

CITY OF ZILLAH GENERAL SEWER PLAN





January 2021 PROJECT NO. 17063E

CITY OF ZILLAH

GENERAL SEWER PLAN



Prepared by



PROJECT NO. 17063E

January 2021

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INTRODUCTION AND EXECUTIVE SUMMARY





INTRODUCTION

The City of Zillah is located in the south-central portion of Washington State in Yakima County, as shown on Figure 1-1 - State Vicinity Map. The City lies just north of Interstate 82, approximately 18 miles southeast of the City of Yakima. Along with increasing growth within the Yakima Valley, there has been a rise in population within the City of Zillah. A future service area for Zillah, known as the Urban Growth Area, has been established through the Growth Management Act planning process. This updated General Sewer Plan will provide Zillah with one component of its Capital Facilities Plan for future services within both the City and its Urban Growth Area (UGA).

This General Sewer Plan includes the approximate location and description of existing and future trunk and interceptor sewers, pumping stations, local service areas, and the sewer collection system to serve those areas. The sections of this Plan describe the basis for development of planning areas, growth projections, forecasted municipal wastewater loadings, and design criteria for recommended collection system improvements. Maps showing the existing sewer system are included in the back pockets of this report.

Zillah recognizes the need to improve and expand its sewer system to meet the demands of system users and to keep pace with other growth-oriented improvements in this vital Yakima County community. HLA Engineering and Land Surveying, Inc., was authorized by the City of Zillah to prepare this updated General Sewer Plan, which represents the culmination of planning and data collection efforts.

REQUIREMENTS

State regulation 173-240-050 WAC specifies that a General Sewer Plan include the following information:

- Purpose and need for the proposed plan.
- A discussion of who will own, operate, and maintain the system.
- The existing and proposed service boundaries.
- Layout map, including existing and proposed sewers, existing and proposed pump stations and force mains, topography and elevations, streams, lakes, and other bodies of water, and location of major water system components.
- Current and future population.
- Existing domestic or industrial wastewater facilities within the vicinity of the general plan area.
- A discussion of any infiltration and inflow problems.
- A statement regarding provisions for and adequacy of wastewater treatment.
- List of all sources of, and quality and quantity of, industrial wastewater discharged to the system.
- Location of private and public wells or other sources of water supply.
- Alternatives evaluated.
- Financial evaluation, including the cost per service in terms of both debt service and operation and maintenance costs.
- A statement regarding compliance with any adopted water quality management plan under the Federal Water Pollution Control Act as amended.
- A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA).

PURPOSE AND OBJECTIVE OF PLAN

This General Sewer Plan has been developed to serve as a guide for the expansion of the City of Zillah's wastewater collection, treatment, and disposal facilities. The following major components are included in this Plan:

• Definition of the planning area, determination of the areas in and around Zillah most likely to grow, and the projected population increases.





- Development of estimates for the current quantity of wastewater and the projected quantity to be generated within the planning area.
- Evaluation of the capacity and condition of the existing sewer system, including lift stations.
- Recommendations for extension of the existing sewer system, including lift stations.
- Development of design standards for extension of sewers.
- Review and evaluation of the existing treatment and disposal facilities.
- Development of policies for the extension of sewer service.

The sections of this Plan describe the basis for development of planning areas, growth projections, forecast wastewater loadings, and design criteria for recommended improvements. By regulation, general sewer plans are required to contain maps showing sources of drinking water supply, storage, and treatment. Major City of Zillah water system components are shown on Figure 3-1.

An equally important reason for developing a general sewer plan is to assure orderly growth of the system while maintaining reliable wastewater collection and treatment service. This Plan is intended to guide sewer utility actions in a manner consistent with other activities taking place in the community.

