

DIVISION 00

DESIGN STANDARDS

SECTION 00500
DESIGN STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Codes and Standards
- B. Design Standards
- C. Construction Drawing Requirements

1.02 RELATED SECTIONS

- A. Section 00620 - Documentation

1.03 SUBMITTALS

A. Construction Drawings

1. One copy of Construction Drawings shall be submitted to the City Engineer for preliminary review.
2. Two copies of Construction Drawings shall be submitted to the City Engineer for final approval with exhibit illustrating incumbent property.
3. Five full size copies of Construction Drawings shall be submitted to the City Engineer before start of construction. These drawings shall be stamped by the City Engineer and distributed as required.

B. Easements and Land Acquisition

1. All Easements and Land Acquisitions shall be submitted on the City's Standard Easement form and shall be included on the recorded subdivision plat.
2. All Easements shall be accompanied by an exhibit illustrating encumbered property.
3. One copy of all necessary Easement forms shall be submitted to the City Engineer for review.
4. One signed copy of all necessary Easement forms, including exhibits, shall be submitted to the City Engineer for final approval and recordation.
5. All necessary permits shall be submitted to the City Engineer for final approval. Required permits include, but are not limited to: state and county utility line permits, canal crossing permits, Railroad Crossing permits, UPDES permits, Army Corp. of Engineer permits, encroachment and excavation permits, etc.
6. All necessary permits and easements must be submitted prior to final approval being granted by the City.
7. Right of Entry Easements shall be provided for all storm drains, storm water devices & grease traps.

1.04 CITY ENGINEER'S AUTHORITY

- A. The City Engineer shall review submitted Construction Drawings for compliance to these Design Standards and Construction Specifications.
- B. The City Engineer shall note any changes to Construction Drawings, required to bring Construction Drawings into compliance with these Design Standards and Construction Specifications.

- C. Required changes shall be made to Construction Drawings and returned to the City Engineer for final approval.
- D. The City Engineer shall have additional authority such as is stated in these Design Standards and Construction Specifications.

PART 2 EXECUTION

2.01 CODES AND STANDARDS

- A. Design shall be based on the following:
 - 1. Sanitary Sewer Systems.
 - a. ASCE Manual and Reports on Engineering Practice No. 60, Gravity Sanitary Sewer Design & Construction.
 - b. Utah State Department of Health Code of Waste Disposal Regulations.
 - c. Utah Division of Water Quality Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal Systems.
 - d. Uniform Plumbing Code, Latest Edition.
 - e. National Electrical Code
 - 2. Culinary and Secondary Water Systems.
 - a. State of Utah Administrative Rules for Public Drinking Water Systems.
 - b. Uniform Plumbing Code, Latest Edition.
 - c. National Electrical Code
 - 3. Storm Drainage Systems.
 - a. Guidelines, procedures and design criteria as defined by the City's Standards & Specification, and Storm Water management Plan.
 - 4. Transportation System
 - a. Guidelines, procedures and design criteria as defined by AASHTO, MUTCD, and ADA.
- B. All Work not specifically described in these design standards and technical specifications shall conform to the APWA "Manual of STANDARD SPECIFICATIONS" as published by the Utah Chapter of the American Public Works Association. The latest edition at the time of the Work shall be used.

2.02 DESIGN STANDARDS

- A. Infrastructure designs shall conform to the most recent City of Saratoga Springs current Capital Facilities and Master Plans; and to these design standards and technical specifications.
 - 1. These Design Standards are design guidelines. The City's design standards do not relieve the developer's engineer from being responsible for examining and understanding local project conditions, confirming the correlation of all design standards with the techniques of construction, coordination of the standards with that of all other industry standards, and for the complete and satisfactory design of the project.

B. SANITARY SEWER SYSTEMS:

- 1. The impact of any proposed sewer system, on the existing sewer system, will be reviewed by the City Engineer. The developer may be required to add additional off-site sewer systems in order to provide adequate sewer service to his development.
 - a. Areas that will be serviced through the proposed development will be considered and the method of service to those areas will be determined and approved by the City Engineer. Increased system size may be required for future development, as approved by the City Engineer.
- 2. The minimum size of sewer main line shall be 8-inch diameter.

3. Sewer lines shall be designed to maintain a minimum velocity of two feet per second (2 fps) during peak flows, unless otherwise accepted and approved by the City Engineer.
4. Unless otherwise accepted and approved by the City Engineer, the minimum sewer slopes shall be as follows:
 - a. 8-inch sewer lines – 0.0040 foot/foot
 - b. 10-inch sewer lines – 0.0028 foot/foot
 - c. 12-inch sewer lines – 0.0022 foot/foot
 - d. 15-inch sewer lines – 0.0015 foot/foot
 - e. 18-inch sewer lines – 0.0012 foot/foot
 - f. 21-inch sewer lines – 0.0010 foot/foot
 - g. 24-inch sewer lines – 0.0008 foot/foot
 - h. Larger than 24-inch per City Engineer's recommendation
5. The minimum sewer depth shall be 13.0 feet under normal conditions.
 - a. In areas of shallower sewer, the following note shall be added to the development plat: "Shallow Sewer Depths! Contractor shall verify sewer depths before excavating for basement. Home(s) with basement may not have sewer service available for basement."
 - b. The City Engineer may increase the minimum sewer depth if required to meet overall system requirements.
6. A minimum of four feet of cover shall be required over all sewer lines, where acceptable to the City Engineer.
7. Sewer shall be located on the low side of streets, preferably 5 feet from street centerlines.
8. A minimum of five feet shall be maintained between the edge of manhole collars to edge of the street pavement.
9. Sewer shall be located at 10-foot minimum horizontal distance from culinary waterlines.
10. Where possible, sewer shall be located at 10-foot minimum horizontal distance from all other public utilities, including but not limited to storm drains, and secondary water lines.
11. Sewer main lines shall be extended to property lines as per City Engineer's directions to service future Development and end of manhole.
12. In the locations where the sewer leaves the public right-of-way a twenty-foot wide sanitary sewer easement will be required. This easement shall be centered on the sewer line, unless otherwise approved by the City Engineer. Sewer easements shall extend ten feet beyond dead end manholes. Show easements on the development plat and on the City's Standard Easement forms, which grant the easements to the City. Easements must be executed and returned to the City Office prior to final approval being granted.
13. No plugged ends of sewer main lines will be allowed. Manholes must be constructed at the ends of sewer lines.
14. The minimum size manhole shall be 4-foot diameter.
15. 5-foot diameter manholes shall be used in the following situations:
 - a. At all intersections of three or more 8-inch or larger pipe lines.
 - b. Where the deflection angle of the pipe line exceeds 90 degrees.
 - c. When both items "a" and "b" are designed in the same manhole, a six-foot manhole is required.
16. A 12 foot paved access road shall be constructed to all manholes and shall be capable of supporting H-20 loading.
17. Where new sewer lines are connected to existing sewer lines, a 5-foot diameter manhole shall be constructed over the existing sewer line.

