying pipe. This condition is most often encountered when excavating below the groundwater table. Depending on the severity of the condition, the contractor may elect to use tight sheeting, stay bracing or a trench box to control trench conditions during pipe laying operations.

Well points or underdrains may also be used to control excessive groundwater conditions. Care must be taken to prevent displacement of running soil or the removal of sand or silt during dewatering. To obtain the desired lateral support for pipe laid under unstable trench wall conditions where sheeting or other similar means are not left in place the trench width should be a minimum of five (5) pipe diameters.

3. Unstable Trench Bottoms

Unstable trench bottoms must be stabilized or alternative foundation methods found prior to laying the pipe. Special foundations include wood pile or sheeting capped by a concrete mat with bedding on top, wood sheeting with keyed- in planed foundation, or the stabilization of the bottom material.

In the case of stabilizing the bottom material the contractor is required to remove a sufficient depth of unstable soil and replace it with a foundation and bedding of processed stone or processed gravel. The

stone or gravel shall be suitably graded and act as an impervious mat into which the unstable soil will not penetrate.

The depth of the processed material used for foundation and bedding shall depend upon the severity of the trench bottom soil condition. Installation of such foundations and bedding material shall be accomplished in six (6) inch layers and suitably padded or compacted. If the foundation material contains larger particles, which could create a hazard to the pipe, a cushion of acceptable bedding material shall be placed between the foundation and the pipe.

4. Over Excavation

During the course of the construction, should the trench be inadvertently over-excavated to a point between six (6) inches and twelve (12) inches below the bottom of the pipe but not beyond twelve (12) inches, the contractor shall fill the area of over-excavation with an acceptable class of embedment material and compact to ninety-five (95) percent of a Standard Proctor Density. Any area of over-excavation below twelve (12) inches from the bottom of the pipe shall be filled with processed stone or gravel in the same manner as described in Item 3. Over-excavation and subsequent filling of the over-excavated area shall be accomplished by the contractor at no additional cost to the village.

5. Running Water

Under certain conditions, the contractor may be faced with unusual amounts of water running in the trench, which may require removal in order to properly lay the pipe. The contractor may simply elect to remove the water with trench sided pumps and use Class I material for bedding. The depth of the Class I bedding will depend on the amount of water. Care shall be taken to ensure that the trench wall soil material will not be removed from the area adjacent to the bedding as the result of running water.

If the contractor uses either well points or underdrains to control the excessive groundwater and Class I material is used as bedding and underdrain, the depth of material must be to a point at least twelve (12) inches above the top of the pipe.

The discharge of excessive water from the trench shall be in accordance with all State and Federal requirements.

6. Rock Excavation

When the pipe is to be installed in a rock cut, a four (4) inch to six (6) inch depth of bedding will be required. The bedding shall be either

Class I or Class II material as shown in the plans and details. If running water is encountered in the rock cut the procedures noted in Items 5 shall be employed.

D. Wide Trench:

Care shall be taken by the contractor to provide as narrow a trench as possible at a point level with the top of the pipe. If the trench width is greater than six (6) pipe diameters, the haunching and initial backfill shall be compacted to a point at least two and one-half (2-1/2) pipe diameters from either side of the pipe. Depending on the severity of the trench conditions, the bedding and foundation shall be compacted to at least the same point or wider and if necessary, to the trench wall. Where an unstable trench bottom is encountered, the entire trench bottom shall be stabilized.

If a soils exploration program has been conducted, that information will be made available to the contractor. In suspect areas the contractor should make an independent investigation and determination of the underground soil conditions as they relate to trench conditions.

E. Bedding:

Prior to the installation of the pipe, the contractor shall bring the bedding material to grade along the length of the pipe to be installed. To ensure that adequate and uniform support is provided under the pipe and to avoid differential settlement of the pipe certain procedures shall be adhered to and precautions taken as outlined below:

Class I Material- When Class I material is used for bedding, little or no compaction is necessary due to the angular nature of the particles. A depth of four (4) inches to six (6) inches of Class I material is generally sufficient to provide uniform bedding depending on the trench conditions encountered. If Class I material is used for bedding it must also be used for haunching at least up to a point twelve (12) inches above the top of the pipe to avoid loss of side support through the migration of trench backfill material into the bedding.

F. Haunching and Initial Backfill

This section outlines the minimal installation procedures related to haunching and initial backfill.

Class I Material

Wet Conditions- In any area where the pipe will be installed below the existing or future groundwater table or where the trench could be subject to groundwater inundation, Class I material, when used shall be placed to a point twelve (12) inches above the top of the pipe. It is important that the contractor work the Class I material to ensure that it

has been placed under the haunch of the pipe to provide adequate side support. Precautions shall be taken to prevent movement of the pipe during the placing of material under the pipe haunch.

The backfill material shall be free of large particles. Where unstable trench conditions such as silts or fine sands exist, care shall be taken to prevent the loss of side support. The loss of side support will increase pipe deflection.

Class II Material

Class II material shall be placed to the spring line of the pipe and compacted. The contractor shall direct operations to ensure that sufficient material has been worked under the haunch of the pipe to provide adequate side support and to prevent movement of the pipe during placement.

Initial backfill shall be placed in at least two (2) stages; one to the top of the pipe and the other to at least twelve (12) inches above the top of the pipe. Each stage of haunching and backfilling shall be compacted.

Class II material shall be placed in maximum lifts of six (6) inches and compacted to a minimum of eighty-five (85) percent of Standard Proctor Density.

G. Pipe Stiffness:

Pipe stiffness requirements shall be in accordance with ASTM D – 2412, acceptable industry standards and the recommendations of the pipe manufacturer.

H. Special Considerations:

1. Bell Holes for Elastomeric Seal Joints

When the pipe being installed is provided with elastomeric seal joints, bell holes shall be excavated in the bedding material to allow for unobstructed joint assembly. Care shall be taken so that the bell hole is no larger than necessary to accomplish proper joint assembly. Where the joint has been made, the bell hole should be carefully filled with bedding and haunching material to provide for adequate pipe support throughout its entire length.

