

IMPROVEMENT PLAN APPLICATION CHECKLIST

All Improvement Plans submitted for a permit shall address the following items on the plans for review by the Department of Engineering. Applicants shall check off each item provided on the plans. Attach a separate letter explaining reasons why any item below is not provided for on the plans.

An up-to-date version of the City of St. Charles, Missouri Code of Ordinances can be found at Sullivan Publications.

General Information

- Plans shall be submitted on 24" x 36" sheets (Preferred)
- Address all conditions of the Planning and Zoning Commission approval.
- All plan sheets shall be signed and sealed by a registered professional engineer.
- Show the locations of all existing entrances on both sides of the street, within 300 feet of any proposed entrance.
- Identify the property by lot lines and location, including dimensions; angles and size, correlated with the legal description of the property.
- Show natural features such as trees, streams, rivers, lakes, drains, topography, and similar features.
- Show existing manmade features such as buildings, structures, easements, existing utilities such as water and sewer lines etc., excavations, bridges, culverts and drains.
- Show location of the site and its geographic relation to neighboring properties showing all adjacent buildings and roads within 100 feet.
- Include existing topography a minimum of 50' outside of property lines.
- All sign locations and sizes must be approved separately. Remove any sign references from the plans. Any proposed signs located on plans should be noted that their size, type and location are to be approved under a separate submittal.
- Include a north arrow and scale on all plan sheets. The plan sheets shall be drawn to a standard scale and should be uniform. The north arrow should never point to the bottom of the page.
- Proposed improvements should stand out from existing conditions on the page by using bolder line weights.
- Provide a legend on all plan sheets and others as necessary.
- Show all utility relocations.
- All street lighting shall be Ameren approved/supplied LED lighting.
- Dimension all non-typical features.
- Provide traffic control plans for construction within existing roadways. Include accommodations for pedestrians where necessary.
- For new developments show survey ties with coordinates. At least 3 ties are required.
- Developments may be required to submit a traffic study showing the impacts to public roadways.
- Upon final approval a sealed set of plans shall be submitted in *.pdf form on a compact disk. Format of the *.pdf file shall be in accordance with City Requirements.

Cover Sheet Information

- Provide a location map of the site with north indicated.
- Indicate the USGS benchmark used for all survey data. All topographic data shall directly relate to USGS data.
- Provide a basis for bearing to establish how north was determined. Show north arrow on all plan sheets.
- Use MO State Plane Coordinates. Zone, Datum, Projection
- List the City of St. Charles General Notes on the cover sheet.
 1. All improvements constructed herein shall comply with the Code of Ordinances of the City of St. Charles.
 2. If property is greater than 1 acre, a Land Disturbance permit from the Missouri Department of Natural Resources is required prior to commencing any demolition, clearing or construction on site. Provide copy of approval from the Department of Natural Resources to the Engineering Department. (Permit #_____)

3. Siltation control shall be the responsibility of the contractor and shall be in accordance with the SWPPP plan. Additional siltation control may be required as directed by the City Engineer. (Code Section 510.090.2)
4. When grading operations are completed or suspended for more than 30 days, permanent grass must be established to control erosion. (Code Section 510.090.4.a)
5. All mud and debris from construction site to be kept off of City maintained streets. Streets shall be swept twice daily. (Code Section 510.090.5)
6. Handicap spaces cannot have a grade in excess of 2% in any direction. (Code Section 400.705.B.4)
7. Handicap accessible routes and ramps cannot have a cross slope in excess of 2%. (Code Section 400.705.B.4)
8. All water main construction including valves, sleeves, meters, hydrants and fittings must conform to City of St. Charles Water Specifications.
9. When a sanitary sewer lateral crosses over a water line, a minimum vertical clearance of 18" shall be provided. If this clearance is not possible, then either the water line or the sewer line shall be constructed of mechanical joint pipe or cased in continuous casing until there is a 10' horizontal clearance between the two lines.
10. All sanitary sewer construction must conform to the latest version of the Metropolitan St. Louis Sewer District's standards and specifications.
11. All street and sidewalk construction is to be per the latest St. Charles City standards.
12. Flowable fill backfill shall be used for all backfill on sewer trenches that are under City streets, from the top of the bedding material (6 inches above the pipe) to the surface, or to within one foot of grade in landscaped areas. (Code Section 510.280.4.a.1)
13. Earth backfill (meeting MSD standards) may be used outside of paved areas, from the top of the bedding material to the surface. Earth backfill should be placed in a maximum 8-inch loose lifts and shall be mechanically compacted to a minimum density of 85% maximum density as determined by the Modified AASHTO T-180 Compaction Test or 90% of maximum density as determined by the Standard Proctor Test AASHTO T-99.
14. All storm sewer design is to conform to the City of St. Charles design requirements. (Code Section 510.290)
15. All storm sewer construction is to be per the Latest Edition of the Metropolitan St. Louis Sewer District (MSD) Standard Construction Specifications for Sewers and Drainage Facilities. (Code Section 510.280)
16. For New Subdivisions Only:
 All jetting shall be performed with a probe route on not greater than 7.5-foot centers with the jetting probe centered over and parallel with the direction of the pipe. Trench widths greater than 10 feet will require multiple probes every 7.5-foot centers. Trench backfill depths less than 8 feet in depth shall be probed to a depth extending to half of the trench backfill, but not less than 3 feet. Trench backfill greater than 8 feet in depth shall be probed to half the depth of the trench backfill but not greater than 8 feet. Jetting shall be performed from the low surface topographic point and proceed toward the high point, and from the bottom of the trench backfill towards the surface. The flooding of each jetting probe shall be started slowly allowing slow saturation of the soil. Water is not to be allowed to flow away from the ditch without first saturating the trench. Contractor shall identify the locations of surface bridging (the tendency for the upper backfill crust to arch over the trench rather than collapse and consolidate during the jetting process). The contractor shall break down the bridged areas using an appropriate method such as the wheels or bucket of a backhoe. When the surface crust is collapsed, the void shall be backfilled with the same material within the sunken/jetted area shall be compacted such that no further surface subsidence occurs. (Code Section 510.280)
17. All sanitary and storm pipe joints and joints on new structures shall use City approved rubber compression type joints. Water stops are required at all points of connection not using rubber compression type joints such as connections to existing structures. (Code Section 510.280.6)
18. Concrete covers on structures will not be allowed. Only cast iron covers are permitted. (Code Section 510.280.5)
19. Brick storm and sanitary structures will not be allowed.
20. It shall be the responsibility of the contractor/developer to provide traffic control per the latest