18. The maximum manhole span shall be 400 feet, as measured from center to center of manholes.
19. A 0.2-foot elevation step shall be provided in all junction manholes no more and no less; except where accepted otherwise by the City Engineer.
 - a. The maximum allowable drop, between inlet and outlet inverts, through a manhole is two feet.
 - b. When the drop in a manhole is between one and two feet, a five-foot manhole is required.
 - c. Where incoming slopes at manholes are greater than or equal to 5 percent, the incoming slope shall be carried through the manhole, unless otherwise accepted and approved by the City Engineer.
20. Where pipes of different diameters melding laterals connect into a manhole, the inside top of the smaller pipe shall match the inside top of the larger pipe, unless approved otherwise by the City Engineer.
21. Where incoming slopes at manholes are greater than or equal to 5 percent and the deflection angle within the manhole is greater than or equal to 45 degrees but less than 90 degrees, a five-foot manhole with an extra deep trough is required.
 - a. Where incoming slopes at manholes are greater than or equal to 5 percent and the deflection angle within the manhole is greater than 90 degrees, a six-foot manhole with an extra deep trough is required.
22. The minimum lateral size shall be 4-inch for residential connections; and 6-inch for commercial and industrial connections.
 - a. Sewer lateral shall have a minimum slope of 2%.
23. Sewer laterals shall tie directly into manholes in cul-de-sacs and at dead end manholes.
24. Sewer laterals may tie directly into manholes wherever possible and practical.
25. Sewer laterals shall conform to the requirements of the Utah State Department of Health Code and the Uniform Plumbing Code; with cleanouts at not more than 100-foot spacing; and no more than two bends in excess of 45 degrees without a cleanout.
26. Each building and/or unit of separate ownership shall require a separate sanitary sewer lateral, unless otherwise approved by the City Engineer.
27. Grease traps shall be required on all commercial development as determined by City Engineer.
 - a. Sampling manholes shall be installed downstream of all grease traps as approved by the City Engineer.
 - b. Sampling manhole & grease trap shall be constructed as per TSSD Standards & Specifications.
28. Force main discharge manholes shall be epoxy lined or equal as approved by City Engineer.
29. Sewer Mains shall be located as indicated on the City's Standard drawings and shall be located in ROW or dedicated open spaces.

C. CULINARY WATER SYSTEMS:

1. The State of Utah Administrative Rules for Public Drinking Water Systems, R309-510, provide minimum sizing requirements for drinking water facilities.
2. Water systems shall be sized as described in the City's Capital Facilities & Master Plans and shall be a minimum of 8" in public right-of-way.
3. The minimum fire flow shall be as per state standards. The fire flow may be increased as determined by the City Fire Marshal.
4. The minimum residual pressure in all parts of the system during peak day demand is to be 40 psi.
5. The maximum operating pressure is to be 100 psi; unless otherwise approved by the City

Engineer.

6. Water systems shall be designed so that pressures conform to the pressure zones shown in the City's Capital Facilities Plan; and as approved by the City Engineer.
7. The construction drawings shall show pipe sizes, types, and classifications.
 - a. All water system appurtenances shall be labeled
8. The maximum pipe line flow velocities shall be 6 feet per second; unless approved otherwise by the City Engineer.
9. The impact of any proposed water system on the existing water system will be reviewed by the City Engineer. The developer may be required to add additional off-site infrastructure in order to provide adequate water supply to his development.
 - a. Areas that will be supplied through the proposed development will be considered and the method of service to those areas will be determined and approved by the City Engineer. Increased system size may be required for future development, as approved by the City Engineer.
 - b. The system storage requirements will be considered for each development and approved by the City Engineer.
10. The minimum cover over top of water lines is to be 48-inches.
11. Water lines 12 inches and larger shall be ductile iron Class-53. Water lines 10 inches and smaller shall be PVC AWWA C900 Class 200.
12. Valves 12 inches or larger shall be butterfly valves; Valves smaller than 12 inches shall be gate valves.
13. Water lines shall be placed in the park strips as required by the City Standards.
 - a. Location shall be on the east side of north/south streets.
 - b. Location shall be on the north side of east/west streets.
14. Valve placement:
 - a. Valves shall be placed at the point of curvature of the curb and gutter radius sections.
 - b. Valves shall be placed at intervals not to exceed 800 feet, unless approved otherwise by the City Engineer.
 - c. At intersections, valves shall be placed on at least three branches of the system, as approved by the City Engineer.
 - d. Valves shall be placed within 10 feet of the upstream and downstream ends of casing pipes.
 - e. Valve nut elevation shall not exceed 4 feet below finished grade without extension.
15. Blow-offs shall be placed at the ends of water lines, at low points in the system, and at other locations as shown on the City's Standard drawings and as approved by the City Engineer.
16. Fire Hydrants:
 - a. Fire hydrants shall have a maximum spacing of 500 feet in residential areas; and a maximum spacing of 300 feet in commercial and industrial areas.
 - b. Fire hydrants shall be placed at the end of cul-de-sac pipe lines, the end of dead end streets, and every 1,000 feet on offsite transmission lines. Temporary hydrants may not be considered as fire protection hydrants; but shall be used for flushing and maintaining lines.
 - c. Fire hydrant spacing shall be approved by the City Engineer; additional fire hydrants may be required by either the City Fire Chief or City Engineer.
17. Air-Vacuum Valve Stations:
 - a. Air-vacuum valve station venting shall be located in a landscaped area near the edge of the right-of-way (ROW) as approved by City Engineer.
 - b. Air-vacuum valve stations shall be placed at high points on transmission lines and at other locations as required for proper system operation, and as approved by the City Engineer.
 - c. Air-vacuum valve stations shall be constructed as indicated on the drawings.

