CITY OF BERKLEY
ENGINEERING DESIGN STANDARDS

The Engineering Design standards herein are intended to provide a basis upon which all site plans for commercial, and single and multi-family sites within the City of Berkley are to be designed and constructed. The requirements outlined herein reflect the requirements of the City of Berkley Department of Public Works and the City's Engineering Consultant and conform to current Engineering practices in the Metropolitan Detroit area. By no means are these standards intended as a substitute for Sound Professional Engineering judgment. The Standards may not apply to all conditions, and alternative solutions may be *permitted* as approved by the pertinent City departments and/or its Engineering Consultant. It is suggested that the applicant obtains a copy of the City of Berkley Zoning Ordinance and Chapter 26, Chapter 106 and Chapter 126 of the Berkley Code of Ordinances to supplement these standards.

Engineering review for site plan review shall be conducted by the City's Engineering Consultant as directed by the City as per the following Engineering Design standards.

Additional reference standards, as well as permitting, that may be applicable to the required Engineering Design standards include:

1. Oakland County Water Resources Commissioner (Stormwater Engineering Design Standards, Water Supply and Wastewater Design Standards) (OCWRC)
2. Oakland County Erosion Control Manual
3. Road Commission for Oakland County Design Standards (RCOC)
4. Southeastern Oakland County Water Authority (SOCWA)
5. The United States Environmental Protection Agency (EPA)
6. Michigan Department of Environment, Great Lakes, and Energy (EGLE)
7. Recommended Standards for Wastewater Facilities (Ten States Standards)
8. Recommended Standards for Water Works (Ten States Standards)
9. Michigan Department of Transportation Standard Specifications for Construction
10. Michigan Department of Transportation – Uniform Criteria for Major Streets
11. Michigan Manual of Uniform Traffic Control Devices

In addition, there may be the need to obtain approval and/or construction/access permits from communities bordering the City of Berkley, including Cities of Southfield, Royal Oak, Huntington Woods and Oak Park.

The site plan must be reviewed and approved by the planning commission and the appropriate City department(s) and/or professional consultants based on the standards herein and as per Article 15 of the City of Berkley Zoning Ordinance. Following preliminary site plan approval, the applicant must submit drawings for final site plan approval as described in this document. Final construction plan approval will be contingent upon approval of the final site plan, receipt and review of the traffic control plan(s), the stormwater maintenance agreement, and receipt of all approved permits and/or permit exemptions.

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SECTION 1: GENERAL

1.1. Complete improvement plans bearing the seal of a licensed Professional Engineer, Surveyor or Architect licensed to practice in the State of Michigan shall be submitted prior to review and approval of any portion thereof.

1.2. A certified boundary survey of the site, prepared and sealed by a licensed Professional Surveyor licensed to practice in the State of Michigan, or a copy of the completed plat shall be submitted with the engineering drawings.

1.3. Plans submitted shall be on 11" x 17" white prints having blue or black lines and shall be neatly and accurately prepared. Judgment should be exercised in the design, layout, and the presentation of proposed improvements. An electronic version of the plans must be made available for submittals. The topographic survey must depict one-half foot contours of the area, shall be on a scale of a least one-inch equals ten feet (1"=10'), and shall show all property and structures within 25 feet of the property for which the permit is being sought.

1.4. For projects or subdivisions having more than one sheet of plans, a general plan having a scale of 1" = 100' shall be provided showing the overall project and indicating the size and general location of all improvements shown in the detailed plans.

1.5. Street names, street and easement widths, lot lines, lot dimensions, lot numbers and ownership shall be shown on all plans.

1.6. Elevations shall be on U.S.G.S. Datum. Two (2) permanent benchmarks for the work shall be indicated on the plans.

1.7. Existing grades and elevations must be provided at each lot corner and grade change points.

1.8. The finished grade shall be indicated for all structures.

1.9. Finish grade and finish floor elevations for the first floor, garage and basement. Provide the finish grade elevation of adjacent houses or structures. The grading plan must also indicate if the adjacent lot is unimproved.

1.10. The location and elevations of all utilities, including manholes on or within 25 feet of the property, must be shown on the plans.

1.11. Plans shall show the location of existing and proposed sidewalks and driveways, including the slope of the driveway to the street. All sidewalks and driveways shall be compliant with state, and local laws, ordinances, and requirements.

1.12. Provide temporary and permanent soil erosion and sedimentation control, including, but not limited to, silt fencing, catch basin inserts in the street adjacent to the subject property, etc.

1.13. Roof downspouts are not permitted to discharge directly into the combined storm sewer system and must be directed onto grass, landscape, or other green space area to prevent ponding of water on the property or from being directed towards adjacent properties.

1.14. Existing sewer lead shall be properly abandoned, and the proposed sewer lead must include a new connection, as approved by the Department of Public Works.

1.15. Plans must show the location of existing trees within the right-of-way.

1.16. Confirmation that a Design MISS DIG ticket has been requested and processed must be provided by noting the ticket number of the plan.

1.17. A demolition plan must be included with all site plans depicting all pavement, utilities, landscape, and other site features that are to be removed as part of the project.

1.18. The developer or their engineer shall be responsible to forward plans for approval to any private utility company (gas, electric, phone, cable, etc.) and any Federal, State or County (Water Resource Commissioner, Road Commission, etc.) agency whose facilities or rights-of-way may be affected by the proposed construction. Public utilities will require the review and approval of the City prior to submittal to the permitting agency.

1.19. It shall be the developer's engineer and contractor's responsibility to verify the existence and location of all underground utilities and to utilize the MISS DIG system prior to construction.

1.20. All site plans shall contain the latest version of the applicable Oakland County Water Resource Commissioner and the Road Commission for Oakland County (if applicable) detail sheets and the developers/owners name(s), address, and phone number. The plans must also contain the City's current Standard Utility Material Specifications table located on the City's Department of Public Works web page. Further, the City of Berkley Standard Construction Notes (included herein as Appendix A) must be reviewed for compliance.

1.21. An Engineer's Opinion of Construction Cost (for both the overall project and for the proposed work within the City right-of-way) must be supplied with the Engineering Plan submittal. This estimate will be used by the City to establish field observation and testing fees for the improvements in accordance with the City Ordinance and to determine the required amount of each construction bond.

1.22. All utility trenches under the 45-degree zone of influence line of existing or proposed pavements, bike paths, sidewalks or drive approaches shall be backfilled with sand compacted to at least 95% of maximum unit weight (copy of density test(s) required).

1.23. Utility crossings of paved roadways will be required to be bored. Open cutting of paved roadways will not be permitted without prior approval from the City.

1.24. Under no circumstance will a new water main or sewer pipe be allowed to be installed within the footprint of an existing or proposed building. In addition, if an existing water main or sewer is within the footprint of a building that is proposed to be redeveloped or razed and reconstructed, a new utility must be relocated outside of the existing or proposed building footprint prior to construction with all costs being the responsibility of the Applicant/Developer.

1.25. An itemized quantity list will be required for all proposed utility improvements (water main, sanitary sewer, storm sewer, paving).

1.26. The developer shall submit to the City four (4) sets of complete site plans for review at each stage of review (preliminary, final, engineering) and for revised site plans at each review stage, if applicable.

1.27. Site Plan Submittal and Review Process

Please refer to Article 15 of the City's Ordinances – SITE PLAN REVIEW PROCEDURES AND REQUIREMENTS – for details on the site plan submittal and review process for developments and redevelopments.

Detailed site plan review checklists, which include the information, specifications, and details required for engineering site plan submittals for commercial and residential developments, as well as-built/record drawing requirements, are included in Appendix B herein.

1.28. Pre-Construction Meeting

Once the approved engineering plans have been issued, and prior to the start of any work on the site, a preconstruction meeting will be required between the Applicant/Developer, their consultants and contractors, the pertinent City departments and their Engineering Consultant. This meeting will verify that all relevant permits have been applied for, that the proper bonds and insurance are provided, and schedule for material testing and construction observation, as necessary. The following is a checklist of requirements for scheduling the pre-construction meeting:

COMMERCIAL DEVELOPMENTS – PRE-CONSTRUCTION MEETINGS The following items represent a standard list of items that are required to be submitted to the City for review and approval prior to scheduling the preconstruction meeting:	NA	INCLUDED	
		YES	NO
1. Set up escrow account with the City for construction engineering services. (City Engineering Consultant will provide the required amount prior to the meeting) *			
2. City Permits (building, utility (right-of-way), site (private), lot split/combination, and Bond (right-of-way restoration bond, etc.) approvals			
3. Permit Approvals/Exemption letters from outside agencies – RCOC, OCWRC, MDOT, SOCWA, EGLE, etc.			
4. (New) easement document(s)/exhibit(s)			
5. Construction Schedule			
6. List of contractors/subcontractors			
7. Traffic Control/Maintenance Plan			
8. Bonds (Performance, Labor & Material, and Maintenance & Guarantee) and insurance policies, including the Owners Contractors Protective (OCP). Each bond must be issued for the total estimated construction cost for ALL work within the public right(s)-of-way. **			
9. Stormwater maintenance agreement (draft document only) ***			

*The escrow amount is the estimated budget for the City's engineering consultant's services, which includes both administrative and field services, as follows:

1.28.1. The City Engineering Consultant will coordinate and conduct the preconstruction meeting for the project, including preparing and distribution of meeting minutes.

1.28.2. The City Engineering Consultant will provide field observation for the portion of the project within the public rights-of-way only, including utility placement and connections, and pavement, curb & gutter and landscape restoration. Inspector Daily Reports will be prepared and submitted to the City. The City Engineering Consultant will also conduct a cursory review of the site as it pertains to the storm sewer material inventory only (i.e., verification of diameter, material, etc.)

1.28.3. The City Engineering Consultant will provide materials testing services for backfill of utility trenches as well as pavement construction within the public rights-of-way only.

1.28.4. The City Engineering Consultant will provide review and recommendation for approval of the selected contractor's required insurance and bonds (Performance, Maintenance and Guarantee, and Labor and Materials). The bonds must in the

amount at least equal to 100 percent of the estimated construction cost (within the ROW) as security for the faithful performance of this contract, for the payment of all persons performing labor on the project under this contract, for furnishing materials in connection with this contract, and to provide the City a guarantee that all completed work will be maintained and free from defects, faults, etc. for a period of one (1) year.

** Samples of the required bonds and insurance certificates are included in **Appendix C** herein.

1.28.5. The City Engineering Consultant will coordinate one (1) punch-list onsite meeting and assist with the development of a punch-list.

1.28.6. The City Engineering Consultant will provide review and approval of the as-built/record drawings.

1.29. Maintenance Agreement

A maintenance agreement shall be required between the city and the owner for all vegetative, structural, and stormwater best management practices (BMPs) to be constructed on site. Stormwater facilities shall be maintained by the owner and shall be repaired and/or replaced by such person when such facilities are no longer functioning as designed. Records of installation and maintenance and repair shall be retained by the owner and shall be made available to the City upon request. The maintenance agreement shall be binding on all subsequent owners of land served by the stormwater management and facilities and shall be recorded in the office of the Oakland County register of deeds prior to the final approval of the City. If the stormwater management BMPs have not been adequately maintained, the City may notify the owner(s) in writing and require the necessary maintenance or repairs within 90 days of the written notice. Should the owner fail to comply with the provisions of this article, the City may, after giving reasonable notice and opportunity for compliance, have the necessary work completed and the owner shall be obligated to promptly reimburse the City for all costs incurred.