edition of the Manual of Uniform Traffic Control Devices.

21. All utilities shall be located underground.
 22. All filled places under proposed storm and sanitary sewer and/or paved areas shall be compacted to 90% of maximum density as determined by the Modified AASHTO T-180 Compaction Test or 95% of maximum density as determined by the Standard Proctor Test AASHTO T-99.
 23. All filled places in proposed roads shall be compacted from the bottom of the fill up to 90% maximum density as determined by the Modified AASHTO T-180 Compaction Test or 95% of maximum density as determined by the Standard Proctor Test AASHTO T-99. All tests shall be verified by a soils engineer concurrent with grading and backfilling operations.
 24. Grades cannot exceed a 3:1 slope. (Code Section 510.090.1)
 25. Construction activities shall abide by the noise restrictions as outlines in Code Chapter 230.
 26. Shop drawings and specifications for all structures and materials shall be submitted to the Engineering Department for review and approval prior to delivery.
 27. For all sanitary sewers within the right of way, a clean out shall be provided, in the right of way, within one (1) foot of the property served, and in addition to any required for adherence to the Plumbing Code. All work to conform to city standards.
- List all utility companies serving the development.
 - Indicate how the site will be served by electric.
 - All utilities must be bored under existing City of St. Charles streets unless approved otherwise by the City Engineer.
 - Missouri One Call System was contacted to locate utilities for survey.
 - Indicate on the plans any permits that have already been approved for this site.
 - Include the list of conditions for approval of the Site Plan from the Planning & Zoning Board.
 - List all design standards utilized in the development of the plans.

Other Agency Approvals

- Obtain any applicable permits and approvals from other regulating agencies. This to include, but not limited to, MoDOT, St. Charles County, MoDNR, FEMA, and adjoining municipalities. Approvals from other regulating agencies are required prior to improvement plan approval by the City of St. Charles.
- Provide proof of approval of improvements by the City of St. Charles Fire Department.
- Provide proof of approval of improvements by the Historic Landmarks Preservation and Architectural Review Board (HLPARB) if applicable.

Right of Way/Easements/Vacations/Encroachments

All new easements required must be submitted on standard forms provided by the City, and must be recorded prior to construction.

- Provide a copy of all existing recorded easement (both within, off-site, and directly adjacent to) required with this development and show limits on the plan.
- Provide a copy of all proposed recorded easement (both within, off-site, and directly adjacent to) required with this development and show limits on the plan. (All new easements required must be recorded prior to construction)
- Provide a copy of all right of way warranty deeds required with this development and show limits on the plan.
- Provide a copy of any proposed, required or recorded cross access easements and show the limits on the plan.
- Show all existing and new right-of-way dimensions and labels.

Parking Lot (Code Chapter 400.705)

- Show number of parking spaces, including handicap spaces provided and number required. (Code Chapter 400.705)
- Show standard dimensions for parking spaces. Standard 9' x 17.5' (Code Section 400.700), handicap spaces 11' wide with 5' adjacent hatched area by 17.5' (Code Section 400.705.B). Provide elevations at the four corners of all handicap spaces.
- Show access aisle dimension. (Minimum 26'-6" wide- 2 way and 15'-3" one-way.) (Code Section 400.700)

- Show placement of handicap spaces as being the closest spaces to the building. Also, show placement of handicap sign indicating \$50-\$300 fine for illegally parking in handicap space. (Code Section 400.705)
- Show number of loading spaces required and show number provided. Show location of loading space (12' x 50'). (Code Section 400.740.A)
- Indicate pavement thickness and pavement detail for parking lot, including concrete curb detail.
- Indicate pavement detail for concrete approach. 7" concrete with 4" aggregate base on prepared subgrade is required for commercial approach to the right of way line.
- Show all setbacks and all existing easements.
- Provide a parking lot lighting diagram showing a minimum of .25 footcandle luminescence throughout the entire paved parking lot. (Code Section 400.700.F)

Water Distribution (Code Chapter 700)

The City of St. Charles follows the following water design standards: City of St. Charles Standard Specifications for Construction of Public Water Mains 2014; Missouri DNR Minimum Design Standards for Missouri Community Water Systems 2013, Ten States Standards 2007, and AWWA Manuals of Water Supply Practices 2012.