SUMMARY OF SYSTEM ANALYSIS

A hydraulic analysis of the existing Zillah collection system was performed to evaluate the capacity of the system and to identify specific hydraulic loading problem areas. The computer-assisted analysis involves using pipe sizes and slopes to develop a model of the main trunk lines of the sewer system. The analysis also examined the capacities of the existing lift stations. The results of the analysis show:

- <u>Existing System</u>: No hydraulic problems were found in the existing system. Collection system pipelines, lift stations, and force mains all have adequate capacity to handle the existing flows and no improvements are needed for capacity reasons. However, improvements to the existing system are needed to address high maintenance areas.
- <u>Year 2039 System</u>: Upon completion of the year 2039 hydraulic analysis, capacity related limits were beginning to be reached within the existing collection system. Year 2039 capacity deficiencies were related to the City's sewer trunk main that follows an old railroad alignment from the west city limits to the Wastewater Treatment Plant (WWTP). The City's two existing lift stations have adequate capacity to meet projected Year 2039 peak flows.
- <u>Full Build-Out System</u>: The hydraulic analysis was completed to examine existing and proposed future sewer network at peak flows generated by the complete development within both the City and the UGA. Flows from the future collection basins were modeled and routed through the existing collection system to examine capacity and determine potential problem areas. The City's sewer trunk main that follows an old railroad alignment from the west city limits to the WWTP was found to have insufficient capacity to handle the projected full build-out flows, and the capacity rating of the plant will be exceeded. The City's two existing lift stations have adequate capacity to meet projected full build-out peak flows, based upon the projected type and location of future growth.





SUMMARY OF RECOMMENDED IMPROVEMENTS

Improvements to the existing collection and treatment system, and expansion to accommodate future growth are identified within Chapter 7 of this Plan. The following is a summary of the recommended improvements (see Figure 7-1):

Maintenance Improvements:

The following improvements are proposed to correct areas within the existing collection system that, through routine maintenance, have been identified as needing attention to address potential problems such as inadequate pipe slopes, separated joints, or root/debris intrusions;

- 1. Sewer Trunk Main Replacement (West city limits to Chevne Road).
- 2. Vintage Valley Road 8-inch Sewer Main Replacement (First Avenue to the Vintage Valley lift station).
- 3. 4th Street, Glenwood Drive, and Westwind Drive 8-inch Sewer Main Replacement.
- 4. First Avenue 8-inch Sewer Main Replacement (Maple Way to Meade Drive and Maple Way to Pearson Street).
- 5. Adams Park 8-inch Sewer Main Replacement (Between Adams Park Drive and Sunset Way).
- 6. Ann Street and Walnut Street 8-inch Sewer Main Replacement.
- 7. Buried Manhole Replacement.

Capacity Improvements:

The following improvement is proposed to address future capacity-related deficiencies within the existing collection system that resulted from the future collection system hydraulic analysis:

8. Sewer Trunk Main Replacement (Cheyne Road to WWTP).

Miscellaneous Improvements:

The following miscellaneous improvement to the City's existing lift stations is necessary to improve station reliability, control and monitoring capability, and failure response time:

Vintage Valley and Zillah West Lift Station Improvements.

WWTP Improvements:

10. Replace or upgrade process equipment at the WWTP which are high maintenance items, inoperable, or provide improved performance.

SCHEDULE OF IMPROVEMENTS AND ESTIMATED COSTS

It is recommended that Zillah proceed with construction of improvements referenced in Chapter 7, and as shown on Figure 7-1. Estimated costs (in 2020 dollars) for construction of the improvements recommended in the previous section are presented in Chapter 7.

ESTIMATED COSTS AND PROPOSED SEWER SYSTEM FINANCIAL PROGRAM

Developing a plan for project financing involves examining current system expenditures and revenues, integrating the schedule and costs of the recommended improvements into the City's financial structure, recommending funding sources, and developing a method to pay for the identified improvements. Most of the recommended wastewater collection system improvements are necessary to reduce operation and maintenance costs and improve system performance, rather than increase capacity. A schedule and





estimate of costs for recommended improvements are provided in Section 7.3 of this Plan. Timing of the improvements has been developed to allow the City to meet the most pressing needs yet maintain positive fund balances.

Revenue increases were necessary to fund recommended system improvements and are included in the proposed operating and reserve fund financial programs provided in Chapter 7. These rate increases were initiated in January 2020. However, due to unknowns related to operating expenses and growth, the City should continue to monitor system finances and make necessary annual adjustments in rates to meet expenses. Future grant/loan funding may also be necessary to finance recommended system improvements without negatively affecting existing fund balances. However, the projects have been scheduled to avoid requiring loans to complete in the financial model. If development increases sooner than anticipated, or if the existing system conditions change so the identified improvements are required to be implemented sooner than shown in the plan, loans are likely to be required to complete one or more of the capital improvement projects earlier than shown in this Plan.