The city shall not issue final approvals until the applicant signs a stormwater site maintenance agreement, plan, and a proposed schedule for perpetual maintenance of the complete storm drainage/management system, in a form approved by city council.

*** An example of a Stormwater Management Operations and Maintenance Agreement can be found in **Appendix G of the OCWRC Stormwater Engineering Design Standards**.

SECTION 2: WATER MAIN

2.1. General

2.1.1. If the proposed improvements include the construction of public water main, the developer shall submit a set of water main only plans (including the water main standard detail sheets) with a completed EGLE permit application for water supply systems. This information will be forwarded by the City's Engineer to the Southeast Oakland County Water Authority (SOCWA) who will then submit to EGLE for permitting. Please note the procedure may also include submission of the permit application via the current EGLE web-based permit portal system.

2.1.2. All water system improvements shall be designed in accordance with the current edition of "Recommended Standards for Water Works" (a/k/a Ten State Standards).

2.1.3. Water mains in new developments shall be installed from boundary to boundary in abutting roads and interior streets, and at other locations and sized as may be deemed necessary by the City for future extensions.

2.1.4. An itemized quantity list for all proposed water main construction must be included on the plans.

2.1.5. All public water mains must be located within a 20-foot-wide easement or public road right-of-way. Easements should extend 10 feet beyond any hydrant. Sketches and descriptions of both the parcel and easement will be required. The documents shall contain a provision to prohibit the construction of any above ground structures within the limits of the easement.

2.1.6. If lead water services are encountered, the homeowner will be given a letter of notice by the City, and the resident must approve the replacement prior to any work on the private service.

2.2. ***Design Requirements***

2.2.1. The distribution system in all developments requiring more than 600 feet of water main shall have a minimum of two connections to a source of supply and shall be a "looped" system. Water mains are to be looped whenever possible. The ability to serve at least 2,000 gpm in single-family detached residential; 3,000 gpm in apartment, cluster residential and similar complexes, institutional, and school areas; and at least 4,000 gpm in office, and shopping centers is essential.

2.2.2. Eight (8) inch minimum diameter mains will be installed in single family residential areas.

2.2.3. Twelve (12) inch mains are the minimum size in commercial, office, and multiple family residential areas except in a looped system of 1,500 feet or less where eight (8) inch mains may be permitted.

2.2.4. Hydrant leads longer than 20 feet must be eight (8) inches.

2.2.5. No service leads are allowed to extend from a six (6) inch hydrant lead.

2.2.6. Profile view is required for all sizes of watermains, or as per current EGLE requirements.

2.2.7. Water mains shall be kept on one side of the street for the entire length of the street. Water mains shall not be located under pavement or under cul-de-sacs.

2.2.8. Gate valves shall be spaced at a maximum of 800 feet intervals on distribution lines. They shall be spaced such that not more than four valves need to be turned off to isolate any section of the water main.

2.2.9. Sufficient valves shall be placed such that not more than 20 single family homes, 30 multiple family units or two (2) hydrants shall be out of service within a section of isolated water main.

2.2.10. Dead-end mains must end with a hydrant and a gate valve and well. All stubs for future looping must include a gate valve and well.

2.2.11. Gate valves should not be located under roadway pavement, bike paths, sidewalks or driveway approaches when possible.

2.2.12. Four (4) inch and larger valves are required to be installed in a gate well, except for six (6) inch hydrant shut off valves.

2.2.13. In single family residential areas, hydrants shall be spaced along the water main a maximum of 500 feet. In no case shall a house be more than 350 feet from a hydrant. Commercial, and multiple family spacing shall be a maximum of 400 feet.

2.2.14. Along major roadways and in areas other than single family residential, hydrant spacing shall be a maximum of 500 feet.

2.2.15. In commercial areas, the exterior of buildings shall be no further than 300 feet from a hydrant, nor closer than 35 feet, measured along shortest feasible exterior route for laying hose. There shall be a fire hydrant located within 100 feet of any building public safety connection.

2.2.16. Where possible, hydrants shall be located at the lot corners, but no closer than eight (8) feet from any driveway or driveway approach.

2.2.17. Hydrants located in parking areas shall be protected with a six (6) inches (minimum) concrete curb or standard guard posts.

2.2.18. When connecting to an existing water main, a tapping sleeve, gate valve and well will be required unless connection to the existing main can be made without interrupting service on the main.

2.2.19. The plans shall indicate the finish grades of all hydrants and gate well. When connecting to an existing water main, a tapping sleeve, gate valve and well will be required unless connection to the existing main can be made without interrupting service on the main.

2.2.20. Water mains shall be located so as to provide a minimum of ten (10) feet horizontal clearance between the nearest edge of the water main and the nearest edge of any sanitary or storm sewer.

2.2.21. A minimum vertical clearance of 18 inches shall be maintained between the top or bottom of any water main and the top or bottom of any sewer or utility. Vertical clearance of less than 18 inches will require concrete encasement of the sewer or utility.

2.2.22. Restrained joints shall be used at all bends, tees, hydrant shoes, plugs and caps where necessary to prevent lateral movement of the water main. Thrust blocks will not be allowed unless required by the permitting agencies.

2.3. ***Materials***

Materials shall be in accordance with the current City Standard Utility Materials Specifications (or approved equal), which can be obtained from the DPW or the City website.

2.4. ***Installation***

2.4.1. All water main shall be installed with a minimum cover of five-and-a-half (5.5) feet below finish grade or top of curb (or road centerline if uncurbed)

where the main is parallel to a road. When water mains must dip to pass under another utility, the sections which are deeper than normal shall be kept to a minimum length by the use of vertical bends properly restrained.

2.4.2. The contractor will fill, disinfect and pressure test all new water main construction under the supervision of City of Berkley and/or its agent.

2.4.3. Before any water main is accepted by the City, it must pass a pressure test complying with the current specifications and procedures of the City. The maximum loss of water for the 2-hour hydrostatic test shall be 11.65 gallons, per inch diameter of main, per mile of pipe over a 24-hour period.

SECTION 3: SANITARY SEWER

All construction must conform to the current Oakland County Water Resources Commissioner standards and/or as specified herein.

3.1. *General*

3.1.1. A separate and independent building sewer shall be provided for every building except when one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through an adjoining alley, court, yard or driveway, the building sewer from the front building may be extended to the rear building and the whole considered as one building sewer.

3.1.2. Old building sewers and water services shall not be used in connection with new buildings. Remaining foundations not constitute an existing building.

3.1.3. All building sewer construction and the installation of pipes, fittings and appurtenances shall be done in accordance with the building regulations of the city, the city's utility connection policy and such supplementary rules and regulations as the Director of Public Works may prescribe, which shall be effective upon approval by the city council.

3.1.4. The applicant for the building sewer permit shall notify the Community Development Department when the building sewer is ready for inspection and connection to the public sewer. The connection to the city main and any connections to the structure or there along shall be made under the immediate supervision of the Director or their designee.

3.1.5. If the proposed improvements include the construction of public sanitary sewer, the developer shall submit a set of sanitary sewer only (with sanitary

standard details) plans with a completed EGLE permit application for wastewater systems. This information will be forwarded by the City's Engineer to the proper agencies for permitting.

3.1.6. All sanitary sewer improvements shall be designed in accordance with the current edition of "Recommended Standards for Wastewater Facilities" (a/k/a Ten State Standards). A sanitary sewer basis of design is required to be included on the plans for all sanitary sewer extensions.

3.1.7. A grease interceptor will be required for all food service operations. No connections for domestic waste will be allowed to the interceptor.

3.1.8. Downspouts, weep tile, footing drains, sump pump discharges, or any conduit, that carries storm or ground water shall not be allowed to discharge into a sanitary sewer.

3.1.9. An itemized quantity list for all proposed sanitary sewer construction must be included on the plans.

3.1.10. Sanitary sewers will be required across the entire frontage of the site.

3.1.11. All public sanitary sewers must be located within a 20' wide easement or public road right-of-way. Easements should extend 10' beyond the last manhole. Sketches and descriptions of both the parcel and easement will be required. The documents shall contain a provision to prohibit the construction of any above ground structures within the limits of the easement. The easement width may be increased depending on the proposed sewer depth, soil conditions or adjacent facilities.

3.2. *Design Requirements*

3.2.1. At all connections to the City 's Sanitary System or extension thereto, in the first manhole upstream from the connection, provide a water-tight bulkhead with a 1" diameter pipe through the bulkhead for measuring infiltration immediately upstream. Also, a one-foot sump at the base of the manhole shall be provided.

3.2.2. The minimum allowable size of a public sanitary sewer is 8" diameter.

3.2.3. The following table of minimum slopes and maximum manhole (MH) spacing for sanitary sewers shall be adhered to. Additional diameters and grades are provided in the Ten States Standards document.

Diameter	Minimum Grade	MH Spacing (Min.)
8”	0.40%	300 Feet
10"	0.28%	300 Feet
12"	0.22%	350 Feet
15"	0.15%	350 Feet
18"	0.12%	350 Feet
21"	0.10%	350 Feet
24"	0.08%	400 Feet

3.2.4. The last upstream run of sewer must be at a grade of 1.00% or greater.

3.2.5. The minimum slope for 6” diameter building leads is 1.00%. Cleanouts are required every 100 feet and at all bends.

3.2.6. A monitoring manhole is required on the sanitary lead for all non-residential connections to the sanitary sewer system. The monitoring manhole can only have one (1) lead running through it. It must be located on a straight run of lead and cannot be a manhole on a public sewer main.

3.2.7. Each building structure shall have a separate individual sanitary service lead connected to a public sanitary sewer.

3.2.8. Sanitary sewers will not be approved in the rear lot easement.

3.2.9. The following information shall be indicated on the sanitary sewer profile:
a) Length of run between manholes.
b) Type, class, size and slope of pipe.
c) Class of bedding.
d) Rim elevation of all manholes.
e) Existing and proposed ground elevation line above the route of the sewer.
f) A logical numbering system for manholes shall be included.
g) Invert elevations of all sewer at manholes.
h) Location and limits of sand backfill where required.
i) Location and elevations of crossings with other utilities.

3.2.10. Provide a minimum depth from top of curb (or road centerline if uncurbed) to the top of any sanitary sewer of 9 feet at locations where the sewer grade is parallel to the road grade. Under any design the sewer shall be deep enough to reasonably serve, by gravity, a standard depth basement.

3.2.11. Sanitary sewer shall be placed on the opposite side of the street from the water main and shall have a horizontal separation of at least 10 feet.

3.2.12. External drop connections are required at manholes where the invert of the outlet pipe is 18 inches or more below the invert of the inlet pipe. Internal drop connections will not be allowed.

3.2.13. Where the proprietor must extend the sanitary sewer from off-site, the proprietor shall extend sanitary sewer leads to the property line of all adjacent property on both sides of the right-of-way the entire length of the off-site sanitary sewer extension.

3.2.14. In new subdivisions, all service leads shall be sand backfilled and extended a minimum of ten (10) feet past the property line or to the easement line.

3.2.15. The plan and profile view of the proposed sanitary sewer shall generally be shown on the same sheet.

3.2.16. Maximum flow velocity for pipe flowing full shall be maintained by matching the eight-tenths point of the diameter depth above invert for pipe size increases.