18. Water Service Connections shall include the corporation stop at the main line, CTS Poly service line to the meter yoke, an angle stop, back-flow angle valve, PVC meter box, and cast iron frame and cover, as shown on the City Standard drawings.
19. In the locations where the water lines leave the public right-of way a ten-foot wide easement will be required. This easement shall be centered on the water line, unless otherwise approved by the City Engineer. Water easements shall extend ten feet beyond dead ends and hydrants. Show easements on the development plat and on the City's Standard Easement forms, which grant the easements to the City. Easements must be executed and returned to the City Office prior to final approval being granted.
20. Each building and/or unit of separate ownership shall require a separate water service line, unless otherwise approved by the City Engineer.
21. PRESSURE REGULATING STATIONS shall be constructed, where required to provide water supply between pressure zones, as indicated on the City Standard drawings and as approved by the City Engineer.
 - a. The station plumbing shall consist of a main line and a by-pass line. The combined capacity of the main line and by-pass plumbing shall equal the capacity of the incoming pipe line. The main line will normally be one pipe size smaller than the incoming line and the by-pass line will be sized as required.
 - b. Plumbing will include pressure regulating valves on each line, isolation valves on each side of each regulating valve, and all appurtenant plumbing items, as indicated on the standard drawings and as approved.

D. SECONDARY WATER SYSTEMS:

1. The State of Utah Administrative Rules for Public Drinking Water Systems, Part II, R309-200 through R309-211, provide minimum sizing requirements for secondary water facilities.
2. Secondary Water systems shall sized as described in the City's Capital Facilities Plan and shall be a minimum of 6" in public right-of-way.
3. The normal minimum pressure in all parts of the system during peak day demand shall be 30 psi.
4. The maximum operating pressure is to be 90 psi; unless otherwise approved by the City Engineer.
5. The maximum pipe line flow velocities will be 6 feet per second; unless approved otherwise by the City Engineer.
6. The impact of any proposed water system on the existing water system will be reviewed by the City Engineer. The developer may be required to add additional off-site infrastructure in order to provide adequate water supply to his development.
7. Areas that will be supplied through the proposed development will be considered and the method of service to those areas will be determined and approved by the City Engineer. Increased system size may be required for future development, as approved by the City Engineer.
8. The system storage requirements will be considered for each development and approved by the City Engineer.
9. The minimum cover over top of water lines is to be 36-inches.
10. Secondary water lines shall be placed in the park strips as required by the City Standards.
 - a. Location shall be on the west side of north/south streets.
 - b. Location shall be on the south side of east/west streets.
 - c. Location shall be on the opposite side of the street from culinary water lines.
11. Water lines 12 inches and larger shall be ductile iron Class-53. Water lines 10 inches and smaller shall be PVC AWWA C900 Class 200.

12. Valve placement:
 - a. Valves shall be placed at the projection of the end of curb and gutter radius sections at the point of curvature.
 - b. Valves shall be placed at intervals not to exceed 800 feet, unless approved otherwise by the City Engineer.
 - c. At intersections, valves shall be placed on at least three branches of the system, as approved by the Engineer.
 - d. Valves shall be placed within 10 feet of the upstream and downstream ends of casing pipes.
13. Blow-offs shall be placed at the ends of water lines at the low points in the system, and at other locations as shown on the City's Standard drawings and as approved by the City Engineer.
14. Water Service Connections shall be constructed as shown on the City Standard drawings.
15. In the locations where the water lines leave the public right-of way a ten-foot wide easement will be required. This easement shall be centered on the water line, unless otherwise approved by the City Engineer. Water easements shall extend ten feet beyond dead ends. Show easements on the development plat and on the City's Standard Easement forms, which grant the easements to the City. Easements must be executed and returned to the City Office prior to final approval being granted.
16. Each building and/or unit of separate ownership shall require a separate water service line, unless otherwise approved by the City Engineer.
17. PRESSURE REGULATING STATIONS shall be constructed, where required to provide water supply between pressure zones, as indicated on the City Standard drawings and as approved by the City Engineer.
 - a. The station plumbing shall consist of a main line and a by-pass line. The combined capacity of the main line and by-pass plumbing shall equal the capacity of the incoming pipe line. The main line will normally be one pipe size smaller than the incoming line and the by-pass line will be sized as required.
 - b. Plumbing will include pressure regulating valves on each line, isolation valves on each side of each regulating valve, and all appurtenant plumbing items, as indicated on the standard drawings and as approved.
18. Air-Vacuum Valve Stations:
 - a. Air-vacuum valve station venting shall be located in a landscaped area near the edge of the right-of-way (ROW) as approved by City Engineer.
 - b. Air-vacuum valve stations shall be placed at high points on transmission lines and at other locations as required for proper system operation, and as approved by the City Engineer.
 - c. Air-vacuum valve stations shall be constructed as indicated on the drawings.
19. Drains shall be installed at all low points on pressure irrigation lines, and at other located as directed by the City Engineer.