2. Minimum Cover for Load Application

A minimum of thirty six (36) inches of cover over the top of the pipe shall be provided prior to wheel loading of the trench. A minimum of forty eight (48) inches of cover shall be provided before either a hydrohammer or hoe-pack is used to compact the trench.

3. Use of Compaction Equipment

Care shall be taken to avoid contact between the pipe and compaction equipment. Compaction of haunching, initial backfill and backfill material shall generally be done in such a way to avoid use of the compaction equipment directly above the pipe until sufficient backfill has been placed.

4. Removal of Trench Protection

If Sheet piling or other trench protection is removed, care shall be taken so as to not disturb previously constructed foundation bedding, haunch material and initial backfill. If it has been necessary to drive sheet piling or other trench protection below the top of the pipe, consideration should be given to leaving it in place. Removal could jeopardize the side support necessary for flexible conduits.

5. Maintenance and Restoration of Pavement, Walks, Road Surfaces, etc.: All concrete or asphalt pavements, curbs, drives and walks removed, destroyed, or damaged by the contractor will be replaced by the contractor in a manner equal or superior to the previously existing pavement. In removing the concrete pavement, a saw will be used and a three-quarter (3/4) inch-deep cut made on each side of the part to be removed.

Where trenches cut or damage roadways or drives, other than hard surface pavements, the contractor will thoroughly compact the trench backfill and restore the roadway with a road gravel fill at least eight (8) inches thick and will, during the life of the contract, maintain the roadway in good condition with additional gravel as settling takes place.

6. Sewer and Drainage Structures: Manholes, catch basins, inlets and special structures will be constructed at the locations shown on the plans and will be of the size and type called for on the plans. Manholes and catch basins will be constructed to conform to Village specifications and in accordance with the detailed drawings.

7. Sanitary Manholes: Sanitary manholes will be constructed of precast reinforced concrete risers and tops in conformance with the detailed drawings and specifications. The manhole bottom riser section will have the base slab poured monolithically with the riser.

Joints on precast risers and tops will be modified grooved tongue with rubber gaskets conforming to the requirements for concrete sewer pipe.

Joints around pipes entering or leaving manholes will be flexible rubber joints such as Press Wedge II, Res-Seal, Kor-N-Seal, LinkSeal, or other approved equal. All pipe openings will be fabricated at the time of manufacture, and no

manholes will be accepted where openings have been made in precast units at the work site.

All sanitary manholes shall have an infiltration fabric placed from the top of the frame casting base over the adjustment rings and over at least half of the transition cone section of the manhole chimney. The material shall be Infa-Shield or approved equal.

8. Drop Manhole Connections: Drop manhole connections will be constructed on sanitary manholes in conformance with the standard detail drawings whenever a sewer enters a manhole at an elevation of eighteen (18) inches or more above the invert of the outlet sewer pipe.
9. Sanitary Test Manhole: The first manhole upstream from point of connection to existing sanitary sewer system will have a twelve (12) inch-deep sump that will be filled with concrete and channeled upon successful completion of infiltration testing.

The outlet pipe from this manhole will be plugged with a waterproof stopper to prevent discharge to the existing system until acceptance of the system by the municipality. 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.

10. Storm Drainage Structures: Storm sewer manholes, catch basins and inlets will be constructed of precast reinforced concrete, concrete manhole block, brick, poured-in-place reinforced concrete, or combinations of the above. Storm sewer structures will conform to the detailed drawings and specifications.

Joints on precast reinforced concrete risers and tops may be either cold applied bituminous mastic or modified grooved tongue with rubber gasket.

The entire outside surface of all concrete block and brick masonry portion of drainage structures will be plaster coated with one half (1/2) inch-thick mortar. Inside the sump must also be coated.

All manholes on storm sewers eighteen (18) inches in diameter and smaller will have two (2) feet-deep sumps unless otherwise called for on the plans.

Poured in place reinforced concrete structures will conform to detail drawings and the requirements for structural concrete construction provided in MDOT Section 706 of Standard Specifications for Construction.

11. Construction Methods for Sewer and Drainage Structures: Construction methods for the sewer and drainage structures will conform to MDOT Specifications Division 4, except as stated in this document.

Construction methods for poured in place structural concrete and the placement of steel reinforcement will conform to Section 706 of MDOT Standard Specifications for Construction.

Precast reinforced concrete units will be such that no more than fifty (50) percent of the circumference, measured on the inside face will be deleted on any horizontal plane for sewer pipe openings. There will be no less than twelve (12) inches of residual concrete measured on any horizontal plane between pipe openings.

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

12. Final Grade Adjustments - Existing Structures: Adjustment of sewer or drainage structures will apply to all final adjustments made on existing structures where the elevation of the cover is not changed by more than one (1) inch, and no more than one (1) inch vertical of the structure requires reconstruction. Each vertical foot in excess of one (1) inch will be treated as structure reconstruction.

13. Final Grade Adjustments - New Structures:

a. Sanitary Sewers: Where manholes are outside pavements and sidewalks, the final grade adjustments will be made with precast concrete grade adjustment rings; brick construction will not be allowed except where located in paved surfaces. Grade rings will be a minimum of three (3) inches thick, reinforced with two full circles of three and one sixteenth ($3\frac{1}{16}$) of an inch in diameter steel reinforcing wire. The manhole casting frame and concrete adjustment rings will be secured to the precast cone section with a minimum of four (4) and five eighths ($\frac{5}{8}$) inches in diameter cadmium coated threaded studs or bolts. All joints in the assembly will be sealed with rubber "O" ring gaskets. The maximum allowable grade adjustment using grade rings will be fifteen (15) inches. The final grade adjustment for manholes located in pavements and sidewalks will be made with brick and mortar. A minimum of three (3) or a maximum of six (6) courses of brick will be placed on top of the precast cone section.

b. Storm Drainage Structures: 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 will apply.

14. Frames and Covers: Cast iron frames and covers will be furnished and placed incidental to all proposed structures. Gray iron castings will be of the type,

size, and weight specified on the drawings. The castings will conform to the requirements of MDOT Specification Section 908.05, latest revision.