CHAPTER 1 -

BASIC PLANNING INFORMATION





1.1 BACKGROUND INFORMATION

1.1.1 Wastewater System Ownership

The City of Zillah, a municipal corporation located within the eastern part of Yakima County as shown on Figure 1-1 - Washington State Vicinity Map, owns and operates its own wastewater collection, treatment, and disposal system. Decisions regarding daily sewer system operations are made by the Public Works Director. Financial decisions regarding major system improvements and establishment of sewer rates are made by the Zillah City Council. The following parties are involved in the operation, maintenance, and planning for the Zillah wastewater collection, treatment, and disposal facilities:

WASTEWATER SYSTEM NAME, OWNER, AND OPERATOR:

Zillah Wastewater Treatment Plant 740 Railroad Avenue Zillah, WA 98953-9427

Owner: City of Zillah Mayor: Scott Carmack Public Works Director: John Simmons Wastewater Treatment Plant Operators: Dolly Meyer and Tyson Driesen

WASTEWATER SYSTEM CONSULTING ENGINEER:

HLA Engineering and Land Surveying, Inc. 2803 River Road Yakima, WA 98902 Phone: (509) 966-7000 Project Engineer: Dean P. Smith, PE

1.1.2 Service Area Description

The City of Zillah and its Urban Growth Area are located in eastern Yakima County, in the lower Yakima Valley, in the south-central portion of Washington State, as shown on Figure 1-1. The City lies approximately 18 miles southeast of the City of Yakima just north of Interstate 82. The City is situated at an elevation of 760 to 870 feet above mean sea level. The Yakima River lies just south of the City, and most of the older part of the City is situated on a bench separated from the Yakima River flood plain by a steep bluff.

Like the rest of the Yakima Valley, Zillah and its Urban Growth Area has a warm and dry climate. The Cascade Mountain Range acts as a barrier between Yakima County and the Pacific Ocean, keeping precipitation low and temperatures warm. The mean annual temperature range is from a low of 17.8°F to a high of 89.2°F. The median temperature is 64.7° F and mean annual precipitation is 7.2 inches. With a warm climate and rich volcanic soils, Yakima County is a significant agricultural region, as well as a recreational area.

In 2006, Zillah completed an update to its Comprehensive Plan as required by the Growth Management Act. An update and amendment of this Comprehensive plan was approved and accepted by the planning commission in June 2017. Zillah's Urban Growth Area (UGA) boundary includes land northeast of the Yakima Valley Highway. Zillah's existing and future sewer service area boundaries are shown on Figure 1-2 – Existing and Future Sewer Service Area Boundaries. Zillah's existing sewer service area boundary generally corresponds to the city limits while the future sewer service area boundary generally corresponds to the UGA.









EXISTING AND FUTURE SEWER SERVICE AREA BOUNDARIES

LEGEND



Zillah City Limits

Zillah UGA Boundary

Zillah Proposed UGA

Toppenish City Limits

Toppenish UGA Boundary



01/06/2021 P:\arcview\2017\17063\FIG 1-2.mxd 2803 River Road Yakima, WA 98902 509.966.7000 Fax 509.965.3800 www.hlacivil.com





Zillah's economy depends largely on the agricultural industry and has most recently been impacted by the wine and tourism industry. Zillah is located in the heart of Washington Wine Country and is quickly becoming known for its quality wine production, attracting tourists to wine tastings and other related events. The City also has a viable commercial and service business community.

1.1.3 Wastewater System History

The City of Zillah was incorporated in 1911, after its population grew due to agricultural development with the construction of the Sunnyside Canal in the 1890's. The City's original sewer collection system was constructed in 1908 and the WWTP was constructed in 1950. Table 1-1 provides a summary of the development of and some of the major improvements to the City's sewer system starting in 1908.