E. STORM DRAIN SYSTEMS:

1. The impact of any proposed storm drain system on the existing drainage system will be reviewed by the City Engineer. The developer may be required to add additional off-site storm drain systems in order to provide adequate drainage control for his development.
2. Areas that will be drained through the proposed development will be considered and the method of drainage for those areas will be determined and approved by the City Engineer. Increased system size may be required for future development, as approved by the City Engineer.
3. Drainage structures, consisting of drainage channels, bridges, culverts, storm drain pipe lines, and appurtenant structures, shall be designed to convey the anticipated storm water discharge.
 - a. Bridges shall be designed to convey a 100-year storm event.
 - b. Culverts shall be designed to convey a 100-year storm event.
 - c. Storm drain lines shall be designed to convey 25-year storm event.

- d. Drainage channels shall have a minimum of 2' of free board above the 100-year high water elevation.
 - e. Drainage Channels shall be designed to convey the 100-year storm event.
 - f. Storm drain use shall be designed for a maximum depth to diameter ratio of 80%.
 - g. Drainage channels shall be designed for a maximum velocity of 7 fps.
4. Drainage structures shall be constructed as indicated on the City Standard drawings.
 5. Cleanout boxes shall be located at every change in alignment or slope and at junctions with other lines, as approved by the City Engineer.
 6. Inlet boxes shall be placed as follows:
 - a. Spaced at no more than 500 feet apart to collect sheet flow of storm water.
 - b. Located at the uphill end of radius sections.
 7. Maximum spans between structures shall be 400 feet from center to center of structures.
 8. All storm drains in public right-of-way shall be constructed with reinforced concrete pipe; with minimum size of 15-inch diameter unless otherwise approved by City Engineer.
 9. Storm drain lines shall be designed to maintain a velocity of two feet per second (2 fps) during peak flows unless otherwise accepted and approved by the City Engineer.
 10. Unless otherwise accepted and approved by the City Engineer, the minimum pipe slopes shall be as indicated in the section for sanitary sewer lines.
 11. Minimum cover shall be as per manufacturers recommendation over all reinforced concrete drain lines.
 12. Storm drains shall be located as indicated on the City's Standard drawings and shall be located in ROW or dedicated open spaces.
 13. Where pipes of different diameters connect into a drainage structure, the inside top of the smaller pipe shall match the inside top of the larger pipe, unless approved otherwise by the City Engineer.
 14. A 0.2-foot minimum elevation step shall be provided in all junction manholes; except where accepted otherwise by the City Engineer.
 - a. The maximum allowable drop, between inlet and outlet inverts, through a manhole is two feet.
 - b. When the drop in a manhole is between one and two feet, a five-foot manhole is required.
 - c. Where incoming slopes at manholes are greater than or equal to 5 percent, the incoming slope shall be carried through the manhole, unless otherwise accepted and approved by the City Engineer.
 15. A 12 foot paved access road shall be constructed to all manholes and shall be capable of supporting H-20 loading.
 16. Sump manholes designed to infiltrate water are not permitted.
 17. Storm drain lines shall be extended to property lines as per City Engineer's direction to accommodate future development and shall end at a manhole.
 - a. No plugged ends of storm drain will be allowed. Manholes must be constructed at ends of storm drain line.
 18. In the locations where the storm drain leaves the public right-of way a twenty-foot wide drainage easement will be required. This easement shall be centered on the drain line, unless otherwise approved by the City Engineer. Drainage easements shall extend ten feet beyond dead end structures. Show easements on the development plat and on the City's Standard Easement forms, which grant the easements to the City. Easements must be executed and returned to the City Office prior to final approval being granted.
 19. Storm Water Treatment Systems shall be constructed where and as directed by the City Engineer.
 - a. Treatment systems shall be designed to treat all of the flow from the areas where storm water

- needs to be treated, with no bypass into the City storm water system of the treatment design storm parameters.
 - b. Systems shall be designed to remove all of the oils and floatables from the storm water and 80% of the total suspended solids (TSS) 110 microns or larger.
 - c. Systems shall be sized to treat the first flush and to pass the 100 year peak flow with no washout.
20. Detention Systems.
- a. The capacity of all detention systems shall be sufficient to contain the anticipated runoff volume from a 100-year 24-hour storm event over those portions of the gross aggregate area under design; with a maximum release of 0.2 cfs/acre or the historic flow rate, whichever is less.
 - b. Systems shall be constructed as described and as shown in the City's Standards.
 - c. Low flows, where applicable, shall be piped through the detention system.
 - d. Detention system capacity may not be reduced for infiltration or evaporation rates.
 - e. Retention systems are not permitted. All systems must have both an outfall and overflow system.
 - f. Ponds are to be landscaped per City's Standards.
 - g. Provide access roads to all inlet/outlet structures.
 - h. All ponds shall have a minimum of 1' of free board above the 100 year high water elevation.
 - i. Maximum interior and exterior slopes shall be 3:1.
 - j. Detention areas may not be located within residential lots.
 - k. Detention areas shall be a minimum of 10' from property lines.
 - l. Underground systems shall have impermeable liners and shall not be permitted to infiltrate.
21. Install fabricated galvanized steel trash grates over the ends of all exposed pipes, 15-inch and larger.