15. Stubs, Connections, Bulkheads and Miscellaneous Items of Work: Where called for on the drawings, existing sewers will be connected in.

Where called for on the drawings, drop connections, bulkheads, and stubs for future sewer connections will be provided. Bulkheads will be constructed or removed as called for on the drawings.

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

16. Infiltration Limitations: The infiltration rate for all sanitary sewers and for storm sewers, where rubber gasket joints are specified to be used, will not exceed a maximum of one hundred (100) gallons per inch diameter per mile of sewer per twenty four (24) hours. Upon infiltration in excess of the above amounts, joints will be recaulked or remade or, if necessary, the pipe will be relaid. The test will be repeated until the results show that seepage has been reduced below the above maximums. The method of testing and measurement will be approved by the DPW. The contractor will provide the necessary equipment and labor for making the tests and the cost of same will be born by the contractor.
17. Wyes and Risers: Wye branches, slants or stubs fitted with suitable stoppers will be set for each lot shown and at such other points as called for on the plans. Connection of service lead to main at 2 o'clock position.

Risers will be constructed where shown on the plans. They will be constructed of six (6)-inch ABS or plastic solid wall pipe, ASTM D-2751, latest revision, or PVC pipe conforming to the requirements of ASTM D 3034 (SDR 23.5), unless otherwise called for on the drawings. They will connect to wye branches constructed as part of the sewer proper and will be constructed as shown on the detail sheet to a height of six (6) feet below the surface of the ground, unless otherwise instructed by the Village Engineer. A pipe stopper will be placed in the top bell. Fittings and stoppers will be equipped with the allowable type of joint used on the sewer. Backfill at all risers will be carefully placed and tamped sufficiently to ensure against damage from backfill settlement. Payment at the unit bid price for risers will be made for the length of riser pipe placed.

The contractor will also furnish and place a three (3)-inch minimum diameter cedar marking post, three (3)-feet in length, to be set directly above the end of the riser or wye branch, as the case may be.

Each marker will be set so that it will be in a vertical position when the backfill is completed. The top of the marker will be 6 inches below the ground surface.

18. House Connections: The contractor will construct house connections where shown on the drawings. They will be constructed of PVC pipe conforming to the requirements of ASTM D 3034 (SDR 26) unless otherwise called for on the drawings, and approved by the Village and Village Engineer. A pipe stopper will be placed at the end of the connection. Pipe and stopper will be equipped with allowable type of joint used on the sewer. Payment at the unit price bid for house connections will be made for the length of house connections built, including the length of the bend.

The invert of the house connections at the point of terminus will be a minimum of eight (8) feet, six (6) inches below grade except where otherwise directed by the engineer.

The contractor will also furnish and place a three (3) inch minimum diameter cedar marking post, three (3) feet in length, to be set directly above the end of the house connection. Each marker will be set so that it will be in a vertical position when backfill is completed. The top of the marker will be six (6) inches below the ground surface.

19. Contractor Safety Requirements: Trenching operations will be conducted by the contractor in a manner, which provides safe working conditions for the workers and the public, and will protect adjacent property from damage.

Trench sides will be either cut back to the slope, as necessitated by soil and ground water conditions, which will provide stable sides, or supporting systems will be installed that can restrain the earth sides from movement. Trench supporting systems will be designed by a qualified employee of the contractor.

The contractor will employ at all times at the site of the work a qualified person who will be responsible for the safety of the work and the workmen. This individual will make all decisions relevant to the stability of the trenches, the adequacy of all protective devices, proper operation of equipment, and all other matters related to safety.

The contractor will not store, along and next to the trench, excavated material, heavy equipment, backfill materials, sewer pipe and other construction materials that may impose too great a load on the earth and cause squeezing or caving of the earth. The contractor will always provide a safe means of emergency exit from all trench excavations.

20. Sanitary Sewer Acceptance Tests: All sewers will be subjected to low-pressure air tests, infiltration tests or exfiltration tests before acceptance by the Village.

The contractor will provide all labor, tools and equipment necessary to perform the tests. All tests will be done in the presence of an inspector.

- a. Low Pressure Air Tests: All sewers of twenty four (24) inches in diameter or less, where ground water level above the top of the sewer is two (2) feet or less, will be subjected to low pressure air tests. The procedure for air testing of sewers will be as follows:

The sewer line will be tested in increments between manholes. The line will be cleaned and plugged at each manhole. Such plugs will be designed to hold against the test pressure and will provide an airtight seal. One of the plugs will have an orifice through which air can be introduced into the sewer. An air supply line will be connected to the orifice. The air supply line will be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge will have minimum divisions of one tenth (0.10) PSIG and an accuracy of four one hundredths (0.04) PSIG.

The sewer will be pressurized to four (4) PSIG greater than the greatest back pressure caused by ground water over the top of the sewer pipe. At least two (2) minutes will be allowed for the air pressure to stabilize between three and one half (3 ½) and four (4) PSIG. If necessary, air will be added to the sewer to maintain a pressure of three and one half (3½) PSIG or greater.

After the stabilization period, the air supply control valve will be closed so that no more air will enter the sewer. The sewer air pressure will be noted, and the timing for the test begun. The test will not begin if air pressure is less than three and one half (3 ½) PSIG, or such other pressure as is necessary to compensate for ground water level.

When testing more than one pipe size in a test section, the minimum holding time will be computed by the Village Engineer in accordance with ASTM Spec. C-828. (NCPI tables are based on text and equations from ASTM C-828)

- b. Infiltration Test: All sewers more than twenty-four (24) inches in diameter will be subjected to infiltration tests. All sewers of twenty four (24) inches in diameter or smaller, where the ground water level is less than two (2) feet above the top of the sewer, will be subjected to an infiltration test.

- c. Exfiltration Test: Exfiltration tests may be substituted for low pressure air tests where ground water level is less than two (2) feet above the top of the sewer and where approved by the Village Engineer. Exfiltration tests will not

be allowed where the external water pressure exceeds four (4) feet of Head.