- When constructing new water mains provide separate water main plan sheets.
- Show and label all water appurtenances, valves, and meters. Valving should be appropriate for future system control as determined by the Engineering Department.
- Include the City Standard Plans for all waterline installation features.
- Evaluate watermain material type with installation location. Water main located under pavement that runs parallel to the roadway is required to be ductile iron pipe.
- Show thrust blocks on the plan and profile.
- Label all bends.
- Show location and size of water service.
- Show placement of water meter and valve. (To be placed within Right of Way or easement)
- An irrigation system requires a separate meter and tap. (For commercial sites)
- Show placement of fire suppression line.
- Provide profile sheets for a water main construction. Show the location of all other utility crossings.
- Show location and size of existing water main that the water service lead is connecting into. Note: if the connection is within the City right of way, then show extent of excavation and show scope of work to repair the right of way, ie, limits of concrete removal and replacement. An excavation permit may be required for work within right of way.
- Indicate that flowable fill is required for all backfill within water line trench under paved area.
- All waterlines installed as part of the distribution system of St. Charles for any reason or application other than domestic use, shall be required to have a backflow prevention device installed on the water service in accordance with Missouri State Rule 10 CSR 60-11.010 and City of St. Charles Standard Specifications for Construction of Water Mains. All rules and regulations pertaining to the backflow prevention (cross connection) shall be followed as required, regulated and detailed by the State of Missouri, Department of Natural Resources. (Code Section 700.110)
- Show the water main crossing on the sanitary sewer profile sheets. Show encasement where required. Concrete encasement is not permitted.
- Include when Water Main **Extensions** are proposed: A copy of the MoDNR permit for the system construction shall be provided prior to issuance of the City construction permit.
- Locate the nearest existing fire hydrant and any proposed hydrants. (Indicate on the plans if the hydrants are to be private)
- Coordinate water main size with the Public Works Water Division to determine size and looping requirements for the development.
- New water mains must extend to the extent of the property to allow for future development connection.
- For public water main construction, a Water Main Extension Permit is required from MoDNR and the City of St. Charles Engineering Department. (Code Section 700.30)

Sanitary Distribution (Code Chapters 705 & 710)

The City of St. Charles follows the following sanitary design standards: Missouri DNR Wastewater Design Guides 10CSR-20-8, and Ten States Standards 2007

- Show location and size of sanitary sewer laterals on plan and profile sheets. Please note a minimum 6" lateral is required.
- Show location of where the sanitary lateral connects into the public sewer. Show location and flowline elevations of the upstream and downstream structures. If sewer connection is within City right of way, then show extent of excavation and show scope of work to repair the right of way, ie, limits of concrete removal and replacement. If work is within right of way, an excavation permit may be required. Also, if sewer work is within the right of way, then flowable fill will be required. (Note: lateral cannot connect into a manhole)
- Provide a profile of any proposed public sanitary sewer showing flowlines, pipe size, top of structure elevation, proposed gradeline, limits of flowable fill backfill, existing gradeline, existing utility, utility crossings and overall scope of work.
- (Include when Sanitary Main **Extensions** are proposed) Upon receipt of comment letter from the City stating that the plans are approved, applicant shall submit a completed copy of the MoDNR application form for construction project, a check written to the MoDNR for the appropriate fee, the number of signed and sealed plan and specification sets required by the MoDNR form plus one set for the City, two copies of the Engineering Report required by the MoDNR form, and two copies of the DGLS geologic evaluation required by the MoDNR form. The City will then send the Continuing Authority letter to the engineer to be forwarded to MoDNR.
- Sanitary sewer alignments are normally limited by the available easements, which in turn should reflect proper alignment requirements.
Sanitary sewers shall be aligned:
 1. To be in a straight line between structures for all pipe sewers thirty inches (30) in diameter and smaller.
 2. To be parallel with or perpendicular to the centerlines of straight streets unless otherwise unavoidable. Deviations may be made only with approval of the City.
 3. To avoid meandering, off-setting and unnecessary angular changes.
 4. To make angular changes in alignment for sewers thirty (30) inches in diameter or smaller in a manhole located at an angle point and for sewers thirty-three (33) inches in diameter or larger, by a uniform curve between two tangents. Curves shall have a minimum radius of ten times the pipe diameter.
 5. To avoid angular changes in direction greater than necessary and any exceeding ninety (90) degrees.
- Sanitary Sewers shall be located:
 1. To serve all property conveniently and to best advantage.
 2. In public streets, roads, alleys, rights-of-way, or in sewer easements dedicated to the City.
 3. In easements on private property only when unavoidable.
 4. On private property along property lines or immediately adjacent to public streets, avoiding crossing through the property.
 5. At a sufficient distance from existing and/or proposed buildings (including footings) and underground utilities or other sewers to avoid encroachment and reduce construction hazards.
 6. To avoid interference between house connections to foul water or sanitary sewers and stormwater sewers.
 7. In unpaved or unimproved areas whenever possible.
 8. To avoid, whenever possible, any locations known to be or probably to be beneath curbs, paving or other improvements particularly when laid parallel to centerlines.
 9. To avoid sinkholes and creeks.
 10. No sanitary lateral clean outs or sampling tees shall be placed within the area of the stormwater overflow path.
- The flowline of sanitary sewers shall meet the following requirements:
 1. The flowline shall be straight or without gradient change between the inner walls of connected structures.