F. STREET SYSTEMS:

1. Streets systems, consisting of curb and gutter, sidewalks, handicap ramps, street pavement, and appurtenant items shall be designed as described below, as shown in Tables 1, 2, and 3 , and as shown in the City Standards.
 - a. Table 1 shows the ROADWAY DESIGN STANDARDS; including right-of-way widths, pavement widths, street grades, and appurtenant design criteria.
 - b. Table 2 shows the subgrade protection layer required to be placed to protect subgrade soils. Prior to placement of any typical pavement section, a subgrade protection layer must be placed. Directions for this are outlined on Table 2.
 - c. Table 3 shows the typical pavement sections required for the different categories of traffic. Different options are provided for some of the sections.
 - d. Table 4 shows the Geosynthetic Requirements for Type 1 and 2 geogrids if those options are utilized.
2. Street system designs shall be shown on the construction drawings and shall be acceptable to the City Engineer.
3. Streets shall be constructed with asphaltic concrete, course untreated base, course and granular borrow material for sub-base and/or subgrade protection, and a geotextile as required.
 - a. Thickness of each course shall be determined based on the subgrade and pavement classification. Table 1 outlines the standard design standards. Table 2 outlines the required subgrade protection based on the design CBR of the subgrade. Table 3 outlines the required pavement section based on classification of the roadway. All sections must be approved by the City Engineer.
 - b. Thickness may be modified by design of a geotechnical engineer, but must be approved by the City Engineer.
4. No new street pavement will be cut into for three years after acceptance of pavement, unless otherwise approved by the City Engineer.
5. Speed tables shall be constructed as indicated on the drawings; where and as directed by the City Engineer.
6. Street light locations shall be at intersections and every 300 feet, placed on alternating sides of streets.
7. Round-about intersections may be constructed where and as accepted by the City Engineer.

- a. Round-about designs shall be as indicated on the standard drawings.
8. Type 2 slurry seal shall be placed on all streets upon completion of paving.

TABLE 1

ROADWAY DESIGN STANDARDS				
	RESIDENTIAL (Class I)	COLLECTOR (Class II)	MINOR ARTERIAL (Class III)	MAJOR & PRINCIPLE ARTERIAL (Class IV)
ROW Width	56'	77'	95'	180'
Pavement Width	24'	44'	44'	60' – 80'
Number of Lanes	2	3	3	5 – 7
Design Speed	25	30	40	55
20 Year ESAL Requirement	60,000	250,000	700,000	2,000,000
Vehicle Design	Passenger, School Buses, Delivery trucks, dump Trucks	Passenger, School Buses, Delivery trucks, Dump/Concrete Trucks	Passenger, School Buses, Delivery Trucks, Dump / Concrete Trucks	Passenger, School Buses, Delivery Trucks, Dump/Concrete Trucks, Semi Loads
Stopping Sight Distance	200	300	300	425
Horizontal Alignment & Radius	200	300	565	1190
Vertical Curve Min "K" Sag/Crest Requirements	37/20	49/29	64/44	115/114
Grades	0.5 - 10	0.5 - 8	0.5 - 8	0.5 - 8
Intersection Sight Distance	335	445	445	555
Minimum Signalized Intersection Spacing	N/A	1,320'	2640'	2,640'
Minimum Full Movement access Spacing	125'	500'	500'	660'
Corner Curb Radius	25	25	35	40
Access Spacing				
Minimum Signal Spacing (ft.)*	N/A	1,320	1,320	2,640/2,640
Minimum Un-signalized Full-Movement Access Spacing (ft.)*	125	500	500	660/660
Minimum Right-In/Right-Out Access Spacing (ft.)*	100	250	250	330/350
Residential Driveways Permitted	Yes	Discouraged	No	No/No

*Distances to be measured from center of driveway to center of driveway

TABLE 2

(Subgrade protection layer must be placed over the subgrade soils prior to placement of the pavement section. A design CBR must be determined by a geotechnical engineer. Based on this CBR value, the chart below provides how much Granular Borrow must be placed to adequately support the typical sections referenced in Table 3. If the in-situ CBRs of the subgrade are found to be softer than the design value, those values should be used.)