For the purpose of exfiltration testing, the internal water level will be equal to the external water level plus four (4) 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 will not exceed sixteen (16) feet. A prospective test that would exceed this sixteen (16)-foot limit should not be taken. The line under construction can be broken down to smaller sections such that the maximum head of sixteen (16) feet will not be exceeded.

The actual exfiltration or leakage from the sewer line can be measured by recording the volume of water lost over a given period of time in a stand pipe 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 such that the total volume of water lost would be based upon the amount of water added and the difference in elevation of water at the end of testing converted to gallons. When the stand pipe method is used, the time interval to record the difference in elevation of the water surface will be fifteen (15) minutes minimum. When the upstream manhole method is used, the time interval will be two (2) hours minimum.

Approximately four hours should elapse after the test section is filled with water to permit trapped air to escape 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. The maximum exfiltration rate will be the same as that permitted for an infiltration test.

Within a reasonable length of time following pipe laying and backfilling, the contractor will complete the work necessary to perform testing. The contractor will perform all of the necessary preliminary tests and will make all of the necessary repairs, including the repair of all visible leaks, cracks, and retests with his own forces to ready the sewers for final inspection and witnessing of tests by the inspector. Immediately after the sewers have passed such preliminary tests, the contractor will notify the Village Engineer at least twenty four (24) hours in advance to arrange for final inspection and witnessing of tests.

Where ground water conditions require dewatering operations to construct sewers of 24 inches in diameter or smaller, the contractor may, at his option, perform preliminary air tests after backfilling and while the dewatering equipment is still operating.

Where preliminary acceptance tests have been performed shortly after sewer construction, such tests will not automatically result in acceptance of the sewer. The Village will cooperate fully with the contractor in the performance of preliminary tests, but recognizes the value of such tests as an early means of only tentative evaluation of workmanship and materials. Final acceptance will not be considered until after a reasonable length of time following pipe laying and backfilling to allow as much as possible for development of the earth load on the pipe.

Manholes on sewers to be subjected to air tests will be equipped with a one half (1/2) inch diameter galvanized capped pipe nipple extending through the manhole three (3) inches into the manhole wall and at an elevation equal to the top of the sewer pipe. Before the air test, the groundwater elevation will be determined by blowing air through the pipe nipple to clear it and then connecting a clear plastic tube to the pipe nipple. The tube will be suspended vertically in the manhole and ground water elevation determined by observing the water level in the tube. The air test pressure will be adjusted to compensate for maximum groundwater level above the top of the sewer pipe to be tested. The height of water in feet will be divided by two and three tenths (2 3/10) to determine the additional pressure to be added to all low pressure air test readings. After all tests are performed and the sewer is ready for final acceptance, the pipe nipple will be removed and the hole in the manhole wall will be plugged with hydraulic cement.

If a sewer fails to pass any of the previously described tests, the contractor will determine the location of the leaks, repair them and retest the sewer. The tests will be repeated until satisfactory results are obtained.

The method of testing and measurement will be approved by the Village Engineer. The contractor will provide the necessary equipment and labor for making the tests.

Chemical or cement grouting will not be considered an acceptable method of repairing leaking pipe, joints or structural failures, except where specifically approved by the Village Engineer. In this regard, the decision of the Village Engineer will be final.

d. Hydrostatic Tests of Force Mains: Prior to acceptance, force mains will be flushed, inspected and hydrostatically tested as specified herein. The contractor will furnish all necessary personnel, temporary bracing, plugs, test pumps and all other necessary apparatus for conducting the test.

Before applying test pressure, all air will be expelled from the pipe. If necessary to accomplish this, taps will 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 will be maintained at one hundred (100) psi at the point of highest elevation in the test section by

pumping water into the pipe for 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, will not exceed a rate of fifty (50) gallons per inch diameter of main per mile of pipe in twenty four (24) hours.

The proprietor will furnish all water used on this project including water used for hydrostatic testing. If he elects to purchase water from the Village of Dexter, he will pay for the full metered amount at the current water rate for the system used.

If a meter is not available to measure the volume of water, the contractor will pay for a minimum of three (3) times the volume of the pipe installed or as otherwise determined by the Village Engineer.

e. Test for Alignment: All sewers will 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 will be corrected to the satisfaction of the engineer to pass this test.

f. Test for Deflection of PVC Pipe: PVC pipe sewers shall be installed in such a manner that the initial deflection of the conduit shall not exceed five (5) percent of the inside diameter of the pipe. Final backfill shall be installed in such a manner that the initial deflection of the conduit shall be installed for a minimum of 30 days prior to deflection testing.

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

g. Televising of Sewer: All public sewers must be televised. Test results must be approved by the Village before putting the sewer in service. Copies of the videotape must be submitted to the Village. The submitted videotape will be permanently retained by the Village.

Air Test Table for Vitrified Clay and Concrete Pipe

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

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

Air Test Table For PVC and ABS Pipe Minimum Specified Time Required for a 1.0 PSIG Pressure Drop For Size and Length of Pipe Indicated for Q=0.0015 *

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

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

Site Plan Checklists

Village of Dexter Checklist for Preliminary Site Plans

General Requirements

The following requirements apply to Preliminary Site Plans:

- 1. Plans must be submitted on 24 inch x 36 inch paper with a minimum horizontal scale of 1 inch = 20 feet and vertical of 1 inch = 2 feet for sites less than three acres or a minimum horizontal scale of 1 foot = 100 feet and vertical of 1 inch = 10 feet for sites of three or more acres.
- 2. An overall site plan at 1 inch = 100 feet or 1 inch = 200 feet needs to be submitted when the size of the site prohibits a single plan sheet. Show street names, units, utilities, pavement, site dimensions, and phase lines.
- 3. Plans must be signed and sealed by a professional engineer or architect registered in the State of Michigan. All correspondence concerning the design of the site will be directed to the engineer whose seal appears on the plan.