3.2.17. Provide a drop of 0.10 feet in the downstream sewer invert for a direction change of 30 degrees or greater to compensate for velocity head loss of the incoming flow.

3.2.18. Service leads and common header pipes for multiple and commercial properties shall be a minimum of 6 and 8 inches in diameter, respectively, with a minimum slope of 1.0%.

3.2.19. Private sanitary sewer leads of excessive length, although not a public sewer, may require calculations, a profile plan, inspection and testing. Each site will be considered individually by the DPW and Community Development Departments.

3.2.20. All existing and proposed sewer service leads shall be clearly shown on the plans.

3.2.21. Proposed sewer service leads are regulated by the City of Berkley adopted plumbing code requiring a minimum of 1% slope. Proposed building sanitary sewer leads shall not be connected to existing or proposed storm drain systems or outlet pipes.

3.3. ***Materials***

3.3.1. Service leads installed with the lateral sewer shall be a minimum of 6 inches in diameter and shall be Schedule 40 PVC or SDR 23.5.

3.3.2. New sanitary sewer manholes must be water-tight and shall be pre-cast sections with modified grooved tongue joints with rubber gaskets, conforming to A.S.T.M. Designation, C-478. Also, a butel rubber coating around the casing and cone shall be provided for all new manholes as noted on the City 's or its agent's standard detail sheet.

3.3.3. Main line sewer shall be PVC Truss pipe, Solidwall SDR 26, or RCP, C-76, Class IV or V, or approved equal.

3.4. ***Installation***

3.4.1. No sanitary sewer installation or portion thereof shall have infiltration exceeding 100 gallons per inch diameter per mile of pipe per 24-hour period.

3.4.2. Each end of a service lead shall be marked by setting a 2" square wooden stake vertically above the end of the lead.

3.4.3. Each tee or end of service lead shall have water-tight and airtight stopper of compatible joint material and shall be adequately braced to withstand exfiltration and/or air test pressure.

3.4.4. When existing manholes are to be tapped, a hole of the appropriate diameter shall be core drilled through the wall of the manhole. A watertight fitting shall be used to connect the pipe into the manhole.

3.4.5. A minimum of 30 days after installation and prior to acceptance, all sewers shall be subjected to infiltration, air or exfiltration tests, or a combination thereof, in accordance with the following requirements, prior to acceptance of the system by the City of Berkley and prior to removal of the bulkhead.

3.4.6. All sewers over 24" diameter shall be subjected to infiltration tests. All sewers of 24" diameter or smaller, where ground water level above the top of sewer is over seven (7) feet, shall be subjected to an infiltration test.

3.4.7. All sewers of 24" diameter or less, where the ground water level above the top of the sewer is seven (7) or less, shall be subjected to air tests or exfiltration tests.

3.4.8. A minimum of 30 days after installation and prior to the acceptance of new mainline sanitary sewer systems, a televised inspection of each section of the mainline shall be conducted from manhole to manhole. Video and log of this inspection shall be submitted to the Community Development Department to document the current condition of the sanitary system at the

time of the utility acceptance. The video and log shall be consistent with the Standards of the City of Berkley.

SECTION 4: STORM SEWER

All construction must conform to the current Oakland County Water Resources Commissioner standards and/or as specified herein.

4.1. *Design Requirements*

4.1.1. Storm sewer systems shall be designed for a ten-year intensity rainfall. The Rational Method for arriving at storm sewer runoff shall be used. An "n" value of 0.013 shall be used for concrete pipe.

4.1.2. The formula for a ten (10) year rainfall intensity shall be equivalent to I = 175/(T+25) in which T is the time of concentration (minutes), and I is the intensity (inches per hour).

4.1.3. The initial T is generally 20 minutes for residential areas and 15 minutes for high runoff areas.

4.1.4. The consulting engineer shall use the following minimum values for "C", the runoff coefficient, in the "Rational Formula" of computing storm water flows (Q = CIA) or as per the current Oakland County standards.

Impervious Hard Surfaces	C = 0.90
Gravel Surface	C = 0.50
Vegetated/Turf Surface	C = 0.20

Other values of the runoff coefficient may be used or required at the discretion of the City's Engineer for such areas as parks and open-spaces or unusual sites.

4.1.5. Sufficient capacity shall be provided in the storm sewer system to take fully developed tributary upstream drainage into the system. When a storm sewer is designed to provide capacity for upstream areas, the hydraulic gradient shall remain in the pipe.

4.1.6. Storm sewer design calculations, including a drainage area map shall be included on the engineering plans. The storm district map shall show all on-site and off-site drainage districts. A minimum 1" = 50' scale is allowed. The district limits must be over laid on a proposed grading plan for the site.

4.1.7. All public storm sewers must be located in a public right-of-way or an easement. The minimum storm sewer easement shall be 12 feet. The easement size will vary as required for maintenance and access. Any storm sewer that accepts runoff from abutting property or public right-of-way must be placed in a minimum 12-foot storm sewer easement.

4.1.8. If a storm sewer is designed to take on-site drainage only, the hydraulic gradient must be no higher than one (1) foot below ground. When the hydraulic gradient is above the top of the sewer pipe, the design elevation of the hydraulic gradient shall be indicated on the profile at each manhole.

4.1.9. Storm water detention is necessary for all developments in the City. See Section 5, Storm Water Detention / Retention Facilities, for details.

4.1.10. Manholes shall be located as follows:

a) All changes in alignment
b) Points where the size of the sewer changes
c) Points where the grade of the sewer changes
d) The junction of sewer lines
e) Street intersections or other points where catch basins or inlets are to be connected.

4.1.11. Manhole and catch basin spacing for storm sewers shall be as follows:

Diameter of Sewer	Maximum Spacing
12” – 15”	400 ft.
18" - 21"	400 ft.
24" - 30"	450 ft.
36" & 42"	500 ft.
48" & larger	550 ft.

4.1.12. The minimum size of a public storm sewer is 12-inch diameter. 10-inch diameter pipe will be allowed for sewer lines that pick up footing drain or roof conductor drainage. No open covers will be permitted for a 10-inch diameter storm sewer.

4.1.13. Connection must be made at manholes or catch basins. Blind taps are not allowed.

4.1.14. The following information shall be indicated on the storm sewer profile:

a) Length of run between manholes.

b) Type, class, size and slope of pipe.
c) Class of bedding.
d) Rim elevations of all manholes.
e) Existing and proposed ground elevations above the route of the sewer.
f) A logical numbering system for manholes shall be included.
g) Invert elevations of all sewers at manholes.
h) Locations and limits of sand backfill, where required.
i) Locations and elevations of crossing with other utilities.

4.1.15. The following table of minimum slopes for storm sewers shall be adhered to:

Size and Minimum Slope

12" @ 0.32%
15" @ 0.24%
18" @ 0.18%
21" @ 0.14%
24" @ 0.12%
27" @ 0.10%
30" @ 0.09%
36" @ 0.07%
42" @ 0.06%
48" @ 0.05%

4.1.16. The minimum velocity may not be less than 2.5 feet per second in a pipe flowing full. The maximum velocity in storm sewers shall be ten (10) feet per second. The contents of a larger pipe will never be discharged into a smaller line even though the slope may be steeper for the smaller line. This principle does not apply, however, to a restricted opening or discharge.

4.1.17. Where possible provide a minimum of three (3) feet of cover from the top of curb (or road centerline) to the top of any storm sewer.

4.1.18. For subdivisions, storm sewers shall be located in the public road right-of-way or in easements adjacent to the public road right-of-way. Storm sewers shall not be located in rear yards except to pick up rear yard drainage or for sump pump discharge lines.

4.1.19. At all pavement catch basins and inlets, forty (40) lineal feet (twenty in each direction) of six (6) inch edge drain shall be constructed at the back of curb line in each direction, backfilled with pea gravel and includes fabric. Additional edge drain may be required as directed by the City Engineer.

4.1.20. No more than 1.0 acre of area shall be tributary to one standard catch basin. Catch basins may be placed side by side to provide additional capacity.

4.1.21. A maximum of 900 feet of drainage is allowed to any catch basin from two (2) directions.

4.1.22. Where lateral storm sewers are proposed, all new homes must be constructed with sump pumps which discharge to an underground pipe connected to an underground public rear yard drain or storm drain. The sump pump discharge lead shall be a minimum of four (4) inch diameter. The lead shall be constructed at a minimum 1.0% grade and connected to a structure. No blind taps are allowed.

4.1.23. The minimum grade for swales and ditches shall be 1.0%. All ditch slopes greater than 3.0% will require sod vegetation. Ditch slopes greater than 5.0% will require rip rap and/or check dams.

4.1.24. For residential developments and redevelopments, rear and/or side yard catch basin(s)/inlet(s) may be required unless stormwater drainage can be maintained on site and be positively directed and ultimately discharged to the nearest stormwater collection system in the City right-of-way/street via surface (ditch/swale/sheet flow) drainage.

4.2. ***Materials***

4.2.1. Pipe for storm sewers within the public right-of-way or under any roadway or driveway shall be C-76 reinforced concrete pipe conforming to Classes IV or V, or HDPE or PVC if approved by a geotechnical consultant and approved by the City.

4.2.2. Pipe outside the influence of the public right-of-way may be double-walled, High Density Polyethylene (HDPE) with smooth interior and annular exterior corrugation meeting requirements of ASTM F2306. Special bedding and backfill will be required.

4.2.3. Joints for storm sewer shall be tongue and groove premium joints with rubber gaskets.

4.2.4. All lead material shall be schedule 40 PVC.

4.2.5. Storm manholes are to be a four-foot (4') diameter minimum with an eccentric cone. Catch basins are to be a minimum four feet (4') diameter with a two (2) foot sump and an eccentric cone. Inlets may be a two (2) foot diameter. All storm structures must conform to ASTM C-478.

4.3. *Installation*

4.3.1. All storm sewers shall be installed on Class "B" bedding or better.

4.3.2. A prefabricated bar screen shall be installed on all storm sewers eighteen (18) inch in diameter and larger.

4.3.3. Refer to the standard detail sheets for additional material and construction standards.

4.3.4. HDPE sewers may require deflection testing with a nine-point mandrel a minimum of 30 days after installation. At no point will the pipe have out of round deflections greater than five (5) percent of normal pipe diameter.

SECTION 5: STORM WATER DETENTION / RETENTION FACILITIES FOR NEW SUBDIVISIONS, SITE CONDOMINIUMS AND COMMERCIAL DEVELOPMENTS

All construction and land activities must conform to the current Oakland County Water Resources Commissioner standards and/or as specified herein.

This article is intended to specifically apply to stormwater detention/retention which is a prevailing need where the absence of detention/retention could endanger the property, health, safety and general welfare of the residents and property owners of the city.

Further, the purpose of this article is to regulate the rate of stormwater runoff flow from land within the city in order to protect the public health and minimize the problems resulting from an overloading of the city sewer system.