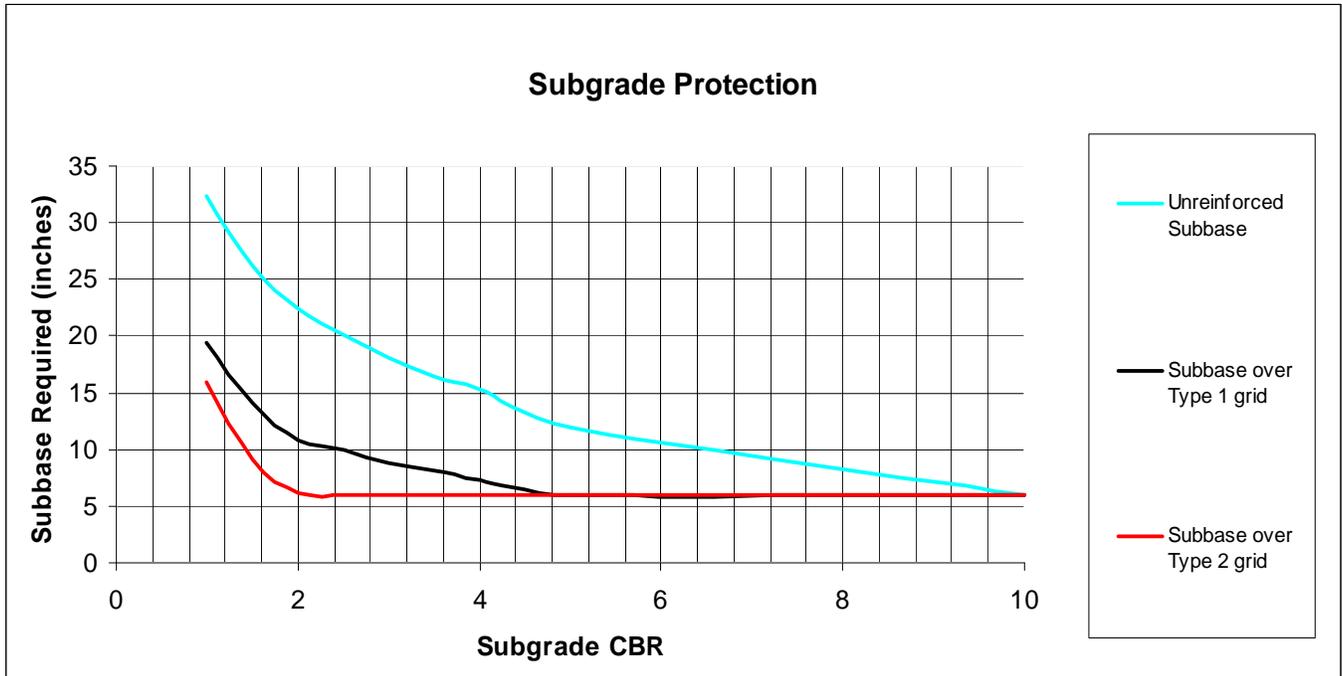


TABLE 3

Minimum Pavement Sections Based on Classification

(The following section(s) must be placed on top of the subgrade protection layer outlined in Table 2)

Residential Typical Section (Class I)		
3" AC (Asphalt Concrete) 8" UTBC (Untreated Base Course)		
Collector Typical Section Options (Class II)		
4" AC 8" UTBC		3" AC 8" UTBC Type 1 Geogrid
Minor Arterial Typical Section Options (Class III)		
5" AC 8" UTBC		4" AC 8" UTBC Type 1 Geogrid
Major & Principle Arterial Road Typical Section Options (Class IV)		
5" AC 6" UTBC 9" GB (Granular Borrow)	5" AC 8" UTBC Type 1 Geogrid	4" AC 6" UTBC Type 1 Geogrid 9" GB
<p>(a) Road classification and structural design must be submitted by a licensed and qualified engineer for review and approval by the City Engineer.</p> <p>(b) Traffic classifications I & II require a 1/2" mix HMA design</p> <p>(c) Traffic classifications III & IV require a 3/4" mix HMA design</p> <p>(d) If collapsible soils are identified in the initial soils investigation or during construction, the subgrade soil shall be over-excavated and re-compacted a minimum of 18-inches or deeper as directed by a licensed and qualified geotechnical engineer.</p>		

TABLE 4

Structural Geogrids for Typical Pavement Sections

Alternate products to Type 1 and Type 2 Geogrids used for subgrade protection will need to provide the full-scale calibration and validation of their methodology, as outlined by Giroud-Han. Alternate products to Type 1 geogrid used within a typical pavement section will need to provide full-scale Accelerated Pavement Testing, as outlined in NCHRP Report 512, validating their design methodology. Testing submitted for Type 1 geogrids must be performed on paved sections with at least 100,000 passes of a dual wheel tandem loading.

Type 1 Geogrid

Biaxial Type 1 Geogrid Quality Control Values			
Geogrid Properties	Test Method	MD	CMD
Type of Geogrid		Punched and Drawn	
Rib Shape	Observation	Rectangular or Square	
Rib Thickness	Nominal Dimensions	Minimum 0.05 in	
Nominal Aperture Size	I.D. Callipered	1.0 to 1.5 inches	
Flexural Stiffness	ASTM D-5732-95	Minimum 750,000 mg-cm	NA
Minimum True Initial Modulus in Use	ASTM 6637-01	Minimum 27,420 lb/ft	Minimum 44,550 lb/ft
Junction Efficiency	GRI-GG2-87	93%	
Resistance to Long Term Degradation	EPA 9090 Immersion Testing	100%	

Triaxial Type 1 Geogrid Quality Control Values					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.05	0.05	
Mid-rib width	I.D. Callipered		0.04	0.04	
Rib Shape	ASTM D-5732-95				rectangular
Aperture Shape	ASTM 6637-01				triangular
Radial Stiffness	ASTM 6637-01				15,430 lb/ft @ 5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%

Type 2 Geogrid

Biaxial Type 2 Geogrid Quality Control Values			
Geogrid Properties	Test Method	MD	CMD
Type of Geogrid		Punched and Drawn	
Rib Shape	Observation	Rectangular or Square	
Rib Thickness	Nominal Dimensions	Minimum 0.07 in	
Nominal Aperture Size	I.D. Callipered	1.0 to 1.5 inches	
Flexural Stiffness	ASTM D-5732-95	Minimum 2,000,000 mg-cm	NA
Minimum True Initial Modulus in Use	ASTM 6637-01	Minimum 34,000 lb/ft	Minimum 42,000 lb/ft
Junction Efficiency	GRI-GG2-87	93%	
Resistance to Long Term Degradation	EPA 9090 Immersion Testing	100%	

Triaxial type 2 Geogrid Quality Control Values					
Geogrid Properties	Test Method	Longitudinal	Diagonal	Transverse	General
Type of Geogrid					Punched and Drawn
Rib Pitch	Nominal Dimensions	1.6	1.6		
Mid-rib depth	Nominal Dimensions		0.07	0.06	
Mid-rib width	I.D. Callipered		0.04	0.05	
Rib Shape	ASTM D-5732-95				rectangular
Aperture Shape	ASTM 6637-01				triangular
Radial Stiffness	ASTM 6637-01				29,500 lb/ft @ 5% strain
Junction Efficiency	GRI-GG2-87				93%
Resistance to Long Term Degradation	EPA 9090 Immersion Testing				100%

H. SPECIAL SOILS DESIGN:

1. There are many areas within the City where collapsible soils exist. Where these collapsible soils exist within a proposed development, the soil's bearing capacities shall be determined by an approved geotechnical engineer. The foundations for all facilities to be constructed on these soils shall be designed by the geotechnical engineer to support the facilities as required. These facilities shall include utility lines, roadways, structures and appurtenant items.
2. The City Engineer may designate areas where known collapsible soils exist. Soils reports done for a proposed developments shall also be used to define if and where any areas of collapsible soils may exist. Where these areas exists, special care shall be taken with all construction, as described herein.