2. Gradient changes in successive reaches normally shall be consistent and regular, with small or insignificant differences in successive reaches. Gradient designations less than the nearest 0.001 foot per foot, except under special circumstances and for larger sewers, shall be avoided.
3. The hydraulic grade line shall not rise above the intrados of the pipe.
4. When the grade of a sewer is twenty percent (20%) or greater, a concrete cradle or collars is required. For grades exceeding fifty percent (50%) a special design and Project Specifications are required.

Manholes:

1. Manholes shall be located at changes in direction, changes of pipe size, flowline gradient, and at junction points with connecting sewers. For sewers thirty-three (33) inches in diameter and larger, manholes shall be located on special structures at junction points with other sewers and at changes of size or gradient.
2. Spacing of manholes shall not exceed four hundred (400) feet for pipe sewers thirty-six (36) inches in diameter and smaller, five hundred (500) feet for pipe sewers forty-two (42) inches in diameter and larger, except under special approved conditions. Spacing shall be approximately equal, whenever possible.

In addition, street access manholes should be located at a spacing of not more than 1200 feet apart to facilitate sewer maintenance requirements. "Street access manholes" are those manholes in or adjacent to a paved street accessible to the City.

3. Manholes on sanitary sewers ten (10) inches through thirty-six (36) inches shall be a minimum of forty-eight (48) inches in diameter and/or have a square bottom section with sides of forty-eight (48) inches, depending on the sewer diameter. Manholes on sewers eight (8) inches in diameter shall have a minimum bottom section of forty-two (42) inches. Manholes on sewers greater than thirty-six (36) inches in diameter shall be built in accordance with the Standard Specifications.
4. At stream and channel crossings, manholes shall be located on both sides of the crossing at changes in pipe material. The manholes shall be a minimum of ten (10) feet from the top of the bank on both sides of the crossing. A greater distance may be required where erosion beyond the ten (10) feet is probable.
5. All manholes on sanitary sewers that are built within the 100-year flood limits, the stormwater overflow path, or in other areas determined to be subject to flooding shall be provided with lock type watertight manhole covers.
6. Manholes for sanitary sewers shall be precast concrete or poured in place type and waterproofed on the exterior, as approved by the City.
7. Outside foul water drops are not permitted.
8. Manholes suspected to be subjected to high concentrations of H₂S shall be lined with a protective epoxy layer.

Gradients *

The following minimum slopes of sanitary pipe sewers are those giving at least three (3) feet per second velocities flowing full, based on Manning's formula using an "n" value of 0.013 unless otherwise directed by the City. Slopes greater than these minimums shall be used wherever possible.

For sewers with a design grade less than one percent (1%), field verification of the pipe grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements.

The City may require the submittal of revised hydraulic calculations for any sewer reach having an as-built grade flatter than the design grade by more than 0.1%. Based on a review of this hydraulic information, the City may require the removal and replacement of any portion of the sewer required to ensure sufficient hydraulic capacity and cleansing velocity of the system.

Pipe Size Minimum Slope in Ft. per 100 Ft. (% Grade)

6" - (house lateral) 2.0%

8" - 1.0%

10" - 0.6%

12" - 0.6%

15" - 0.4%

18" - 0.3%

21" - 0.3%

24" - 0.2%

27" - 0.2%

30" - 0.2%

36" - 0.1%

Pipes larger than thirty (36) inches in diameter shall maintain a cleansing velocity of three (3) feet per second.

Flow Design

All lateral and sub-main or collecting sewers shall be designed on the basis of an average per capita use of not less than one hundred (100) gallons per day, and on that basis shall be designed with capacities of four hundred (400) gallons per capita per day at peak flow unless otherwise directed by the City. Sanitary flow from day schools with gymnasiums, showers and cafeterias shall be computed on the basis of thirty (30) gallons per capita per day discharged in eight (8) hours. On this basis the daily peak flow rate shall be 90 x 4 gallons per capita per day for the lateral sewers. Sanitary flow from tourist camps and trailer courts shall be computed on the basis of 2.5 persons per each unit for each twenty four (24) hour period at fifty (50) gallons per capita per day times a peak factor of four (4). Sanitary flow from apartments, boarding schools and condominiums and other smaller facilities shall be computed at the same rate as residential property. Sanitary flow from all other types of institutions, commercial property, industrial plants, etc., shall be separate and individual studies based on a conservative ultimate anticipated flow multiplied by the peak factors applicable to each case. In the case of industrial flow, when the rate and volume can be predetermined with a reasonable degree of accuracy, no dilutions or diminishing factor shall be applied against this flow in the outfall, sub-trunk or trunk sewers.

Population Factors

Family population factors for the various areas in the City are to be determined from the latest United States Census Tracts. An acceptable figure is 3.7 persons per household unit.

Sanitary Flow Table

Population Unit Cu. Ft./Sec.