Preliminary Plans must include the following:

- 4. Name, address and phone number of the engineer/architect, owner and the applicant if different from the owner. Owner's signed consent is needed for preliminary site plan approval application if the applicant is not the owner.
- 5. Legal description of property, including lot number and sidwell number.
- 6. Location map showing section number and major thoroughfares.
- 7. Title block, scale, north arrow, and date for each sheet.
- 8. Provide the following information regarding zoning:
 - Existing and proposed zoning classification of property
 - Delineation of required yards
 - Dwelling unit schedule
 - Density of development
 - Lot area per dwelling unit for residential projects
 - Lot coverage percent
 - Floor area ratio
 - Location and size of required buffers
- 9. Location and area of development phases, building program by phase, and projected schedule of development by phase.
- 10. Parcel dimensions and adjoining rights-of-way.

- 11. Adjacent land uses and zoning, including any adjacent property owned by the applicant, location of adjacent buildings, drives and streets.
- 12. General topography and soils information.
- 13. Proposed building use and other uses of property including any outdoor storage areas.
- 14. Proposed building/structures, including location, outline, general dimensions, distance between buildings/structures, floor area, numbers of floors, height, number and type of dwelling units where applicable.
- 15. Proposed streets and drives, including general alignment, right-of-way, surface area and width.
- 16. Location and size of open areas and recreation areas.
- 17. Proposed parking and loading, including location and dimensions of lots, typical dimensions of spaces and aisles, angle of spaces and required number of spaces by zoning. ADA passenger loading zones shall also be shown. Adequate room for turning movements must be provided.
- 18. Location and width of all existing and proposed easements on the site or adjacent to the site.
- 19. General location and size of all utilities (water, sanitary, storm); location of overhead wires and poles.
- 20. Areas of intended grading; outline of existing structures and drives; existing natural and manmade features to be retained or removed.
- 21. Walls or berms, as required by zoning, must be shown in cross-section. Walls separating a grade differential of more than 18 inches are considered retaining walls and require a structural engineering design and review. Design engineer must supply calculations with final site plan submittal.
- 22. Existing and proposed plantings and landscaping shown in accordance with zoning requirements.

Topographical Survey

The topographical survey must include the following:

- 1. USGS benchmarks (minimum of two) using NAVD 88.
- 2. Property lines indicated by bearing and distance.

- 3. Existing offsite elevations at 2-foot intervals at a minimum of 100 feet around the property.
- 4. Elevations at property corners and along property lines and sufficient onsite elevations or contours to establish site drainage.
- 5. Existing natural or manmade features to be removed or retained, including but not limited to; ditches, culverts, utilities (invert and casting elevations), sidewalks, utility poles, easements, finish grade of adjacent buildings, trees, wetlands, ponds, structures, driveways and curb cuts.
- 6. Adjacent roads with existing and future rights-of-way per the Master Plan.
- 7. Grades must be shown on both sides of the road at ditch centerline, top of bank, edge of shoulder, edge of pavement or top of curb and pavement centerline. (This must be shown on the final site plan and may be necessary for the preliminary site plan stage).

Water Main

- 1. Minimum size water main is eight (8) inches. Maximum dead-end main lengths are: 40 feet for a 6-inch fire hydrant lead; 450 feet for an 8-inch main; 1000 feet for a 12-inch main.
- 2. All mains must end with a gate valve then a hydrant or blow-off.
- 3. Show water service location, type and size. No private services are allowed from a 6-inch hydrant lead or mains over 16 inches in diameter.
- 4. A 10-foot horizontal separation and an 18-inch vertical separation must be maintained between the water main and sanitary or storm sewers.
- 5. If public water main is on private property a minimum 12-foot-wide easement must be provided.
- 6. Valve spacing:

In case of a breakage: Three (3) valves to isolate break, no more than two (2) hydrants out of service; no more than 30 single family units or 30 multiple units out of service. For major commercial and industrial developments, building service must be maintained from a looped system with valves and wells on either side of the building service.

- 7. No Parking within ten (10) feet of a hydrant.

- 8. Fire Department will comment of hydrant locations.
- 9. Plans must conform to Fire Department Guidelines and Section 3.E of these standards.
- 10. In areas where no water main exists, water main must be proposed across property frontage or to a property line, as directed by the Village and Village Engineer.
- 11. Where possible, avoid placing water main under pavement.

Sanitary Sewer

- 1. Where public sanitary sewer is proposed outside of the right-of-way, a sanitary sewer easement, with a minimum width of 20 ft must be provided. If sewer is deeper than 10ft, additional easement width may be needed. The easement must be shown on the plans.
- 2. In areas where no sanitary sewer exists, sanitary sewer must be extended across the frontage or to a property line as directed by the Village engineer.
- 3. Show size and location of proposed sewers and building service leads.

Storm Sewer

- 1. Proposed collection points, system layout, sizes and outlets must be shown on the site plan.
- 2. Minimum twelve (12) foot wide easement must be provided for public storm sewer. It must be shown on the plans. Additional width may be required depending on the depth of the sewer.

Storm Water Treatment

- 1. Supply preliminary storm water treatment calculations, including the first flush volume, bankfull volume, and 100-yr detention volume, for site plan review per Village requirements. Show that sufficient room exists on site to provide for the appropriate amount of storm water treatment.
- 2. Acceptable means are Best Management Practices, including underground infiltration or storage, oversized storm pipes, and a separate detention or retention basin.

Site Grading

- 1. Sufficient proposed grades must be provided to ensure that:

- a. Drainage is adequately discharged offsite with proper detention.
 - b. No upstream drainage is restricted.
 - c. Paving slopes are adequate.
 - d. The site generally drains without standing water.
 - e. Adjacent property will not be adversely impacted.
- 2. Elevation representing the brick ledge, finished grade, and the first floor grade must be indicated.
 - 3. Proposed grading will meet abutting property line elevations. Differentials in grade must incorporate a one (1) vertical to four (4) horizontal maximum slope to the abutting property line.
 - 4. An easement from the adjacent property owner will be required for any grading necessary on offsite property at the time of final site plan submittal.