For clarification, while stormwater detention and retention are both methods used to manage and control, or reduce the peak flow of stormwater runoff, helping to mitigate the impacts of stormwater runoff and reduce the strain on drainage systems, they serve different purposes. **Stormwater detention** involves temporarily holding stormwater and then slowly releasing it at a controlled rate to prevent flooding and erosion downstream as well as reducing the risk of damage to downstream infrastructure. Detention can be achieved by constructing detention basins/ponds, underground tanks, sewer pipe networks, or other structures designed to temporarily store stormwater. **Stormwater retention** involves the capture and storage of stormwater, allowing it to infiltrate into the ground or to evaporate over time, which can help to recharge groundwater and reduce the volume of stormwater entering the drainage system. Retention can similarly be achieved by constructing infiltration basins/ponds, bioretention areas, rain gardens, wetlands, underground tanks or storage pipe networks, or other structures designed to capture and hold stormwater.

5.1. ***General***

5.1.1. Storm water detention/retention is required for all developments in the City.

5.1.2. Detention basins shall be designed to detain improved storm water over the developed areas on site. The applicant is not required to detain water from offsite areas in the drainage district.

5.1.3. All land activities shall comply with the current Oakland County Water Resources Commissioner (OCWRC) Stormwater Engineering Design Standards with the exception of the one (1) acre or greater requirement for stormwater management in that the City of Berkley requires all land activities regardless of size to be governed by OCWRC's design standards unless otherwise described herein.

5.1.4. If the stormwater system is proposed to be a retention system with no outlets, the system will be required to hold two 100-year storms.

5.1.5. All projects are required to provide adequate sediment and erosion controls in order to ensure no offsite sedimentation collects transports into adjacent properties, sewer systems, and public rights-of-way, regardless of size.

5.1.6. Drainage from a new development, renovation or addition shall not be diverted onto abutting private property. Drainage from a new development, renovation and addition requiring detention shall be directed to the detention basin. Discharge from the basin and overflow shall not be diverted onto abutting private property.

5.1.7. The stormwater detention requirements for developments less than one (1) acre in area are as follows:

Detention Table for Commercial Developments and Residential Subdivisions and Site Condominiums with a parcel size of 1 Acre or less

Development Area (acres)	Detention Volume Required (Cubic Feet)	Maximum Outlet (CFS)	Minimum Outlet Requirements
0.91 to 1.00	8,000	0.97	4 - 2" Orifices
0.81 to 0.90	7,200	0.73	3 - 2" Orifices
0.71 to 0.80	6,400	0.73	3 - 2" Orifices
0.61 to 0.70	5,680	0.49	2 - 2" Orifices
0.51 to 0.60	4,780	0.49	2 - 2" Orifices
0.26 to 0.50	4,000	0.49	2 - 2" Orifices

5.2. ***Project Variances/Exceptions***

5.2.1. Developments, renovation or additions of less than 0.26 acres or 11,325 square feet in area will not require stormwater runoff detention/retention at the time of the improvement. For such case, a restrictive covenant must be executed by the property owner and recorded with the Oakland County Register of Deeds stating that when the next future improvement occurs on the property which will make the accumulated area of existing improvement and the future improvement greater than 0.26 acres or 11,325 square feet, the property owner will make the stormwater detention/retention improvements as specified in this article on the accumulated area.

5.2.2. The City shall have the authority to grant variances/exceptions to the detention requirements as contained within this section if the area of the proposed development is between 0.26 and 0.50 acres and upon reasonable written demonstration of practical and/or financial difficulty by the Applicant related to stormwater detention compliance and/or exceedance of the project budget which would cause the project to be delayed or abandoned. Circumstances may include limited buildable area, special zoning requirements, parking requirements, other site restrictions, etc. Regardless of any variance/exception granted, the City will maintain the minimum requirement for the Applicant to detain stormwater runoff from the proposed *improvement(s)* on the site.

5.2.3. Renovations and additions that do not involve parking lot, private street, drive or sidewalk removal and replacement, will not require stormwater runoff detention/retention at the time of the improvement, unless adequate undeveloped land is available for detention/retention on the property. If stormwater detention/retention is not included as part of the renovation, a restrictive covenant must be executed by the property owner and recorded with the Oakland County Register of Deeds stating that when the next future improvement occurs on the property under this article, the property owner will make the stormwater detention/retention improvements as specified in this article on the accumulated area.

5.3. ***Method Used***

The Oakland County Water Resources Commissioner (OCWRC) Stormwater Engineering Design Standards, subtitled the “Requirements, Rules, and Design Criteria for Stormwater management”, as made available by the Oakland County Drain Commissioner's office, shall be utilized in the design and implementation of all stormwater topics, including, but not limited to, determining the volume of detention/retention required; stormwater management; flood control; long term stormwater infrastructure maintenance; and low-

impact development (LID) techniques, or "green infrastructure" to reduce runoff and pollution, improve water quality, and promote soil conservation. The Planning Commission and City Council may determine alternate requirements as deemed necessary and advisable during the course of their special land use permit and site plan review process.

As per the OCWRC, underground detention facilities will be allowed on sites where traditional stormwater management measures are not feasible and will be evaluated on an individual basis. The underground facility must comply with all standards imposed on traditional facilities; including, but not limited to, a restricted outlet, overflow structure, overflow route, and a perpetual maintenance plan.

5.4. ***Design Requirements***

5.4.1. Detention and retention facilities design shall follow the Oakland County Water Resources Commissioner (WRC) current Stormwater Engineering Design Standards. Developments that do not meet these requirements will, at a minimum, meet the standards in this section of the City of Berkley Engineering Design Standards.

5.4.2. Leaching systems may be designed with a maximum infiltration rate of six (6) inches per hour and store a volume equal to a 100-year storm. Sufficient data must be available to support the use of a leaching system. In no case shall the infiltration rate be greater than 0.2 cfs per acre. A form of sediment control must be provided with all leaching systems.

5.4.3. Sediment control system must provide 80% removal of the annual total suspended solids (TSS) based on a 100-micron particle size and treat 100% of the runoff from the 1-year/24-hour storm event. Rain events in excess of the 1-year/24-hour event must bypass the system without causing re-entrainment of floatable contaminants.

5.4.4. A minimum of 12 inches of freeboard must be maintained for all systems. All building openings must be above the freeboard elevation.

5.4.5. All basins shall be required to be designed to drain by gravity unless designed with a permanent water elevation. Detention basins designed to utilize pumps for dewatering will not be permitted.

5.4.6. Where a retention basin will be utilized, it is the developer's engineer's responsibility to provide documentation to confirm that the soils in the area of the basin can infiltrate at a minimum rate of six (6) inches per hour. In no case shall the infiltration rate be greater than 0.2 cfs per acre. This information shall appear on the engineering plans. A leaching basin will be

required for all retention systems unless the ground water level is within two (2) feet of the outlet.

5.4.7. All open detention basins must be fenced if the side slopes exceed 1 vertical to 5 horizontal. This may be waived by the City if the design of the basin is an integral part of the landscaping and the location and depth does not present a potential hazard. The maximum side slope for a basin with fencing shall be 1 vertical to 3 horizontal.

5.4.8. A 20-foot-wide access easement must be provided to all basins.

5.4.9. An agreement for the long-term operation and maintenance of detention / retention facilities must be completed by the developer and submitted to the City prior to final acceptance of the as-built record drawings.

5.4.10. Calculations for the runoff coefficients, detention volume and restrictor sizing shall be clearly shown on the proposed detention/grading plan(s).

5.4.11. Outlet detail or details shall be clearly shown on the plans. Restrictor size, type and location shall be clearly indicated on utility plans. The 100-year free overflow shall be clearly labeled with the appropriate calculations and details.

5.4.12. As built plans shall be provided for all detention areas. Plans shall clearly indicate sufficient site grades; water surface contours and revised calculations based on the as-built grades verifying that the required volumes have been met. Deficiencies in detention storage volume shall be addressed with plans to provide the required detention volumes.

5.4.13. The City of Berkley will require approval prior to construction to alter or regrade any area that provides storm water detention storage (swale, pond, pipe system, paved surface, etc.) or provides freeboard for a detention system (berms, landscaping, curbing, walls, etc.) Upon completion of the site work, an as built plan will be required to verify the restricted outlet, site grading and detention storage volumes in comparison to originally approved grades and volumes. Storm Detention and Right-of-way work shall be completed and approved prior to the City signing off on any final occupancy permit or other approval.

5.4.14. One detention volume calculation shall be made for the entire site. Previous hard surface improvements that required detention or a lien shall be included in calculation. Cumulative hard surface improvements shall be shown on the plan and labeled accordingly with the areas of improvement and dates of construction.

5.4.15. The minimum size outlet pipe shall be 8" diameter. Manholes shall be provided at each connection to public sewers of 15" or less and at all pipe junctions 10" and larger.

5.4.16. Restrictors shall be sized to discharge at the appropriate rate. To minimize the potential for orifice clogging, the minimum size restricted orifice is 2" in diameter. All restrictors and their respective calculations shall be indicated on the plans. The total cumulative discharge from all restrictors shall equal the site total discharge.

5.4.17. The restricting outlet structure (manholes and catch basins) shall be precast concrete and 48" minimum diameter with a 2' minimum sump, or approved alternative.

5.4.18. The City of Berkley shall retain the authority to approve/deny the construction of detention basins within public utility easements based on potential impacts to public utilities.

5.4.19. No structure shall be installed within a detention basin that may allow the circumventing of detained water storage. Detention basins shall not be installed above any utility structure, manhole, water gate well, electrical handhole, etc. or within the limits of trash enclosures or any building.

SECTION 6: GRADING FOR SUBDIVISIONS, SITE CONDOMINIUMS AND COMMERICAL DEVELOPMENTS

6.1. ***General***

6.1.1. A grading plan is required for all developments. Rear yard storm drainage systems are required for all residential development and redevelopment projects. Refer to Section 4: Storm Sewer herein and Chapter 26 – Article VII (Building and Building Regulations) of the Berkley Code of Ordinances.

6.1.2. The grading of the proposed development shall not create drainage problems, or make existing drainage problems worse, on adjacent property. If necessary, storm drains shall be extended to the adjacent property to alleviate drainage problems.

6.1.3. A building permit shall not be issued until a grading plan has been submitted to the City and approved.

6.1.4. A soil erosion permit is required for all earth disruption over 1.0 acre, or as

deemed necessary by the permitting agency. It is the responsibility of the developer to inquire with the appropriate agency regarding the necessity of a permit.

6.2. ***Design Requirements***

6.2.1. First floor and basement (where applicable) elevations for each proposed structure or building shall be shown on the plans.

6.2.2. The grades of existing adjacent buildings, drainage structures and streets shall be shown. The actual surveyed grades of existing adjacent ground and yards shall be shown on a grid pattern up to a minimum of 100 feet from the property line. The drainage pattern of all adjacent existing land shall be indicated.

6.2.3. The grading plan shall be designed to ensure that if a failure or overflow occurs within the storm system, water will drain away in overland swales without flooding houses.

6.2.4. The finished grade shall be compatible with the grades of surrounding buildings, roads, yards and with the existing ground at the proposed house. Finished grade set below the crown of the road will require that all stormwater is intercepted and routed so that it does not adversely impact any buildings.

6.2.5. All existing and proposed ground grades are to be in tenths of a foot.

6.2.6. Rear yard swales shall be no longer than 400 feet before being intercepted by a catch basin and shall have a minimum grade of 1.0%.

6.2.7. The proposed side yard swale elevation shall be shown between all buildings. This elevation must be a minimum of 0.5 feet below the lower adjacent house grade. The side yard swale must have a minimum slope of 1.0% to the front and rear.