One Person @ 400 G/D = 0.00062cfs

One Household Unit @ 3.7 Persons @ 400 G/C/D = 0.00229cfs

Where G/C/D = Gallons per Capita per Day

Basic Formula:

Flow in Cu. Ft./Sec. = Population x Flow(in G/C/D) / 646,317

Hydraulic Grade Line

1. Hydraulic Grade Line Limits

The hydraulic grade line for sanitary and combined sewers shall not rise above the pipe intrados.

The beginning point for the hydraulic grade line computations shall be the higher (i.e. more conservative) elevation as determined below:

For connection to existing pipe systems

- a. Top of pipe intrados at least two reaches downstream of the connection point to the existing system; or
- b. The hydraulic grade line computed for the existing system, especially where the downstream system has suspected or known lack of capacity issues.

Field verified structure and flowline elevations, pipe sizes and characteristics shall be used.

- Pipes having a cover of less than three (3) feet shall be encased in concrete, or a stronger pipe be used, unless otherwise directed by the City.
- Show all utilities in sanitary sewer profiles.
- Provide a typical pipe cross section view of the sewer, backfill and trench width. All pipes are to be bedded in MSD type 1 or 2 bedding unless otherwise directed by the engineer.
- Show the proposed daily sanitary flow and provide average daily sanitary flow, peak flow and velocities within the proposed sanitary sewer.
- Note the anticipated groundwater elevation.
- Provide a copy of the sanitary approval letter from MoDNR for extensions greater than 1000'.
- Based on upstream zoning, estimate the proposed daily sanitary flow and provide calculations indicating average daily flow, peak flow and velocities within the proposed sanitary sewer and the downstream sewer.
- Indicate if pretreatment is required based on city codes. (Code Chapter 710)

Sanitary Pump Stations

The City St. Charles follows the following Pump Station design standards: City of St. Charles Pump Station Design Standards 2014.

- Shop drawings shall be submitted to the Engineering Department for review and approval prior to construction.

Streets and Sidewalks (Code Chapters 505 & 405)

The City St. Charles follows the following Transportation design standards: St. Louis County Highway Department Design Criteria Manual 2011, AASHTO Policy on Geometric Design 2011, AASHTO Roadside Design Guide 2011, Manual on Uniform Traffic Control Devices 2009 with 2012 Rev. 1 & 2, & ADA Standards for Transportation Facilities 2006.

- All entrance approaches are to be 7" concrete with 4" Type I Aggregate Base.
- All sidewalks shall be constructed with a minimum of 5' wide with 4" Type I Aggregate Base and 4" Concrete Improvements along street frontages must accommodate improvements in coordination with the STL Bike Plan.
- Sidewalks shall meet ADA standards for running and cross slopes.
- Curb ramps shall meet ADA standards for grade, landing area, detectable warning, push button location, etc.
- All signs in right-of-way must conform to the MUTCD standard with City supplied ID tags. The signs locations shall be identified with station and offset and are required to be included the as-built plan submittal referencing the ID tag number. Ensure sign size is appropriate for facility type.
- Show all crossroad centerline skews and intersections.
- Pavement markings shall follow MUTCD standards.
- Provide details on reflective markers on raised islands. Reflective markers should be included on all raised islands.
- Stop bars, crosswalks, and arrows are type 2 preformed marking tape.
- Plans detail color and width of all markings. Provide dimensions/stations for all pavement markings.
- The City may require the developer to increase the pavement thickness from the required 6" thickness as identified in Code Section 405.240.A.3. The City is willing to enter into a cost sharing agreement for the additional expense based on an approved Engineer's Cost Estimate outlining the difference in cost to construct. Further discussion is recommended with City Staff for a determination to be made.
- Show typical joint details and spacing for construction of all public streets.
- Minimum Grade at centerline of public roads allowed is in accordance with (Code Section 405.150.L)
- For subdivision development, traffic calming must be utilized which includes traffic calming measures being spaced a minimum of 400' or show intersections at a minimum spacing between intersection at 400'. Traffic calming measures include: raised intersections, neighborhood traffic circles, chicanes, neckdowns, center island narrowings and chokers as identified in the informational report entitled "Traffic Calming State of The Practice" by the Institute of Transportation Engineers (ITE) or as directed by the Director of Engineering. (Code Section 405.150.Z).
- All the corners at any intersecting streets, embracing the full width of the sidewalks thereof, shall bear a uniform elevation, except when the contour of the streets or other conditions necessarily require otherwise. Whenever it shall be deemed expedient not to bring all the corners of any intersection to the same level, then the elevation at each corner of such intersection shall be given. (Code Section 505.520)
- Show curb radii for all Minor Streets. A minimum radius is 32' (Code Section 405.150.U).
- Show right of way width and label all road classifications. (Code Section 405.150.L).
- Provide roadway profile for each street within development. Show sidewalks along streets unless not required by ordinance. (Code Section 405.150.L).
- Provide detectable warning surfaces for all curb ramps.
- Include City of St. Charles Standard Typical Section for each proposed roadway section.
- Include warping detail for cul-de-sacs and intersections.
- Provide underdrains across the street at all curb inlet locations. Provide a detail.