Paving and Right-of-Way Improvements

- 1. Onsite paving requirements:
 - a. Minimum drive widths and parking lot dimensions per standard details.
 - b. Utility structures shall be placed outside of the driveway and paved areas, where possible.
 - c. All private roadways and parking lots must have concrete curb and gutter except in zoning districts classified as Research and Development (RD) with Village approval.
- 2. Public right-of-way, (Village):
 - b. Right-of-way layout must be shown, including:
 - 1) Appropriate right-of-way width.
 - 2) Right-of-way cross-section shown, including pavement width, curb and gutter (if necessary) and sidewalk locations.
 - c. All roads must have curb and gutter unless otherwise approved by the Village.
 - d. Passing lane, acceleration lane and taper, deceleration and taper as required by the Department of Public Services.
 - e. Shoulder requirements (uncurbed roads): Local road six(6) inches – 22A gravel, five (5) foot wide restored with grass.
- 3. Dedication of right-of-way along frontage to the ultimate right-of-way shall be shown.
 - a. Major road: One hundred twenty (120) feet.
 - b. Collector road: Eighty-six (86) feet.
 - c. Local Road: Sixty-six (66) feet or sixty (60) feet (residential areas only).

- 4. Sidewalks are required along the property frontage of all lots, as referenced in the most current Village of Dexter Master Plan. Sidewalks must meet the standards noted in Section VI.F: Sidewalks.

Village of Dexter Checklist of Final Site Plans

Final Site Plans must include all the checklist items of preliminary site plans and those requirements listed below:

General Requirements

- 1. Plans must be submitted on 24" x 36" white paper with a minimum horizontal scale of 1 inch = 50 feet and vertical of 1 inch = 5 feet. Other acceptable scales are 1 inch = 20 feet, 1 inch = 30 feet and 1 inch = 40 feet.
- 2. An overall site plan at 1 inch = 100 feet or 1 inch = 200 feet needs to be submitted when size of site prohibits a single plan sheet. Show street names, units, utilities, pavement, site dimensions, phase lines, lot lines and lot numbers.
- 3. Plans must be signed and sealed by a professional engineer or architect registered in the State of Michigan. All correspondence concerning the design of the site will be directed to the engineer whose seal appears on the plan.

Final Plans must include the following:

- 4. Legal description of property, including lot number or sidwell number, parcel dimensions and adjoining rights-of-way.
- 5. Village of Dexter standard notes, including water, sewer, storm and landscaping.
- 6. Location map showing section number and major thoroughfares.
- 7. Name, address and phone number of the engineer/architect, owner and the applicant, if different from the owner. Owner's signed consent is needed for application if the applicant is not the owner.
- 8. Title block, scale, north arrow, and date for each sheet with a summary of each particular sheet.
- 9. It must be shown that adequate sight distance exists at each point of entry to the site.
- 10. Provide the following information regarding zoning:
 - Existing and proposed zoning classification of property
 - Delineation of required yards
 - Dwelling unit schedule
 - Density of development
 - Lot area per dwelling unit for residential projects
 - Lot coverage percent
 - Floor area ratio
 - Location and size of required buffers

Total ground floor area

- 11. Adjacent land uses and zoning, including and adjacent property owned by the applicant, location of adjacent buildings, drives, streets, parking lots, and other improvements on adjacent properties.
- 12. Proposed buildings/structures, within the location referenced to property lines or a common base point, including, location, exterior dimensions, distances between buildings, height in feet and stories, first floor, floor area, finished grade, brick ledge elevations, number and type of dwelling units where applicable.
- 13. Proposed parking and loading, including location and dimensions of lots, typical dimensions of spaces and aisles, angle of spaces and required number of spaces by zoning. ADA loading zones shall be shown. Adequate room for turning movements must be provided.
- 14. Locations of proposed trash container enclosures, size, typical elevation, and vertical section of enclosures showing materials and dimensions. Requirements per Waste Management are included in the Appendix.
- 15. Location and type of proposed screens and fences, including height, typical elevation and vertical section showing materials and dimensions.
- 16. Location, type, size, area and height of proposed signs.
- 17. Location, type, direction and intensity of outside lighting.
- 18. Location and size of open areas and recreation areas.
- 19. Landscape plan showing location, size of plant materials, and standard notes. No trees are permitted within 6 ft of a utility.
- 20. Walls or berms, as required by zoning, must be shown in cross-section. Walls separating a grade differential of more than 18 inches are considered retaining walls and require a structural engineering design and review. Design engineer must supply calculations with engineering plan submittal.
- 21. The storm sewer, sanitary sewer and water main will be shown on the same plan view.
- 22. Plan and description of measures to control soil erosion and sedimentation during grading and construction operations until a permanent ground cover is established.
- 23. A traffic study must be provided to the Village Engineer for review. Exceptions will be only allowed with written permission from the Village Engineer.

- 24. Sufficient information to show that the latest standards of the American with Disabilities Act is being met.

Topographical Survey

The following information needs to be shown on the topographical survey:

- 1. USGS Benchmark, (minimum of two). All elevations must be to NAVD 88.
- 2. Property lines by bearing and distance.
- 3. Existing natural conditions, including trees, wooded areas, streams, marshes, ponds, and other wetlands. Clear indication of all natural features to remain and to be removed. All trees 8 inches in diameter or larger will be accurately located on the final site plan and labeled as to be either preserved or removed. Replacement requirements should be noted.
- 4. Existing offsite elevations at a minimum of 50 feet intervals around the property. Elevations at property corners and along property lines and sufficient onsite elevations or contours to establish site drainage.
- 5. Existing improvements shown. Any buildings, structures and other improvements, including drives, ditches, culverts, bridges, utilities (invert and casting elevations), sidewalks, utility poles and towers, easements, pipelines and finish grade of adjacent buildings. Clear indication of all improvements to remain and to be removed.
- 6. Show existing adjacent roads with both existing right-of-way and future right-of-way per the Master Plan. Grades must be shown at ditch centerline, top of bank, edge of shoulder, edge of pavement or top of curb and pavement centerline. Grades must be shown on both sides of road.