I. RESTORATION OF SURFACES:

1. All improved surfaces shall be restored to match original conditions, as acceptable to the City Engineer.
2. Paved surfaces shall be restored to the thickness plus 1" and types as required to match adjacent paved surfaces; conforming to City standards.
3. Landscaped areas shall be restored to match adjacent areas, conforming to the City Standards and as acceptable to the City Engineer. Landscape materials shall conform to adjacent materials.
4. Cultivated areas shall be restored to match adjacent areas, conforming to the City Standards and as acceptable to the City Engineer. These areas shall be seeded with material conforming to adjacent materials.
5. All disturbed areas, not improved, shall be restored with native grasses to match adjacent areas, conforming to the City Standards and as acceptable to the City Engineer. These areas shall be seeded with material conforming to adjacent materials, as acceptable. Restored area shall achieve 70% plan coverage prior to acceptance.

2.03 DRAWINGS

A. Preliminary Construction Drawings shall include at a minimum, the following information:

1. Cover Sheet that includes:

- a. Project Name
- b. Sheet index
- c. Vicinity Map
- d. Legend
- e. Contact information for key contacts including developer, engineer, utility companies, and City
- f. Data Table for Overall project and for each phase that lists in SF, Acres, and by percent of total
 - i. Total Area
 - ii. Total Impervious Area
 - iii. Total Lot or Building Pad Area
 - iv. Total Landscape Area
 - v. Total ROW area
 - vi. Total Number of Lots

g. City Standard notes:

- i. Contractor shall field verify locations and invert elevations of existing manholes and other utilities before staking or constructing any new sewer lines.
- ii. Contractor shall field verify locations and invert elevations of existing storm drain structures and other utilities before staking or constructing any new storm drain lines.
- iii. All construction shall comply to the Standard Technical Specifications and Drawings for the City Of Saratoga Springs, Utah.

- iv. Existing Utilities have been noted to the best of Engineers knowledge, it is owners and contractors responsibility to locate utilities in field and notify Engineer and City if discrepancies exist.
 - v. Post-approval alterations to lighting plans or intended substitutions for approved lighting equipment shall be submitted to the City for review and approval.
 - vi. The City reserves the right to conduct post-installation inspections to verify compliance with the City's requirements and approved Lighting Plan commitments, and if deemed appropriate by the City, to require remedial action at no expense to the City.
 - vii. All exterior lighting shall meet IESNA full-cutoff criteria unless otherwise approved by the City."
2. Existing/Demolition Plan Sheet that includes:
- a. Existing topography
 - b. All existing features in and adjacent to project including;
 - i. Roads
 - ii. Sidewalks and curb and gutter
 - iii. Utilities both underground and overhead and existing pole locations
 - iv. Existing striping including lane configurations and crosswalk locations.
 - v. Existing Buildings
 - vi. Wells and septic systems
 - vii. Trees
 - viii. Street Lights
 - ix. Utility pedestals and transformers
 - c. Plans for the removal or relocation of existing infrastructure as needed for project
 - d. Areas classified as sensitive lands including 100-yr flood plains, natural drainages, water bodies, rivers, wetlands, and 30% + slopes.
 - e. Existing easements or other encumbered areas.
3. Overall Site Plan Sheet that includes:
- f. Street names and widths
 - g. Subdivision lots with lot numbers, areas in SF and Acres, and boundary dimensions
 - h. Street centerline and ROW data
 - i. Hydrant Locations
 - j. Lighting locations
 - k. Roadway improvements (curb, gutter, sidewalk, drive approach, ADA ramps, monuments)
 - l. Parking Layout (if applicable)
 - m. Dimensioning and labeling of applicable items including setbacks, ROW's, spacing between structures, curb return radii, etc
 - n. Phasing of project including location of temporary turn-around's at phase boundaries.
4. Overall Grading and Drainage Plan Sheet that includes:
- a. Existing Contour Lines (in grey) at one-foot intervals
 - b. Proposed Contours at one-ft intervals, proposed contours should tie back to existing at limits of grading
 - c. County or City benchmark elevation
 - d. Storm drain system showing pipe alignments, sizes, materials, slopes, junction boxes, inlets, and catch basins
 - e. Detention system including spillways and overflow structures
 - f. Location and type of storm water treatment device
 - g. Points of connection to existing system
 - h. Slope Arrows and labels along gutters, swales, catch and fill slopes, parking areas, and lots.
5. Overall Utility Plan that includes:
- a. Sanitary Sewer system showing pipe alignments, sizes, materials, slopes, manholes, and laterals
 - b. Culinary and Secondary Water systems showing pipe alignments, sizes, materials, slopes, manholes, meters, and laterals.
 - c. Location of meters and lateral for all open space areas