- Private streets are not to be approved nor shall public improvements be approved for any private street. (Code Section 405.150.J).
- Prior to approval of the subdivision plat, an escrow agreement is required for the cost of all public improvements including streets. The escrow agreement includes both a Construction Escrow (110% of Engineer's Cost Estimate) and a Maintenance Escrow (10% of Engineer's Cost Estimate). Prior to submittal of an escrow agreement, the developer must first submit an Engineer's Cost Estimate for the construction cost of the public improvements for review and approval (Code Section 405.220).
- Show location of street lighting. The minimum requirement for street lighting facilities shall be one 9,500 lumen high-pressure sodium light at each intersection, but not further than 200 feet within or abutting the subdivision. Light standards shall comply with the City of St. Charles Street Lighting Policy.
- Prior to approval of the development, street lighting connection fees shall be paid by the developer.
- Where new or improvements to existing signals are required with the development, please contact the Engineering department for a design checklist.

Cross Section Sheets – Required for Arterial Streets

- Show all utilities in cross sections.
- Cross sections show the existing and proposed grades at least 10 feet beyond the improvements.
- Note any abrupt or special sections. All driveways, intersections/side roads must have a section to at least 10 foot beyond improvements.
- End areas labeled for cut and fill shown in square footages for each section.
- Volumes in cubic yards for cut and fill between each section labeled.
- Proposed and existing right-of-way and easements shown on cross sections.
- Dimension and label all non typical features.
- Cut and fill slopes labeled, are the slopes recoverable, has protection been given to non-recoverable slopes.
- Offset, slopes and elevations labeled for proposed improvements and grades.
- Show the baseline/centerline of the street with elevation at profile grade.

Stormwater (Maintenance/Repairs requiring excavation to existing sewers) (Code Section Chapter 510)

The City St. Charles follows the following storm water design standards: MSD Plan Preparation Guidelines 2006, MSD Standard Construction Specification 2009, and City of St. Charles Pump Station Design Standards 2014

- Obtain an excavation permit.
- Indicate on plans how traffic control will be handled during construction.
- Show pavement replacement limits, thickness and type of pavement removal. Note: all concrete replacement due to storm sewer or sanitary sewer repair/construction shall be removed and replaced to the nearest joint.

Stormwater (New Construction) (Code Section Chapter 510)

The City St. Charles follows the following storm water design standards: MSD Plan Preparation Guidelines 2006, MSD Standard Construction Specification 2009, and City of St. Charles Pump Station Design Standards 2014

- Label all storm sewers with regards to size, type and classification, i.e. 15" Reinforced Concrete Pipe, Class III.
- Label all storm sewers as "Public" or "Private".
- Provide profiles of all storm sewer construction. Show slope of sewers, distance between structures, type of structure, utilities in profile view, and type of backfill (i.e. flowable fill within the right of way).
- Show a typical pipe cross section view of the storm sewer, backfill, and trench width. (All pipes shall be bedded in MSD Type 1 or Type 2 bedding unless otherwise directed by the engineer. (Code Section 510.280.3)
- Show existing and proposed grade lines on profiles.
- Inlet details for the type of inlet or grate to be used.

- Rock lining or other permanent erosion control is installed at channel changes. It is required to have geotextile material under rock lining.
- Pipes do not decrease in size in the direction of flow.
- Sewers shall be aligned: *
 1. To be in a straight line between structures, such as manholes, inlets, inlet manholes and junction chambers, for all pipe sewers thirty (30) inches in diameter and smaller.
 2. To be parallel with or perpendicular to the centerlines of straight streets unless otherwise unavoidable. Deviations may be made only with approval of the City Engineer.
 3. To avoid meandering, off-setting and unnecessary angular changes.
 4. To make angular changes in alignment for sewers thirty (30) inches in diameter or smaller in a manhole located at the angle point, and for sewers thirty- six (36) inches in diameter or larger, by a uniform curve between two tangents. Curves shall have a minimum radius of ten times the pipe diameter.
 5. To avoid angular changes in direction greater than necessary and any exceeding ninety (90) degrees, structures shall be designed to accommodate A-loks or Z-loks when deflection at a structure is unavoidable or sediment is possible.
- Storm sewers shall be located: *
 1. To serve all property conveniently and to best advantage.
 2. In public streets, roads, alleys, rights-of-way, or in sewer easements dedicated to the City.
 3. On private property along property lines or immediately adjacent to public streets, avoiding diagonal crossings through the central areas of the property.
 4. At a sufficient distance from existing and proposed buildings including footings, and underground utilities or other sewers to avoid encroachments and reduce construction hazards.
 5. To avoid interference between other stormwater sewers and house connections to foulwater or sanitary sewers.
 6. In unpaved or unimproved areas whenever possible.
 7. To avoid, whenever possible, any locations known to be or probably to be beneath curbs, paving or other improvements particularly when laid parallel to centerlines.
 8. Drainage to sinkholes is not permitted.
 9. Crossing perpendicular to street, unless otherwise unavoidable.