6.2.8. General direction of flow of the rear yard drainage and swales must be indicated with arrows.

6.2.9. The maximum allowable grade shall be 1 vertical to 4 horizontal.

6.2.10. The proposed ground elevations shall be indicated at each lot corner and top of curb or edge of pavement.

6.2.11. The maximum driveway slope is 8.0%. The slope of the driveway shall be

labeled on the plans.

6.2.12. Proposed retaining wall designs may require review by the City's Consulting Engineer at the City's discretion.

SECTION 7: PAVING & PRIVATE ROADS

7.1. *General*

7.1.1. For both public and private roadways proposed in the City, the City of Berkley, in conjunction with the Road Commission for Oakland County's design standards for subdivisions will be utilized as the basis for the design unless modified in this section.

7.1.2. Alternative paving designs for private roads/driveways may be submitted to the City for consideration at the time of Site Plan Review. They will be reviewed by the City's Consulting Engineer and recommendations will be made to the City. Such alternative paving designs shall only be acceptable in those instances where the City finds that the proposed design will provide an acceptable level of serviceability, ease of maintenance and are consistent with other paving in similar areas elsewhere in the City.

7.1.3. For roads under the jurisdiction of the Road Commission for Oakland County (RCOC) or the Michigan Department of Transportation (MDOT), all improvements shall be designed to meet their requirements.

7.1.4. Acceleration, deceleration and passing lanes designed in accordance with RCOC/MDOT standards are required at all road entrances that front on paved major roads unless waived by the RCOC/MDOT.

7.1.5. Alternate horizontal and vertical alignments may be considered with written approval from the City Public Safety Department.

7.2. *Design Requirements*

7.2.1. The minimum outside radius of a cul-de-sac (back of curb) shall be fifty (50) feet. The back of curb inside radius shall be twenty (20) feet. All right-of-way radii shall be sixty (60) feet minimum.

7.2.2. Alternate horizontal and vertical alignments may be considered with written approval from Public Safety.

7.2.3. Roadways shall have a minimum of two (2) 12-foot lanes with or 27-foot-

wide back of curb to back of curb.

7.2.4. A boulevard section may be allowed in an enlarged right-of-way. Pavement widths shall be at least twenty-four (24) feet for all boulevard streets (back of curb to back of curb). The distance from the property line to curb shall be sixteen (16) feet on boulevards. The minimum island width shall be ten (10) feet and maximum sixteen (16) feet. The nose of the boulevard island shall be set back at least twelve (12) feet from the edge of pavement of the intersecting street.

7.2.5. Vertical curves are necessary when a change in grade of 1.0% or more occurs. The minimum length of vertical curve shall be 100 feet.

7.2.6. The minimum pavement vertical grade for roadways shall be 0.40% when concrete curb and gutter is provided, 1.0% with open ditch and the maximum allowable grade on any roadway is 8.0%.

7.2.7. The maximum cross slope on a cul-de-sac is 3.0%.

7.2.8. All proposed roadways shall be profiled. The pavement profile view shall include:

7.2.9. Elevations at each station for the top of curb, or at centerline if not curbed.

7.2.10. Existing ground elevations at the center of the right-of-way, and 30 feet either side of the centerline.

7.2.11. Station and elevations of all high points, low points, grade-breaks and necessary information at vertical curves. Grades for vertical curves must be indicated at twenty-five (25) foot intervals.

7.2.12. The station and top of curb grade of all pavements catch basins and inlets.

7.2.13. The pavement radius at all intersections of all roads shall be a minimum twenty-five (25) feet.

7.2.14. Finish grade of all structures shall be indicated in the plan and profile views.

7.2.15. The minimum pavement cross-section for a residential road is four (4) inches of hot mixed asphalt (HMA) on eight (8) inches of aggregate. A thicker HMA, or possibly a nonreinforced six (6) inch to eight (8) inch concrete section, may be required by the City depending on the average daily traffic volumes as well as percentage of truck traffic. Additional layers and types of aggregate may be required depending on the type and condition of the

subsoils determined during the geotechnical investigation when pavement cores and soil borings are extracted.

7.2.16. The minimum commercial parking lot pavement cross-section is three (3) inches of hot mixed asphalt on eight (8) inches of aggregate or six (6) inches of concrete on six (6) inches of aggregate Thicker cross sections (either or both the pavement and the aggregate section) for commercial parking lots may be required depending on the underlying soil conditions and/or as directed by the City.

7.2.17. All sidewalks are to be concrete and a minimum of four (4) inches thick on four (4) inches of Class II sand. Sidewalk ramps and sidewalk flags that cross driveways must be six (6) inches thick.

7.3. ***Materials***

7.3.1. The subgrade material for paved private roads and parking lots shall be 21AA crushed concrete or limestone aggregate or as deemed necessary by the Developer or the City and/or its Consulting Engineer.

7.3.2. The HMA mix for private roads and parking lots shall meet current MDOT standards.

7.3.3. Concrete shall be mixed, placed, tested and cured as per current MDOT standards.

7.4. ***Installation***

7.4.1. The installation of private roads and parking lots within the City may require inspection by the City Department of Public Works and/or the City Consulting Engineer at the following stages:

a) After the sub grade has been rough cut to the plan elevation.
b) After the placement of the aggregate base or aggregate roadway surface.
c) Full-time during the placement of the pavement (where applicable).
d) After all the required vegetation has been established.

Appendix A

CITY STANDARD CONSTRUCTION NOTES

The following notes shall be placed on <u>ALL</u> engineering plans. They may be modified when appropriate.

<u>City of Berkley Standard Construction Notes</u>

1. A preconstruction meeting must be scheduled with the City of Berkley Department of Public Works (DPW) prior to the start of construction (schedule, insurance, bonds, info. flyer).
2. The DPW will complete site inspections for all work within the City right-of-way or along public utility corridors. Please contact the DPW foreman two days before work starts at 248-658-3490.
3. The City recommends the applicant and/or contractor video or photograph the project area prior to the start of construction as documentation of existing conditions.
4. All existing gate valves and hydrants are to be operated only by the City's Department of Public Works personnel. At no time shall the Contractor operate these facilities himself. The Contractor shall contact the Department of Public Works a minimum of 48 hours in advance of the need to schedule these activities and operations.
5. Use of a public fire hydrant will require a City meter with appropriate backflow prevention. Arrangements must be made with the DPW prior to construction. The current fee can be obtained at the City's Department of Public Works and is adjusted periodically.
6. The contractor shall take appropriate measures to protect public and private trees in the work area as detailed in Section 130-44(d) of the City Code. Any damage to trees shall be reported to the City.
7. The work area must be kept clean and dust free. Contractor will provide street sweeping as necessary.
8. Concrete trucks will not be permitted to wash out into the City's combined sewer system or catch basins.
9. Two-way traffic must be maintained for any work within the public roadway with traffic control devices in place according to the MMUTCD, latest edition.
10. Temporary road repairs must be checked and maintained on a daily basis.
11. Existing pavement shall be removed at existing joints and sawcut full depth prior to removal.
12. Compacted sand backfill meeting MDOT Granular Material, Class IIA requirements will be required for all trenches and excavations on this project, and acceptable backfill material meeting all specified requirements is expected to be imported for this use. All backfill is to be placed and compacted to a 95% maximum density regardless of whether the area is within the roadway or the greenbelt.
13. New concrete pavement shall match existing cross section - minimum 7" thick on a compacted sand base with epoxy coated #5 (5/8") dowels, 18" long, grouted in place, 24"

on center on all sides. (Each dowel must be imbedded 9” into the existing concrete). Further, full length dowels are to be installed through the curblines. Placement of concrete below 40 degrees Fahrenheit will not be accepted.

14. It is the responsibility of the contractor to call MISS DIG at least three (3) days prior to job start.
15. The contractor is responsible for all damage to public utilities, pavement, curb, curb and gutter, and sidewalk in the public right-of-way.
16. All soil erosion and sediment must be controlled and contained on site. All public drainage structures requiring cleaning shall be completed prior to final inspection by the City.
17. City will require certification of the constructed storm detention system by way of a signed/sealed letter by the Applicant/Developer’s Design Engineer. It is assumed that the Design Engineer will be in the field during this phase of construction, in particular, so they can confirm it was properly constructed.
18. ADA compliant ramps with detectable warning (Brick Red color, ADA Solutions or approved equal, 24" x 48”) are required for any ramps disturbed during construction.
19. Trash collection shall not be interfered with by the Contractor's operations.
20. ADA Detectable Warning Surface Plates must be Alertcast®, Orange Plastic, 24” x 48” or approved equal (ADA Solutions has previously been approved as well).
21. The Contractor must install temporary fencing to protect the public from equipment and any open excavations, as required, and around the trees that are to remain, prior to construction. Refer to Chapter 106, Article VII, Section 106-304 for fencing requirements.
22. Silt sacks are to be installed in all drainage structures prior to the start of construction and be in place for the duration of the project to aid in prohibiting debris from entering the sewers.