- d. Locations of all water valves and fire hydrants.
 - e. Locations and types of all pipe bends and fittings
 - f. Existing Utilities and plans for relocations as necessary.
 - g. Points of connection to existing structures and pipe lines shall be labeled.
 - h. Existing and proposed easements as required by City Standards.
6. Erosion Control Plan Sheet that includes:
- a. Finish Grade Contours
 - b. BMP locations and labels
 - c. Slope arrows and labels across site
7. Landscaping and Irrigation Plan Sheet that includes:
- a. Landscaping plans
 - b. Planting Schedule
 - c. Irrigation Schematic
 - d. Metered Points of Connection
 - e. Fencing locations and types
 - f. Conceptual Layout of Amenities within open spaces with labels and dimensions
8. All sheets shall include
- a. Drawing scale for both vertical and horizontal
 - b. North arrow
 - c. Match Lines if necessary to refer reader to adjacent drawings
 - d. All submitted Preliminary Construction Drawings shall be Standard D-size drawings (24" x 36")
 - e. All drawings shall be signed and stamped by a professional engineer
- B. Final Construction Drawings shall include all Preliminary Construction Drawing Items as well as, at a minimum, the additional following information:
1. Grading and Drainage Plan shall include:
- a. Size and shape of all structures.
 - b. Rim elevation of all structures.
 - c. Invert-in and invert-out elevations at all structures.
 - d. Drain pipe size, type, and class.
 - e. Location and complete details of detention basins and appurtenant structures.
 - f. Storm water treatment system.
 - g. Plan and profile views of all storm drain lines with stationing of all structures
 - h. Plan and profile views of all roadways with slope labels, vertical curves, and points of inflection
 - i. Profile views shall show existing and final surface profiles.
 - j. Spot Elevations at 50' intervals along all TBC, Walls, PC, PT, Low Points, High Points, Ridge Lines, Connection to exiting, all transition locations.
 - k. The locations of any utility conflicts.
 - l. Data table with Cut/Fill quantities and Import/Export quantities.
 - m. Phase boundaries and identification of what will be completed with each phase.
 - n. Data table (broken up by phase if applicable) with quantities of each storm drain and site/road improvement item totaled by type and size including pipes, structures, fittings, and materials.
2. Sewer systems designs shall include:
- a. Size of all manholes.
 - b. Rim elevation of all manholes.
 - c. Invert-in and invert-out elevations at all manholes.
 - d. Sewer pipe size, type, and class.
 - e. Location and complete details of sewage lift stations or other structures.
 - f. Plan and profile views of all sanitary sewer lines with stationing of all structures and laterals
 - g. Profile views shall show existing and final surface profiles.

- h. The locations of any utility conflicts.
 - i. Phase boundaries and identification of what will be completed with each phase.
 - j. Data table (broken up by phase if applicable) with quantities of each sewer improvement item totaled by type and size including pipes, structures, fittings, and materials.
3. Culinary and Secondary Water system designs shall include:
- a. Pipe line sizes, types and class.
 - b. Locations and types of all valves and fire hydrants.
 - c. Locations and types of all pipe line fittings including bends, tee's, crosses, and reducers.
 - d. Air-vac and blow-off valve locations in both plan and profile views
 - d. Plan and profile views of all water lines with stationing of all structures and laterals.
 - e. Profile views shall show existing and final surface profiles.
 - f. The locations of any utility conflicts, and the location and design of all waterline looping.
 - g. Phase boundaries and identification of what will be completed with each phase.
 - h. Data table (broken up by phase if applicable) with quantities of each culinary and secondary improvement item totaled by type and size including pipes, structures, fittings, and materials.
4. Erosion Control Plan for each phase with details shall include:
- a. Finished grade contours at one-foot intervals.
 - b. BMP locations and labels
 - c. Details for all proposed BMP's, Straw Bales are not an acceptable BMP.
 - d. Location of Sedimentation Pond and Diversion Swales for projects 10 acres or greater
 - e. Data table (broken up by phase if applicable) with quantities of each BMP improvements totaled by type and size including structures, and materials.
5. Construction Details sheets shall include all applicable City Standard or non-standard Details including:
- a. Typical Road Sections and pavement section designs
 - b. Sidewalks and Curb and Gutter
 - c. Sewer
 - d. Water
 - e. Storm Drain
 - f. Street Lights
 - g. Any other relevant details
6. Striping and Signage Plan Sheet with details shall include:
- a. Street Names
 - b. Traffic Control Signage locations and types with references to MUTCD designations
 - c. Pavement Marking locations and types with references to MUTCD and FHWA designations
 - d. City Standard details for signage and striping
 - e. Stationing of all signage and start and stop locations for striping
 - f. Traffic calming locations and details.
 - g. Phase boundaries and identification of what will be completed with each phase.
7. Lighting/Electrical Plan with details shall include:
- a. Lighting locations and types.
 - b. Photometric plan for parking areas and open spaces.
 - c. Lighting details
 - d. Phase boundaries and identification of what will be completed with each phase.
 - e. Location of power sources, conduit, and utility boxes
 - f. City Standard Notes for Lighting Plans including:
 - i. Post-approval alterations to lighting plans or intended substitutions for approved lighting equipment shall be submitted to the City for review and approval.

- ii. The City reserves the right to conduct post-installation inspections to verify compliance with the City's requirements and approved Lighting Plan commitments, and if deemed appropriate by the City, to require remedial action at no expense to the City.
 - iii. All exterior lighting shall meet IESNA full-cutoff criteria unless otherwise approved by the City."
- 8. Landscaping and Irrigation Plan Sheet shall include:
 - a. Detailed landscaping plans with designations for all areas and what surface treatments they shall receive
 - b. Locations of all planting, designations for planting types and a comprehensive planting schedule
 - c. Planting and landscaping details
 - c. Detailed Irrigation design with the location of all valves, filters, and other appurtenances
 - d. Metered Points of Connection
 - e. Fencing locations, types and complete details for fences, posts, gates, and mow strips
 - f. Complete design of all open spaces including trails, pavilions, play areas, and other amenities including labels, dimensions, manufacture, model numbers, and all applicable details and typical sections.
- C. As-built drawings shall be printed on standard D-size mylar and be accompanied by a CD containing electronic copy and contain all information containing construction drawing with any field changes and modifications, including but not limited to:
 - a. Street light alignment, location of conduit, power sources, and street lights.
 - b. Location of Fire Hydrants, culinary water, secondary water, and sewer laterals stubbed into each lot with dimensions reference to permanent surface improvements.
 - c. Landscaping and Irrigation improvements.
 - d. As-Builts shall comply with Section 01780.
 - e. As-Builts shall be stamped and signed by a professional engineer with signature block stating "I have field verified that these record drawings are complete and accurately represent what was constructed for this project."
 - f. Pond Certification form stamped and signed by a professional engineer.

END OF SECTION