Water Main

The following information needs to be shown as part of the water main design:

- 1. Village of Dexter Standard Notes and Details (see Appendix) provided on the plans.
- 2. A quantity list and basis of design must be shown on cover sheet of the plan set.
- 3. Minimum size water main is 8 inches. Maximum dead-end main lengths are 40 feet for a 6-inch fire hydrant lead, 450 feet for an 8-inch main, 1000 feet for a 12-inch main. All mains must end with a gate valve then a hydrant or blow-off.
- 4. Show water service and size. No private services are allowed from a 6-inch hydrant lead or mains over 16 inches in diameter.
- 5. Where water main is next to the right-of-way, a water main easement must extend

across the front of a property line as directed by the Village Engineer.

- 6. Profiles are required on all water mains. Include the following information:
 - 5. Length, size, type, and class of pipe.
 - 6. Top of casting elevation on gate wells.
 - 7. Special backfill areas, i.e., sand.
 - 8. Utility crossings.
 - 9. Existing and proposed ground elevations.
- 7. Minimum 10-foot horizontal separation between the water main and sanitary or storm sewer.
- 8. Minimum 18-inch clearance between water main and storm or sanitary sewer. Top of water main and sewer invert indicated.
- 9. Pipe size, length and type shown in plan view.
- 10. Water main shall be Ductile Iron class 54.
- 11. Tapping sleeve and valve used to connect to existing mains unless connection can be made without interrupting service on the main.
- 12. Minimum 12-foot-wide easement must be shown on the plans.
- 13. Valve spacing:
 - In case of a breakage: Three valves to isolate break, four maximum, no more than two hydrants out of service; no more than 30 single family units or 30 multiple units out of service. For major commercial and industrial developments, building service must be maintained from a looped system with valves and wells on either side of the building service.
- 14. Hydrant spacing: see Hydrant Coverage.
- 15. No parking within 10 feet of a hydrant.
- 16. Fire Department will comment on hydrant locations. A note shall be provided on the plans indicating that hydrants shall be provided with a Storz connection.
- 17. Plan must conform to Fire Department Guidelines. Proposed Knox Box shall be shown on the plans.
- 18. Public water main must obtain a Permit for Water Supply Systems (Act 399) from the Michigan Department of Environmental Quality.
- 19. For new subdivisions, water service shall be shown for each lot, and provided at the center of the lot.

Sanitary Sewer

The following information needs to be shown as part of the sanitary sewer design:

- 1. Village of Dexter Standard Notes and Details (see Appendix) provided on the plans..
- 2. Quantity list and basis of design data must be shown on plan. The existing and proposed residential equivalent units (REU's) must be shown on the plans in accordance with the Village's most current Tap Fee Resolution. If a connection unit factor is not provided in the Tap Fee Resolution that coincides with the development type, the applicant shall develop their own connection unit factors and provide a basis for their determinations for Village approval.
- 3. Where sanitary sewer is next to the right-of-way, a sanitary sewer easement must be extended across the front or to a property line as directed by Village Engineer.
- 4. Minimum 20-foot easement for public sewer must be shown on the plans. Additional width may be needed due to depth of sewer.
- 5. External drop connection required when there is an 18-inch vertical difference between inverts on outlet and inlet pipes.
- 6. Internal drop connections must be approved by DPW or governing agency. They are not allowed under current policy.
- 7. Show building lead type, size, location and invert elevation at building and finish grade of building. Check conflict in elevation with other utilities. Minimum 4-inch diameter at a 2 percent slope or a 6-inch diameter at a 1 percent slope.
- 8. Sewer to be constructed per the following sewer size, grade and manhole spacing table:

Size	Standard Grade Percent	Minimum Grade Percent	Maximum Grade Percent	Standard Run Feet	Maximum Run Feet
8 inches	0.80	0.40	8.0	300	400
10 inches	0.60	0.30	6.2	300	400
12 inches	0.40	0.22	6.0	400	450
15 inches	0.24	0.16	3.6	500	500
18 inches	0.18	0.12	2.8	600	600
21 inches	0.14	0.10	2.2	600	600

- 9. The following must be shown in plan view:
 - a. Length between structures.
 - b. Type, class and size of pipe.
 - c. Slope of sewer.
 - d. Top of casting elevation.
 - e. Easement where required.
 - f. Progressive numbering system.
 - g. Invert elevations if sewer is not also shown in profile.

- 10. Profiles must be shown for sewers and services over 8 inches in diameter and larger with the following information:
 - a. Length, type, class, size and slope of pipe between manholes.
 - b. Top of casting and sewer invert elevations at all manholes.
 - c. Existing and proposed ground elevations.
 - d. All utility crossings.
 - e. Special backfill areas, i.e., sand.
 - f. Provisions for infiltration testing.
 - g. Progressive numbering system.

- 11. For new subdivisions, show the sanitary service for each lot. The sanitary service shall be placed in the center of the lot.

Storm Sewer

The following information needs to be shown as part of the storm sewer design:

- 1. Village of Dexter standard notes and details included.

- 2. Design calculations with hydraulic grade line computed. Attempt to keep the hydraulic grade line within pipe.

- 3. Design of storm sewer shall be as follows:
 - 10. Use the Rational Method, $Q = CIA$, for a 10-year storm event with $I = 175/(T+25)$ and an initial $T = 20$ minutes, maximum.
 - 11. Composite runoff coefficient, C , shall be based on the sum of the percentages of each drainage district covered by impervious and pervious areas multiplied by the respective coefficients listed below, C :
 - Residential:
 - Single family residential: 0.50
 - Multiple Family: 0.70
 - Commercial: 0.85
 - Agricultural: 0.20
 - Downtown: 0.90

 - c. Velocity for flow in the pipe will be a minimum equal to 2.5 feet per second and a maximum of 10 feet per second.