Appendix B

SITE PLAN (FINAL/ENGINEERING) REVIEW CHECKLISTS

1. ENGINEERING (COMMERCIAL DEVELOPMENTS)
2. ENGINEERING (RESIDENTIAL DEVELOPMENTS)
3. "AS-BUILT" REQUIREMENTS

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
A. Applicant/Project Information			
1. Project Name			
2. Section			
3. City/Consultant Project Job No., if applicable			
4. Applicant's Engineer			
5. Date Received			
6. Review Fee Received			
B. Upon Receipt of Plans			
1. Received electronic copy of Site Plan Packet (plans, letters, documents, etc.) and two (2) hard copies, as required			
2. Sealed by Registered P.E.			
C. General			
1. 24" x 36" Sheet			
2. Engineering Scale 1" = 100' General Plan (1" =20' or smaller plot sheets)			
3. North Arrow, Date, and Revision Date(s)			
4. Street Names			
5. Existing and Proposed Property and Right-of-Way Lines			
6. Lot Dimensions, Property Addresses			
7. Legal Description(s), Parcel I.D.'s (Sidwell #'s)			
8. MISS DIG design ticket number stated on plans			
9. Location Map			
10. Building width, length and dimensions between buildings			
11. Existing and Proposed Topographic Survey of site			
12. Existing and Proposed building elevations			
13. Existing and Proposed Utilities, including pipelines, structures and hydrants			
14. Location of surface and/or subsurface drainage			
15. Screening, walls, fences, berms, or greenbelt/landscape areas			
16. Existing and Proposed Pavement/Driveway/Sidewalk surfaces			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
17. Existing and Proposed Parking layout/Parking Space calculations			
18. Street and Easement Width Shown			
19. Easements 12' Wide Minimum			
20. Superimposed on Plan – 1 ft (Existing and Proposed) contours including at least 100 ft outside of the project area			
21. Existing and Proposed Wetland and Floodplain boundary lines			
22. Provide Existing and Proposed cross-sectional Details for all Pavement, Driveways, Curb, and Sidewalk/Ramp.			
23. Benchmarks (on USGS Datum)			
24. Finished grade on all structures			
25. Copy of computed plat			
26. Stormwater detention calculations in accordance with current Oakland County standards (Note – the City of Berkley requires all proposed developments to meet the detention requirements of Oakland County, including sites smaller than 1 acre)			
27. Paved streets (Concrete or Hot Mixed Asphalt (HMA)) with concrete curb and gutter, as required by City			
28. Demolition Plan sheet (or shown directly on Site Plan) to show all removal quantities, including pavement, curb, sidewalk/ramp, utilities, trees, landscape features, etc.			
29. Geotechnical evaluation of site by a registered geotechnical firm to determine existing soil conditions and to offer recommendations/comments on proposed storm water collection system, buildings, etc.			
30. Sequence of Construction (must also indicate the timing for installation of Soil Erosion Control measures) and Construction Phasing, if applicable			
31. Any existing sewer or water main that is under an existing building that is to remain, the Developer/Applicant will be responsible for financing and coordinating the relocation of the utility away from the footprint of the building. Further, no new utility will be allowed to be installed underneath and within the footprint of any building structure.			
32. All new sidewalk ramps must be ADA compliant as per current MDOT and/or Road Commission Standards (Detail w/ slopes, truncated dome inserts)			
33. Existing and Proposed Pavement Markings			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
34. Restoration of grassed areas shall be shown as seed/mulch, hydroseed, sod or other mix			
D. Permits (as required)			
1. Soil Erosion and Sedimentation Control Detail Sheet and copy of Water Resources Commissioner (WRC) Permit			
2. Copy of WRC Drain Tap Permit			
3. Copy of Road Commission for Oakland County (RCOC) Permit, if required			
4. Copy of Road Commission for Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit			
5. Copy of Michigan Department of Transportation (MDOT) Permit			
E. Sanitary/Combined Sewer			
1. Notes on plans including size, material, length and bedding/trench details for all proposed pipes and structures.			
2. Sewers in Easements – Minimum of 2' from Lot Lines			
3. Design meets minimum slope requirements			
4. 8" Dia. Minimum size sewer			
5. Manhole spacing – 8"-10" – 300' - 12"-21" – 350'			
6. Sewer in street right-of-way if possible			
7. Minimum depth from top of curb (or road centerline) to top of sewer 8-1/2' or 9'			
8. End of wye or house lead plugged with same type of joint as main sewer			
9. Allowable type of pipe and joint specified?			
10. Upstream service provided for?			
11. Truss pipe notes provided?			
12. Sanitary Sewer Detail Sheet provided?			
13. R.E.U. Calculations, Basis of Design, provided?			
14. Sanitary Sewers shown in Plan and Profile			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
15. Profile shows: A. Size B. Class/Material/Trench Detail C. Invert D. Slope E. Existing ground F. Proposed grade G. Locations of porous backfill			
16. All existing sanitary leads and water services and their material type, if known, must be indicated on Plans at time of submittal			
17. All existing leads which are not to be re-used must be abandoned (cut and capped) within two (2') of the main.			
18. Existing leads which will be re-used must be inspected by a licensed contractor/plumber and the video footage submitted to the City verifying the lead is suitable for re-use prior to construction			
F. Storm Sewer			
1. Pipe design and proposed storage volume in compliance with current Oakland County Water Resources Commissioner (OWRC) Standards			
2. Map and computations of design (including drainage sublets) 2. Calculations for the runoff coefficients, detention volume and restrictor sizing shall be clearly shown on the proposed detention/grading plan(s). 3. Outlet detail or details shall be clearly shown on the plans. Restrictor size, type and location shall be clearly indicated on utility plans.			
3. Storm Sewers shown in Plan and Profile			
4. Profile shows: A. Size B. Class/Material/Trench Detail C. Invert D. Slope E. Existing ground F. Proposed grade G. Locations of porous backfill H. Hydraulic Gradient, if out of pipe			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
5. Maximum Manhole spacing (12”-18”, 400’; 21”-30”, 450’; 36”-42”, 500’)			
6. Manholes shall be located at: • Any change in alignment, unless approved by the City • Any change in pipe diameter • Any change in elevation • Any junction of the drainage system			
7. Catch basin spacing A. At radius of return of intersection, 150’ max. run if flow goes around corner B. At low points C. 600’ drainage maximum in one direction D. 900’ drainage maximum in two directions			
8. Field catch basin at low points in easement 1200’ max. drainage, 600’ max. in one direction			
9. Field catch basin in rear lot easement when such swale changes direction more than 45°			
10. Taps: Connections must be made at drainage structures. Blind taps may only be allowed with the explicit approval of the City.			
11. Finished easement grades shown			
12. Have Best Management Practices (BMP) for Storm Water Treatment (green roofs, bioswale, vegetation filter strips, rain barrels, etc.) been considered for storm water effluent from impervious surfaces?			
13. Allowable type of pipe and joint specified?			
14. Headwalls and inlet structures as required			
15. Lateral sewers to provide outlet for footing drain discharge for each lot, unless discharge directly to wetland or body of water			
16. Separate storm water and sewer connections to City combined sewer			
17. Storm outlets must have proper energy dissipation (soil erosion measures) such as geo-fabric with stone, rip rap, etc.			
18. Storm sewer end sections must be fitted with bar screen/animal grate if pipe is more than 18” in diameter			
19. Footing drain leads to property line*, unless lot immediately adjacent to wetland or body of water. * Where footing drains don’t discharge to storm sewer by gravity, plans must include note indicating which homes have sump pumps with discharge points.			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
20. Storm Sewer Detail Sheet provided?			
21. Perpetuity maintenance agreement by developer required (for private storm water collections systems)			
22. Downspouts cannot discharge onto pavement areas or be directly connected to combined sewer and must be directed to green areas or into detention systems on-site, if proposed.			
23. Restricted catch basin covers, as required by City DPW			
24. Public Storm Drain: • All public storm drains must be located in a public right-of-way or an easement. Easement drawings and descriptions shall be forwarded to the City upon receiving Site Plan Approval. The easement size will vary as required for maintenance and access. The minimum storm drain easement shall be 12 feet in width. The execution of the easement will be required prior to construction of the system. For any project requiring an easement or license agreement, the City will require the Developer or property Owner to provide a boundary survey and plans prepared by a professional surveyor, licensed in the State of Michigan, for review and approval, prior to issuing any permits. • The City reserves the right to dictate the ultimate size and location for all public storm drains. The City may require public storm drains be installed by private Developers to accommodate future improvements within the drainage district of the proposed improvements and provide extensions and easements for the extension of public storm drains. For stormwater retention, see Section J.			
G. Water Main			
1. Notes on plans			
2. Dedicated easement for public water main			
3. Minimum 8” diameter water main			
4. Main feeders are 8” diameter water main or 12” as specified by City			
5. 6” diameter water main lengths shall not exceed 1400’ (hyd. Runouts)			
6. Gate valves shall be located in the system such that not more than 4 valves will isolate any section			
7. Valving shall be such that a maximum of 30 lots shall be serviced in any one section			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
8. Gate valves 5’ from right-of-way corners			
9. Hydrants at 500’ maximum spacing			
10. Maximum of 350’ from any house to hydrant			
11. New water main to be looped through new site (commercial, multi-family) – no dead ends allowed			
12. Hydrants and Water Main meet City Standards			
13. Hydrants at intersections 15’ from right-of-way corner			
14. Finish grades of hydrants and gate wells			
15. Hydrant at least 4’ from edge of pavement or protected with bumper posts			
16. Water Main Detail Sheet provided?			
17. If lead or galvanized material is encountered on either the private or public side of a water service line, the entire service must be replaced from the main to the building’s meter to comply with the State’s current Lead and Copper Rule (LCR).			
H. Paving			
1. 27’ wide (Residential); 33’ (Commercial)			
2. Cul-de-sac – Min. 21’ B to B (500 ft long)			
3. Minimum Grade = 0.4%			
4. V.C. where 2% change in grade			
5. 6% - Max. grade			
6. At intersections, allow 0.3’ drop in elevation around curb return			
7. Show curve data			
8. Show top of curb grade and elevations			
9. 6” sand base and underdrain needed?			
10. Concrete Curb and Gutter (or integral C&G), as required by City			
11. Curb cut length (≥10’ and ≤25’)			
12. Curb cut spacing (≥25’, commercial only)			
13. Pavement, Driveways, Curb, and Sidewalk/Ramp cross-sections shown on Plans in accordance with City Standards or as directed by the City			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
14. When paving asphalt surfaces, the final adjustment of all castings or road utility boxes to finished grade shall be made immediately prior to placing the wearing course.			
15. Existing pavement shall be sawcut, full depth, prior to removal. Pavement shall be sawcut two (2') feet off the back of curb where concrete curb and gutter is to be installed within concrete roadways and two and a half (2 ½') feet off the back of curb where concrete curb and gutter is to be installed within composite (asphalt over concrete) roadways.			
16. Where portions of composite pavement (asphalt over concrete) are removed for proposed utility work, a new concrete base course with an asphalt overlay shall be placed to match the existing thickness of the existing materials.			
17. Removal of existing pavement shall be to the nearest joint of an existing, acceptable pavement slab or curb and gutter in the opinion of the Engineer. The City reserves the right to dictate the limits of pavement removal or restoration when pavement alterations are proposed or required as part of a development. The alteration limits shall be set to achieve a proper, durable restoration that will integrate with existing and future similar improvements and be in the best interest of the City. Deficient pavement, in the opinion of the Engineer, includes sunken, cracked, broken, and scaled - road and alley pavement, pavement not meeting the standard dimensions, slope or thickness or causing the ponding of water will be determined by the City for replacement at the time of plan review. All existing pavement or portions thereof, along the frontage of a development that is substandard or deficient will be reviewed for replacement when a proposed cut is made into the pavement. Alterations of road and alley pavement on public right-of-way shall be installed to current standards, widths, cross sections, and slopes as dictated by the Engineer.			
18. All public storm drain, sanitary and combined sewer runs containing sections of pipe to be removed and replaced shall be cleaned and televised after the pipe is replaced and prior to replacing the pavement above the repair to ensure the structural integrity of the repair can be approved by the City and their Engineering Consultant prior to the contractor replacing the pavement above the repair. One (1) copy of the video recording (or web link) shall be furnished to the City for review.			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
I. Grading			
1. Are 8 principles of erosion and sediment control being followed? A. Smallest practical area exposed B. Shortest period of time exposed C. Temporary vegetation D. Sediment basins – desilting basins or silt tops E. Provide for accommodating increased runoff F. Final vegetation and structures installed as soon as possible G. Development fitted to topography H. Natural vegetation retained and protected			
2. Will final grading still allow for sufficient cover over existing utilities? (Especially water mains).			
3. Proposed grading will not alter existing drainage conditions in a way that will direct stormwater onto neighboring properties			
J. Stormwater Retention/Detention			
Underground Storage			
1. Calculations for the proposed storage system showing the provided retention volume			
2. Provided retention volume meets or exceeds required volume according to Oakland County Water Resources Commissioner Stormwater Engineering Design Standards			
3. Dimensions (L x W of storage area, pipe diameter, etc.) shown for entire proposed system			
4. Outlet Control Structure provided which limits flow from retention system into combined sewer to allowed flow from Oakland County standards.			
5. Details for proposed storage system and outlet control structure			
6. Adequate cover above storage system provided			
7. Backfill materials and thicknesses match manufacturer and geotechnical report recommendations			
Basins			
8. Does design meet requirements based on Oakland County Retention/Detention Basin Formulas?			
9. Does design meet the City Engineering Consultant's requirements?			