The flowline of storm sewers shall meet the following requirements: *

 1. The flowline shall be straight or without gradient change between the inner walls of connected structures; that is, from manhole to manhole, manhole to junction chamber, inlet to manhole, or inlet to inlet.
 2. Gradient changes in successive reaches normally shall be consistent and regular. Gradient designations less than the nearest 0.001 foot per foot, except under special circumstances and for larger sewers, shall be avoided.
 3. Sewer depths shall be determined primarily by the requirements of pipe or conduit size, utility obstructions, required connections, future extensions and adequate cover.
 4. Stormwater pipes discharging into lakes shall have the discharge flowline a minimum of three (3) feet above the lake bottom at the discharge point or no higher than the normal water line.
 5. A concrete cradle is required when the grade of a sewer is twenty (20) percent or greater. A special design and specification is required for grades exceeding fifty percent (50%).
 6. For sewers with a design grade less than one percent (1%), field verification of the sewer grade will be required for each installed reach of sewer, prior to any surface restoration or installation of any surface improvements.
 7. The City may require the submittal of revised hydraulic calculations for any sewer reach having an as-built grade flatter than the design grade by more than 0.1%. Based on a review of this hydraulic information, the City may require the removal and replacement of any portion of the sewer required to ensure sufficient hydraulic capacity of the system.
 8. Drops greater than 5 feet require reinforced concrete bottoms.
 9. Storm sewers discharging onto slopes greater than 10% shall be designed to promote a hydraulic jump within the final pipe run by flattening the slope of this run for an appropriate length (approximately ten (10) times the diameter)
- Manholes shall be designed to:
 1. For sewers thirty (30) inches in diameter or smaller, manholes shall be located at changes in

direction; changes in size of pipe; changes in flowline gradient of pipes, and at junction points with sewers and inlet lines. For sewers thirty-three (33) inches in diameter and larger, manholes shall be located on special structures at junction points with other sewers and at changes of size, alignment change and gradient. A manhole shall be located at one end of a short curve and at each end of a long curve. A long curve is defined as having a centerline length of curve equal to or greater than one hundred fifty (150) feet.

2. Spacing of manholes shall not exceed four hundred (400) feet for pipe sewers thirty-six (36) inches in diameter and smaller; five hundred (500) feet for pipe sewers forty-two (42) inches in diameter and larger, except under special approved conditions. Spacing shall be approximately equal, whenever possible.
 3. When large volumes of stormwater are permitted to drop ($\geq 24"$) into a manhole from lines twenty-one (21) inches or larger, the manhole bottom and walls below the top of such lines shall be of reinforced concrete. Special structural design may be required for large pipes and/or large drops.
 4. Manholes shall be avoided in driveways, crosswalks or sidewalks.
 5. Connections to existing structures may require rehabilitation or reconstruction of the structure being utilized. This work will be considered part of the project being proposed.
 6. When a project requires a manhole to be adjusted to grade a maximum of twelve (12) inches of rise is allowed if not previously adjusted. When adjustments to raise or lower a manhole are required, the method of adjustment must be stated on the project plans and approved by the City.
- The Hydraulic Grade Line shall be designed to: *
1. The hydraulic grade line at any inlet or storm manhole shall not be higher than two (2) feet below the inlet sill or top of manhole.
 2. Storm sewers shall not flow with greater than three (3) feet of head in the design storm.
 3. The beginning point for the hydraulic grade line computations shall be the higher (i.e. more conservative) elevation as determined below:
 - a. For connection to existing pipe system:
 - (1) Top of pipe intrados of at least two reaches downstream of the connection point of the existing system; or
 - (2) The hydraulic grade line computed for the existing system.
 - b. For connection to channels or ditches:
 - (1) Top of pipe intrados of the proposed pipe, or
 - (2) The hydraulic grade line computed for the channel or ditch as approved by the City.
 - c. For upstream system pipe connection to dry and wet detention basins:
 - (1) The starting hydraulic grade line for all incoming pipes shall be the 100 year-24 hour blocked low flow water surface elevation, where City maintained streets are located adjacent to or upstream of the basins.
 - (2) The starting HGL for all other situations may be the 100 year – 24 hour unblocked low flow water surface elevation, unless the local road authority requires something higher.
 4. When storm sewers are designed to convey 100 year flows, effusion at low lying inlets is not allowed, unless 100 year ponding easements are so delineated, granted, and recorded. Those associated temporary "ponding" easements however, should not be confused with 100 year overland flow paths, for which no conveyance area easements are presently required. Also, such intentional effusive designs may be prohibited for City maintained streets or highways.
- Show all utilities in storm sewer profiles. If SUE work was completed show accurate elevations on the profiles.
- Provide storm sewer hydraulic calculations for the 15 year, 20 minute storm on all proposed pipes, provide proof of downstream capacity. Include the hydraulic grade line on the storm sewer profile drawings.
- Development along natural watercourses shall have residential lot lines, commercial or industrial improvements, parking areas and driveways setback a minimum of 25 feet from the top of the existing stream bank. The section of land between a natural watercourse and lot lines shall be designated as common ground and drainage easement to be maintained by the trustees of the subdivision within all types of residential developments. All developments shall maintain a setback minimum of 50 feet from the top of the existing stream bank to any building or structure. Commercial and industrial areas shall have creek areas dedicated as drainage easements.