- d. Use Manning equation for pipes flowing full.
 - e. Storm district drainage map needs to be provided
 - f. Upstream drainage needs to be accommodated.
 - g. Discharge is not allowed to be diverted onto adjoining properties.
 - h. Storm Water Treatment as required.
4. The following must be shown in plan view:
- a. Length between structures.
 - b. Type, class and size of pipe.
 - c. Slope of sewer.
 - d. Top of casting elevation.
 - e. Easement where required.
 - f. Progressive numbering system on structures.
 - g. Invert elevations for sewers not also shown in profile.
5. Private storm sewers for developments larger than one acre and all public storm sewers must be shown in profile. The following must be shown in profile:
- a. Length, type, class, size and slope of pipe between manholes.
 - b. Top of casting and sewer invert elevations at all manholes.
 - c. Existing and proposed ground elevations.
 - d. All utility crossings.
 - e. Special backfill areas, i.e., compacted sand backfill.
 - f. Progressive numbering system on structures.
6. Connections at storm structures.
- a. Roof drains must be connected at a structure.
 - b. Sump pump discharge connected via a 4-inch minimum pipe.
7. Private sewer requirements:
- a. Provide profile for sites larger than one acre.
 - b. 12-inch minimum pipe size.
 - c. Catch basins/inlets at upstream end will be a minimum of 24 inches in diameter.
 - d. Catch basins with an inlet pipe will be a minimum of 48 inches in diameter.
 - e. First structure upstream of the public system will be a minimum of 48 inches in diameter with a 24-inch sump.
 - f. Minimum cover of 3 feet based on low head structures.
8. Public sewer requirements: Public sewers are any sewers that accept runoff from abutting property or public right-of-way.
- a. Must be shown in profile.
 - b. 12-inch minimum pipe size.

- c. 48-inch minimum diameter for manholes and catch basins.
- d. 24-inch minimum diameter for inlets.
- e. Minimum cover of 3 feet based on low head structure.
- g. Located in public right-of-way or 12-foot minimum easement.
- h. Class IV RCP C-76 must be used for public sewers and private sewers under influence of roadway.

Storm Water Treatment

The following information needs to be shown as part of the storm water treatment design:

- 1. Must be designed per current Village requirements.
- 2. Acceptable means are: Best Management Practices, underground infiltration and storage, oversized storm pipes, detention basin, retention basin.
- 3. Allowable discharge to be determined by one of the following:
 - a. Discharge approved by agency having jurisdiction over outlet, i.e., county drain office or county road sewer, (approval must be submitted).
 - b. S.C.S. Technical Release No. 55 "Urban Hydrology for Small Water Sheds," (calculations must be provided). Allowable discharge could not exceed existing discharge determined.
 - c. Allowable flows designed into the outlet, (previous calculations must be submitted).
- 4. Detention basin requirements are as follows:
 - a. Fenced if side slopes exceed one on five.
 - b. Fences must be a minimum 6 feet high and chain link with an 8-foot access gate.
 - c. Side slope one on three maximum.
 - d. Must drain entirely unless basin is part of overall landscaping plan.
 - e. Bottom must be sodded.
 - f. Minimum bottom slope of one (1) percent
 - g. Minimum 12-inch freeboard provided above 100-year high water level.
 - h. Non-erodible overflow capable of handling a 100-year storm.
 - i. Sedimentation forebay must be provided.
 - j. A maintenance schedule for the storm water treatment systems must be provided on the plans.
 - k. Maintenance agreement with Village must be executed and recorded with the County Register of Deeds.

Site Grading

The following information needs to be shown as part of the site grading design:

- 1. Show sufficient proposed grades to ensure that:

- a. Drainage is adequately discharged offsite with proper detention.
 - b. No upstream drainage is restricted.
 - c. Paving slopes are adequate.
 - d. The site drains without standing water.
- 2. Elevations representing the brick ledge, finished grade and the first floor grade must be indicated.
 - 3. Proposed grading will meet abutting property line elevations. Differentials in grade must incorporate a one on four maximum slope to the abutting property line.
 - 4. Any wall separating a differential grade of more than 18 inches will be considered a retaining structure and requires a structural engineering design and review. Design engineer must supply design calculations.
 - 5. Easement from adjacent property owner will be required for any grading necessary on offsite property at time of engineering plan submittal.

Paving and Right-of-Way Improvements

The following information needs to be shown as part of the pavement design and right-of-way improvements:

- 1. Standard paving details as necessary.
- 2. Onsite paving requirements:
 - 2. Pavement cross-section must be shown. The minimum cross-sections shall be provided as noted in Section VI.B.
 - 3. Minimum slope:
 - Asphalt: 1 percent.
 - Concrete: 0.5 percent.
 - 4. Maximum Slope:
 - Asphalt: 6 percent.
 - Concrete: 6 percent.
 - Note that the most current ADA guidelines must be met for accessible areas.
 - 5. Minimum drive widths and parking lot dimensions per standard details, (see Appendix).
 - 6. Adequate sight distance must be provided at the driveways.
 - 7. All private roadways and parking lots must have concrete curb and gutter.
 - 8. Sufficient room for turning movements must be provided on the plans through the use of turning templates for appropriate design vehicles.
- 3. Public right-of-way (Village) Requirements

- a. Sufficient proposed grades to show drainage patterns (50-foot maximum spacing).
 - b. Pavement cross-section must be shown. The minimum cross-sections are noted in Section VI.B:
 - c. All public roads must have curb and gutter unless otherwise approved by the Village.
 - d. Passing lane, acceleration lane and taper, deceleration lane and taper as required by the Village Engineer. The Village references the requirements of the Washtenaw County Road Commission in requiring passing lanes, acceleration lanes and tapers, and deceleration lanes and tapers.
 - e. Shoulders must be provided on uncurbed roads. Shoulders will be 2 feet wide made up of 6 inches of 22A gravel
4. Dedication of right-of-way along frontage to the ultimate right-of-way shown. See Map in the Appendix.
- a. Major road: One hundred twenty (120) feet.
 - b. Collector road: Eighty-six (86) feet.
 - d. Local road: Sixty-six (66) feet or sixty (60) feet (residential areas only).
5. The following requirements apply to drainage swales:
- a. Must provide adequate culvert capacity.
 - b. Enclosure of swales is generally not permitted (other than for driveways where a culvert is provided).
 - c. Side slopes are 1:3 maximum.
 - e. 2-foot-wide swale bottom.
6. Sidewalks are required along the frontage of all roads. See Section VI:F: Sidewalks for sidewalk standards.