I. ENGINEERING SITE PLAN REVIEW CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
10. Are basin side slopes adequate for maintenance such as lawn cutting? (Maximum 1:5)			
11. Is 4' high vinyl-clad, chain link fence with double opening 12' wide gate and access road provided as required? (For slopes exceeding maximum 1:5 slope)			
12. Is animal grate provided at outlet pipe?			
13. Drainage certification on plans?			
14. Is Detention Basin overflow channel provided?			
15. Are there downstream conditions warranting further restriction or limiting of discharge from detention basin?			

II. ENGINEERING PLAN REVIEW CHECKLIST (RESIDENTIAL PLOT PLANS/DEVELOPMENTS) The following is a engineering site plan review checklist which includes the information, specifications, and details required for residential plot plan/development site plan submittal.	NA	INCLUDED	
		YES	NO
A. Applicant/Project Information			
1. Street Address or Project Name			
2. Section			
3. City/Consultant Project Job No., if applicable			
4. Applicant's Engineer			
5. Date Received			
6. Review Fee Received			
B. Upon Receipt of Plans			
1. Received electronic copy of Site Plan Packet (plans, letters, documents, etc.) and two (2) hard copies, as required			
2. Sealed by Registered P.E.			
C. General			
1. Existing and Proposed Property and Right-of-Way Lines			
2. Lot Dimensions, Property Addresses			
3. Legal Description(s), Parcel I.D.'s (Sidwell #'s)			
4. Location Map			
5. Building width, length, and dimensions between buildings			
6. Existing and Proposed building elevations for first floor, garage and basement and finish grade elevation of adjacent existing homes/buildings.			
7. The plans must include a note requiring MISS DIG to be contacted prior to construction to have the existing utilities located			
8. Obtain all necessary permits (e.g., for the primary building, driveway, water and sewer service lead connections, and garage structure, etc.) from the Community Development Department, pay all required fees, and establish the required inspection escrows.			
9. Obtain an Oakland County Water Resources Commissioner (OCWRC) permit for Soil Erosion and Sedimentation Control (SESC), if required.			
10. All existing trees within the public right-of-way must be shown on the plot plan.			

II. ENGINEERING PLAN REVIEW CHECKLIST (RESIDENTIAL PLOT PLANS/DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
D. Public & Private Utilities			
1. The existing and proposed location(s) of all public (water and sanitary) and private utilities (gas, electric, cable, etc.), including pipelines, structures, appurtenances, etc., must be clearly indicated on the plans, including utility lead information.			
2. The proposed sewer lead must include a new connection (TwisTee sewer saddle, as per the City DPW, or approved equal). The Applicant is responsible for any roadwork and restoration associated with the new utility connections which must be shown on the submitted plans.			
3. The existing sanitary sewer lead must be properly abandoned via a spot liner or another DPW approved method. The Applicant is responsible for any roadwork and restoration associated with the new utility connections which must be shown on the submitted plans.			
E. Grading & Storm Drainage			
1. Existing and Proposed Topographic Survey of site, including the existing grades at each lot corner and grade change points.			
2. Provide spot grade elevations around the entire site to indicate how stormwater drainage will be managed. In particular, the proposed grading must not cause storm or surface water to be obstructed, restricted, accelerated, and/or altered in any way so as to cause a nuisance and/or drainage concern on the adjacent lots.			
3. The proposed location of roof and gutter downspouts must be shown on the plan. Roof downspouts are not permitted to discharge directly into the combined sewer system and must be directed onto grass, landscape, or other green space area to prevent ponding of water on the property or from being directed towards adjacent properties.			
4. Per the City's requirements, the on-site drainpipe must be four (4") inches and then reduced to a two (2") pipe immediately before the outlet pipe joins the combined sewer lead. The two (2") internal diameter pipe section must be between five (5') and ten (10') feet in length.			
5. Also, as per the City DPW, a two (2") inch cleanout must be installed where the two (2") inch pipe is reduced from the six (6") inch drainpipe and a six (6") inch cleanout near where the two (2") inch pipe is connected to the six (6") inch house lead.			

"AS-BUILT" REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS) Upon satisfactory completion and execution of the work as proposed in the approved Final and Engineering Site Plans, the Applicant/Developer must provide a set of "as-built" drawings for review by the City, their appropriate department(s), and/or Professional Consultants prior to final acceptance of the project. "As-built" drawings shall contain all the information shown on the approved construction drawings with the addition of but not limited to the following information.	NA	INCLUDED	
		YES	NO
1. Sanitary sewers and storm sewers A. Plan location of all sewers with respect to Property and right-of-way lines. B. A minimum of three (3) witnesses (dimensions) to all force main bends. C. Length of sewer as measured from center of manhole to center of manhole (this information should be shown on both plan and profile). D. Location of each service lead as measured from the nearest downstream manhole and noted as such. E. Length of stubs out of manholes. F. The following "as-built" elevations on a U.S.G.S datum: A. Manhole, inlet, and catch basin covers; B. Invert elevations of pipes within each manhole; C. Invert elevations for the ends of sanitary and sump service leads. Changes in percents between manholes. G. List of material used for construction. (Example) Manholes: Precast, concrete specialties, press wedge flex-joint, Pipe: Eight-inch V.C.P. Clow, No Bell six-inch V.C.P. Logan, 0-ring H. Any changes in pipe and manhole locations of more than five (5) feet shall be redrawn on the plan and profile. The original plan locations of these facilities should be x-ed out on the plans. I. Any changes to the total quantities shall be lined out and the correct "as-built" quantity indicated. J. The following "as-built" information for all sanitary service leads: 1. Station of wye; 2. Length of lead; 3. Length of riser; 4. Tie from nearest manhole to end of lead,			

"AS-BUILT" REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
2. Retention and detention ponds a. "As-built" of pond; b. The following "as-built" elevations on a U.S.G.S datum: C. Overflow spillway; D. Inlet and outlet pipe inverts; E. Outlet structure cover; F. Outlet and inlet ditch elevations G. Bottom and top of bank slopes. • A statement of final computed volume of the pond as measured from high water elevation to the invert of the outlet pipe.			
3. Roadways A. Top of curb elevations (U.S.G.S. datum) at high and low points, edge of pavement elevations shall be provided in the case of open ditch road designs. B. "As-built" profiles for any changes in road design. C. Parking lot corner elevations			
4. Water mains 1. Plan location of all water mains with respect to property lines. 2. Rim (cover) elevations on gate wells (U.S.G.S. datum). 3. Fire hydrant bury line elevations (U.S.G.S. datum) 4. Distances between gate wells, fittings, and fire hydrants. 5. Type of materials used in construction. 6. Any changes in pipe and structure locations exceeding five (5) feet shall be redrawn on the plan. The original plan locations of these facilities shall be "x-ed" out on the plan. 7. Any changes to the total quantities shall be lined out and the correct "as-built" quantity indicated.			
5. Floodways 1. "As-built" ground elevations of all areas located within a floodway.			

"AS-BUILT" REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
SANITARY SEWER			
A. PLAN VIEW			
1. Lengths Between Manholes			
2. Size of Pipe			
3. Lengths of Casing Pipe			
4. Ties to Manholes in Greenbelt Areas			
5. Ties to Pipe			
6. Permit Number (County and MDPH)			
7. T/Casting Grades			
8. Manhole Numbering			
9. Y Locations (per as-built key)			
10. Show all Utility Easements for Sanitary Sewer			
B. PROFILE			
1. Lengths Between Manholes			
2. Size of Pipe			
3. Lengths of Casing Pipes			
4. Y Locations (per as-built key)			
5. Invert Grades			
6. Manhole Numbering			
7. Percent Slope Between Manholes			
STORM SEWER			
A. PLAN VIEW			
1. Lengths Between Manhole – Catch Basins – Inlets			
2. Size of Pipe			
3. Ties to Manholes – Catch Basins – Inlets to Greenbelt Areas			
4. Ties to Pipe			
5. Type and Class of Pipe			
6. T/Casting Grades			

"AS-BUILT" REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
7. Structure Numbering			
8. Special Structures (low head, 5' dia., 6' dia., 2' sump, etc.)			
9. Show all Utility Easements for Storm Sewer			
B. PROFILE			
1. Length Between Structures			
2. Size of Pipe			
3. Type and Class of Pipe			
4. T/Casting Grades			
5. Invert Grades			
6. Structure Numbering			
7. Percent Slope Between Structures			
8. Type of Joint Used			
DETENTION POND/UNDERGROUND DETENTION SYSTEM (SEE STORM SEWER)			
A. PLAN VIEW			
B. PROFILE			
WATER MAIN			
A. PLAN VIEW			
1. Lengths Between Gate Valve and Well			
2. Size of Pipe			
3. Ties to Gate Valve and Well in Greenbelts			
4. Ties to Hydrants			
5. Ties to Stop Boxes, etc.			
6. Type and Class of Pipe w/or without Polywrap			
7. Finish Grade of Hydrants			
8. T/Casting Grades			
9. Horizontal Bend Locations			
10. Location of Thrust Blocks or Type of Restraint			

"AS-BUILT" REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
11. Offsets to Pipe of Ties to Building			
12. Gate Valve and Well Numbers			
13. Permit Numbers (County and MDPH)			
14. Pipe Manufacturer			
15. Hydrant Manufacturer			
16. Casting Manufacturer			
17. Show all Utility Easements for Water Main			
B. PROFILE			
1. Lengths Between Grade Changes			
2. Size of Pipe			
3. Type and Class of Pipe			
4. Gate Valve and Well Location			
5. Hydrant Location (identify special purposes such as blow-off)			
6. Air Relief Valves / Blow Off Valve Locations			
7. Vertical Bend Locations			
8. T/Casting Grades			
9. Percent Slope Between Pipe			
PAVEMENT			
A. Width and Station of Pavement (measured from centerline)			
1. At end of radius at intersections			
2. At beginning of taper			
3. At end of taper			
4. Any changes in alignment			
5. Radius at intersection			
6. Right-of-way survey data			
B. Drives			
1. Location			

“AS-BUILT” REQUIREMENT CHECKLIST (COMMERCIAL DEVELOPMENTS)	NA	INCLUDED	
		YES	NO
2. Width			
3. Radius, if any			
C. Sidewalk			
1. Location			
2. Width			
3. Changes in alignment			
4. Ramps			

Appendix C

SAMPLE BONDS AND INSURANCE REQUIREMENTS

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned _____

_____

_____

_____ as Principal,

and _____

_____

of _____as Sureties,

are hereby held and firmly bound unto the __"Owner"_____

_____

_____

_____

_____

in the full and just sum of_____ Dollars

($_____)____ for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed and sealed this _____ day of _____ 20___.

The condition of the above obligation is such that if said _____

_____.

_____

shall well and faithfully do and perform the things agreed by __It_____ to be done and performed by the annexed contract, according to the terms thereof, then this obligation shall be void; otherwise, the same shall remain in full force and effect.

It is mutually understood and agreed that in cases where changes are required, either by order of the Engineer, or Owner, or by mutual agreement, such changes or changes shall not modify, discharge or release this bond.