Detention Facilities (Code Section 510.310)

- Add a note on the cover sheet indicating how the City stormwater detention requirements will be met.
- If detention is required for the development, a complete detention report is to be submitted with the improvement plans.
- Stormwater detention easements are required for all detention facilities. These easements must be recorded on the subdivision plat and must note that the maintenance of the facility or facilities are the responsibility of the property owner or owners. (Code Section 510.290.4)
- The maximum flow allowed in a natural channel is 3 cfs and the maximum discharge velocity at an outlet is 3 feet per second. (Code Section 510.290.A.1)
- Provide calculations showing current (pre-developed) and post developed flows for each required storm event in each drainage area. Note: The 50 year developed runoff must be less than the 25 year existing runoff (Code Section 510.290.3.d).
- Provide Elevation vs Discharge tables or curves for all storm frequencies, signed, sealed and dated by a registered engineer in the state of Missouri (Detention Facilities)
- Provide Elevation vs Storage tables or curves for all storm frequencies signed, sealed and dated by a professional engineer in the state of Missouri (Detention Facilities)
- Show inflow calculations and data from all storm frequencies, signed, sealed and dated by a registered professional engineer in the state of Missouri (Detention Facilities)
- Provide hydraulic gradeline calculations for pipes entering and leaving basins for all frequencies, signed sealed and dated by a registered professional engineer in the state of Missouri.
- Include a Geotechnical report for design of detention basin earth fills (if required by the City Engineer) This report should be signed, sealed and dated by a registered engineer in the state of Missouri.
- Show flood areas and elevations on 100 year, 20 minute and 100 year, 24 hour storm event on the development plan. Also, provide for an overland flow path for cases in which the basin is overtopped.
- Provide cross sections of the detention facility adequate to determine the volume of the detention facility.
- Provide approvals from the United States Army Corps of Engineers and Missouri Department of Natural Resources if required.
- Provide flood and creek bank studies signed, sealed and dated by a registered professional engineer if applicable.

Grading

- Show the 25' x 50' temporary gravel wash down area located near the construction entrance and indicate on the plans that all trucks must be washed down prior to leaving the site.
- Show spot elevations in the parking lot to clarify proposed drainage.
- Show existing topography and grade of the premises at a contour interval of not more than two feet and the proposed final contour and finished grade elevations at intervals of not more than two feet; except, that whenever the existing grade is extremely steep and hilly, the contour intervals may be not more than five feet.
- Provide earthwork totals including total volumes of cut and fill in cubic yards. A grading permit is required for any grading operation wherein a minimum of 500 cubic yards of soil is being moved. A grading performance bond is required for any grading operation moving more than 3,000 cubic yards.
- All low places whether on-site or off-site should be graded to allow drainage (this may be accomplished with temporary ditches). Provide copies of signed off-site easements needed to accomplish this.
- Allow no more than 4cfs in any drainage area and no more than ____cfs over slopes exceeding_____.

Retaining Walls

- Retaining walls greater than 4' in height require a separate building permit.
- Retaining walls greater than 6' in height require a fence or protective barrier. (Code Section 510.090.A.1)
- Retaining walls labeled as private.

Storm Water Pollution Prevention Plan (SWPPP) (Phase I & II)

Sites requiring a DNR Land Disturbance Permit and a grading permit will be required to submit a SWPPP packet based on the EPA's template. The SWPPP Operator for the site will be required to have a preconstruction meeting with staff prior to the issuance of the grading permit.

- A SWPPP, including a Storm Water Management Plan and Erosion/Sedimentation Control Plan stamped by a professional engineer per Chapter 3 of Protecting Water Quality, January 2000 by the Missouri Department of Natural Resources, is required for all developments, regardless of size.
- Show a 25' x 50' temporary gravel wash down area located near the construction entrance and indicate on the plans that all trucks must be washed down prior to leaving the site.
- Show spot elevations in parking lot to clarify proposed drainage.
- Show existing topography and grade of the premises at a contour interval of not more than two feet and the proposed final contour and finished grade elevations at intervals of not more than two feet; except, that whenever the existing grade is extremely steep and hilly, the contour intervals may be not more than five feet.
- Provide earthwork totals including total volumes of cut and fill in cubic yards. A grading permit is required for any grading operation wherein a minimum of 500 cubic yards of soil is being moved. A grading performance bond is required for any grading operation moving more than 3,000 cubic yards.
- All low places whether on-site or off-site should be graded to allow drainage (this may be accomplished with temporary ditches). Provide copies of signed off-site easements needed to accomplish this.
- Show locations of all proposed temporary and permanent BMP's.

Trees and Landscaping

- Show limits of existing treelines.
- Provide Landscape Plan that meets City requirements, and follows the Tree Preservation Ordinance. (Code Sections 400.630 - 400.650)

Flood Damage Prevention (Code Section 410.010)

- Depict the appropriate flood hazard zones as shown on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) and reference the applicable FIRM panel number and date.
- Indicate on plans the proximity of the proposed development to the floodplain or floodway.
- If development (subdivision or commercial development) is adjacent to a creek, provide hydraulic data for the creek showing the 100 year flood elevation and show the lowest floor and low sill elevations on the adjacent structures.
- Delineate wetlands subject to United States Army Corps of Engineers regulations. Appropriate documentation of coordination with the COE shall be provided.
- All Development shall be setback at least 25' from the top of any creek and structures shall have a minimum 50' setback.
- Obtain a Floodplain Development Permit and provide approval from Community Development for any work within a floodplain or floodway.

Please Note:

- Any signage to be placed on the subject property requires a separate sign permit.
- Any business occupying the site requires approval of a Business License.
- A completed and signed copy of this checklist must accompany the initial Improvement Plan submittal.