(A Michigan Corporation)

_____ (Seal)

_____

_____ (Seal)
Principal

_____

_____ (Seal)

_____

_____ (Seal)
Surety

Signed, Sealed and Delivered
in the Presence of:

_____

_____

_____

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____

_____

_____

of _____ hereinafter called the Principal,

and _____

_____

hereinafter called the Surety, are held and firmly bound unto _____

_____

in the sum of_____

_____

_____ Dollars ($_____)

to the payment whereof, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Sealed with our seals and dated this _____ day of

_____, A.D., 20__.

WHEREAS, The above named Principal has entered into a contract with _____

_____

dated the _____day of_____, A.D., 20___, wherein said Principal has covenanted and agreed as follows, to-wit:

To furnish all the labor and material_____

_____

_____

_____

AND WHEREAS, This bond is given in compliance with and subject to the provisions of Act No. 213 of the Public Acts of Michigan, for the year 1963, and as may be amended by other Public Acts of Michigan.

NOW, THEREFORE, The condition of this obligation is such that if payment shall be made by the Principal to any Subcontractor or by him or any Subcontractor as the same may become due and payable of all indebtedness which may arise from him to a Subcontractor or party performing labor or furnishing materials or supplies or any Subcontractor to any person, firm or corporation on account of any labor performed or materials or supplies furnished in the performance of said contract, then this obligation shall be void; otherwise, the same shall be in full force and effect.

AND PROVIDED, That any alterations which may be made in the terms of said contract, or in the work to be done under it, or the giving by the party of the first part to said contract, of any extension of time for the performance of said contract, or any other forbearance on the part of either party to the other, shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors or assigns from any liability hereunder, notice to the Surety of any alteration, extension, or forbearance being hereby waived.

(A Michigan Corporation)_____

By: _____

_____

_____

Principal

_____

_____

_____

_____

Surety

Signed, Sealed and Delivered
in the Presence of:

_____

_____

_____

MAINTENANCE AND GUARANTEE BOND

KNOW ALL MEN BY THESE PRESENTS, That we

_____

_____

_____

as Principal, and _____

_____

are held and firmly bound unto _____

in the sum of _____Dollars ($_____)

good and lawful money of the United States of America, to be paid to the_____ its legal representatives and assigns, and we bind ourselves, our heirs, executors, administrators, successors and assigns, and each and every one of them jointly and severally, firmly by these presents.

SEALED WITH OUR SEALS AND DATED THIS _____ DAY OF _____ A.D., 20___.

WHEREAS, the above named principal has entered into a certain written contract with the_____ _____ dated this ___day of_____A.D., 20__, where in the said principal covenanted and agreed as follows, to wit:

for the: _____

_____

_____

_____

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that by and under such contract, the above named principal has agreed with the _____ that for a period of _____ (___) year(s) from the date of approval of the Final Estimate, to keep in good order and repair any defect in all the work done under said contract, either by the principal, his subcontractors, or his material suppliers, that may develop during said period due to improper materials, defective equipment, workmanship or arrangements, and any other work affected in making good such imperfections, all to be made good without expense to the Owner, (excepting only such part or parts of said work as may have been disturbed without the consent or approval of the principal after the final acceptance of the work), and whenever directed so to do by the Owner, by notice served in writing, either personally or by mail, on the principal at _____ _____ or_____ , its legal representatives, or successors, or on the surety at _____

to proceed at once to make such repairs as directed by the _Owner_ and in case of failure to do so within one (1) week from the date of service of such notice, or within reasonable time not less than one (1) week, as shall be fixed in said notice, then the _Owner_ shall have the right to purchase such materials and employ such labor and equipment as may be necessary for the purpose, and to undertake, do and make such repairs, and charge the expense thereof to, and be fully reimbursed for same from said principal or surety. If any repair is necessary to be made at once to protect life and property, the _Owner_ may take immediate steps to repair or barricade such defects without notice to the contractor. In such case the _Owner_ shall not be held to obtain the lowest figures for the doing of the work, or any part thereof, but all sums actually paid therefor shall be charged to the principal or surety. In this connection the judgment of the _Owner_ is final and conclusive.

If the principal for a period of one (1) year from the date of approval of a Final Estimate, shall keep the work so constructed under the contract in good order and repair, excepting only such parts of said work which have been disturbed without the consent or approval of the principal after the final acceptance of same, and whenever notice is given as hereinbefore specified, at once proceed to make the repair as the notice directs, or reimburse the Owner for any expenses incurred by it in making such repairs should the principal or surety fail to do so, then the above obligation shall be void; otherwise, it will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their respective authorized officers this_____day of_____, 20__.

Signed, Sealed and Delivered
in the Presence of:

_____
"Principal"

_____ _____ (L.S.)
Witness

_____ _____ (L.S.)
Witness "Surety"

_____ _____ (L.S.)
Witness

Client#: 7782 PAVCOR

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/02/2015

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Insurance Agent name
Insurance Agency 24724 Any Street (248) 666-6666 P.O. Box 2067 SomeCity, MI 48037-2067	PHONE (A/C, No, Ext): 248 555-5555 FAX (A/C, No): 248 111-1111 E-MAIL ADDRESS: InsuranceAgent@InsuranceGroup.com PRODUCER CUSTOMER ID #:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Company ABC 2654 Street Name AnyCity, MI 48183	INSURER A : Insurance Company 1	
	INSURER B : Insurance Company 2	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY	X	X	MPA00000042433S	11/17/2014	11/17/2015	EACH OCCURRENCE	$1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$100,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$5,000
	X X,C,U						PERSONAL & ADV INJURY	$1,000,000
	X Contractual						GENERAL AGGREGATE	$2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$2,000,000
	POLICY X PRO-JECT LOC							$
A	AUTOMOBILE LIABILITY	X	X	BA00000042434S	11/17/2014	11/17/2015	COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	X HIRED AUTOS							$
	X NON-OWNED AUTOS							$
	X Drive Other Car							$
A	X UMBRELLA LIAB X OCCUR	X	X	CMB00000042435S	11/17/2014	11/17/2015	EACH OCCURRENCE	$2,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$2,000,000
	DEDUCTIBLE							$
	RETENTION $							$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N		X	WC0001100555	05/01/2014	04/30/2015	X WC STATU-TORY LIMITS OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N (Mandatory in NH)	N/A					E.L. EACH ACCIDENT	$500,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$500,000
							E.L. DISEASE - POLICY LIMIT	$500,000
A	Installation Floater	X		MPA00000042433S	11/17/2014	11/17/2015	$150,000 $1,000 deductible	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Municipality Name, their council, members, board members, public officials, consultants, agents, and
(Please refer to attached Endorsements evidencing the change of policy.)

CERTIFICATE HOLDER	CANCELLATION
Municipality Name 18500 Street Name AnyCity, MI 48025	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE **SIGNATURE**

ACORD 25 (2009/09) 1 of 2 The ACORD name and logo are registered marks of ACORD
#S264726/M258177 CRD

DESCRIPTIONS (Continued from Page 1)

employees, as well as the engineer; _____ their owners, directors, officers, constultants, agents, and employees are included as Additional Insured per written contract with respect to the general, auto and umbrella liability coverages for the work performed by the named insured for the certificate holder. Insurance is considered primary and non contributing and a waiver of subrogation applies. Should any of the above described policies be cancelled before the expiration date thereof, the issuing Company will mail 30 days prior written notice to the Certificate holder. Endorsements evidencing the change of Policy are attached.

AMS 25.3 (2009/09)

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#S264726/M258177

SPREXC

ACORD™ INSURANCE BINDER

DATE 06/18/14

THIS BINDER IS A TEMPORARY INSURANCE CONTRACT, SUBJECT TO THE CONDITIONS SHOWN ON THE REVERSE SIDE OF THIS FORM.

PRODUCER Insurance Company Name Any Street City, State Zip	PHONE (A/C, No, Ext): 248-555-5555 FAX (A/C, No): 248-333-3333	COMPANY Selective Insurance Company of Amer	BINDER # BINDER83730
		EFFECTIVE DATE: 06/18/14 TIME: 12:01 X AM / PM	EXPIRATION DATE: 08/18/14 TIME: X 12:01 AM / NOON
CODE: 38-3112729 SUB CODE:		THIS BINDER IS ISSUED TO EXTEND COVERAGE IN THE ABOVE NAMED COMPANY PER EXPIRING POLICY #:	
AGENCY CUSTOMER ID: 7430		DESCRIPTION OF OPERATIONS/VEHICLES/PROPERTY (Including Location)	
INSURED Owner's Name Any Street SomeCity, MI 48001		Project Description	

COVERAGES — LIMITS

TYPE OF INSURANCE	COVERAGE/FORMS	DEDUCTIBLE	COINS %	AMOUNT
PROPERTY — CAUSES OF LOSS: BASIC / BROAD / SPEC				
GENERAL LIABILITY — COMMERCIAL GENERAL LIABILITY; CLAIMS MADE / X OCCUR; X OCP	Owners & Contractors Protective Liability	EACH OCCURRENCE		$ 1,000,000
		DAMAGE TO RENTED PREMISES		$
		MED EXP (Any one person)		$
		PERSONAL & ADV INJURY		$
		GENERAL AGGREGATE		$ 1,000,000
	RETRO DATE FOR CLAIMS MADE:	PRODUCTS - COMP/OP AGG		$
AUTOMOBILE LIABILITY — ANY AUTO; ALL OWNED AUTOS; SCHEDULED AUTOS; HIRED AUTOS; NON-OWNED AUTOS		COMBINED SINGLE LIMIT		$
		BODILY INJURY (Per person)		$
		BODILY INJURY (Per accident)		$
		PROPERTY DAMAGE		$
		MEDICAL PAYMENTS		$
		PERSONAL INJURY PROT		$
		UNINSURED MOTORIST		$
				$
AUTO PHYSICAL DAMAGE — DEDUCTIBLE — COLLISION: — OTHER THAN COL:	ALL VEHICLES / SCHEDULED VEHICLES	ACTUAL CASH VALUE / STATED AMOUNT / OTHER		$
GARAGE LIABILITY — ANY AUTO		AUTO ONLY - EA ACCIDENT		$
		OTHER THAN AUTO ONLY: EACH ACCIDENT		$
		AGGREGATE		$
EXCESS LIABILITY — UMBRELLA FORM; OTHER THAN UMBRELLA FORM		EACH OCCURRENCE		$
		AGGREGATE		$
	RETRO DATE FOR CLAIMS MADE:	SELF-INSURED RETENTION		$
WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY		WC STATUTORY LIMITS		
		E.L. EACH ACCIDENT		$
		E.L. DISEASE - EA EMPLOYEE		$
		E.L. DISEASE - POLICY LIMIT		$
SPECIAL CONDITIONS/ OTHER COVERAGES: Named Insured to include: **Owners Name** & the Engineer, their (See attached Spec Conditions/Other Covs page.)		FEES		$
		TAXES		$
		ESTIMATED TOTAL PREMIUM		$

NAME & ADDRESS

Contractors Name
SomeStreet
AnyCity State Zip

MORTGAGEE / LOSS PAYEE / ADDITIONAL INSURED / X Contractor

LOAN #

AUTHORIZED REPRESENTATIVE: Michael G. Lewis

ACORD 75 (2001/01) 1 of 3 #5069 NOTE: IMPORTANT STATE INFORMATION ON REVERSE SIDE MSB © ACORD CORPORATION 1993

SPECIAL CONDITIONS/OTHER COVERAGES (Cont. from page 1)

consultants, agents, employees,
& such public corporations in whose jurisdiction the work is located.

** Continued From Additional Interests Section **

CONSULTING ENGINEER
ADDRESS

Type: Additional Insured

AMS 75.4 (2001/01) 3 of 3 #5069