TABLE 1-1 – MAJOR SEWER SYSTEM IMPROVEMENTS				
Year	Improvement Description			
1908	Zillah collection system constructed			
1950	Original WWTP constructed			
1977	Existing WWTP constructed			
1994	Improvements to WWTP completed (capacity increased to 0.313 MGD)			
1998	Growth Management Act Comprehensive Plan completed			
1999	Inflow and Infiltration Evaluation completed			
2000	General Sewer Plan completed			
2002	Wastewater Facility Plan completed			
2006	Growth Management Act Comprehensive Plan update completed			
2007	WWTP upgraded (capacity increased to 0.49 MGD)			
2008	Zillah Lakes low-pressure sewer system constructed			
2017	Vintage Valley Lift Station pumps replaced			

1.2 RELATED PLANNING DOCUMENTS

1.2.1 Wastewater Plans

In 2000 and 2012, the City of Zillah completed a General Sewer Plan for the City and its Urban Growth Area (UGA). These documents include:

- 1. Description of the existing (City Limits) and future (UGA) sewer service area;
- 2. Estimate of future sewer service population based upon the current population;
- 3. Forecast of future wastewater loadings based on sewer service population predictions;
- 4. Description and location of existing sewer system, WWTP, and potable water supply components; and
- 5. Design standards for recommended sewer system improvements and a financial plan.

The General Sewer Plan provided Zillah with a component of its Capital Improvement Plan for providing future services within both the City and the UGA.





1.2.2 Wastewater Facility Plan

In 2002, the City of Zillah completed a Wastewater Facility Plan. This document included:

- 1. Description of existing and future sewer service area, population projections, and regulatory requirements;
- 2. Description of existing wastewater treatment facilities and wastewater flows and loadings;
- 3. Presentation and evaluation of four alternatives to the biological treatment capacity of the facility to accommodate the City's projected growth and to meet pending regulatory requirements; and
- 4. Recommendation of a wastewater treatment upgrade alternative and financial strategy for implementation.

1.2.3 Urban Growth Area Comprehensive Plan

The City of Zillah completed and adopted its current Growth Management Act Comprehensive Plan in 2017. This Plan identifies many of the physical, environmental, and economic elements within the City and its UGA, and attempts to forecast anticipated changes within that geographical area. Understanding and predicting future changes within the City and its UGA are critical in forecasting future sewer collection system flows and loading.

In its Urban Growth Area Comprehensive Plan, the City of Zillah updated its UGA with a proposed new boundary. This proposed area is located northeast of the existing UGA and extends out to the Yakima Valley Highway. Zillah can serve this proposed area and has considered expanding its existing UGA to the proposed UGA boundary to accommodate the expected growth of the City. Designation of land uses are also discussed in the Plan and the results are reflected in the City's future zoning.

1.2.4 Water System Plans

The City's Water System Plan was most recently updated in 2016. This document provided Zillah with an in-depth look at their water system, its deficiencies, potential growth, and needs. Completion of the City's original Comprehensive Water Plan took place in 2000.

1.3 NEIGHBORING/ADJACENT WASTEWATER SYSTEMS

No other municipal wastewater systems exist within Zillah's UGA. The nearest municipal wastewater treatment and disposal systems include the Wapato Wastewater Treatment Plant, located 12 miles to the northwest and the Toppenish Wastewater Treatment Plant, located 5 miles south of Zillah. The community of Buena, immediately northwest of the City of Zillah, collects and disposes of wastewater through individual on-site septic tanks and an effluent treatment system. The Buena water and wastewater systems are currently owned and operated by Yakima County.

1.4 EXISTING SERVICE AREA

The existing wastewater system serves a combination of residential, commercial, industrial, and public users within the city limits. The boundary of the current sewer service area is shown on Figure 1-2. Map A, in the back of this Plan, shows the existing Zillah sewer system, including the location of lift stations, manholes, and collection system.

The total area within Zillah's city limits is equal to approximately 1,087 acres, but the current area served by the wastewater collection system includes approximately 907 acres within the city limits. The remaining





un-zoned land includes the SVID canal, roads, right-of-way areas, portions of Interstate 82, and remote, extremely limited areas. Currently, there is one existing connection to the wastewater system outside the city limits, but it will not be considered in the General Sewer Plan projections, as it is negligible.

Existing zoning within the City of Zillah is presented in Table 1-2 and shown on Figure 1-3 – Existing Zoning Map.

TABLE 1-2 – EXISTING ZONING WITHIN ZILLAH CITY LIMITS						
Zoning Category	Total Acreage	Percent of Total				
Commercial (C-1)	53	5.8%				
Commercial Tourism (CT)	63	7.0%				
Light Manufacturing (M-1)	72	7.9%				
Public Lands/Church Zone (PC)	127	14.0%				
Planned Development (PD)	230	25.4%				
Single-Family Residential (R-1)	249	27.5%				
Two-Family Residential (R-2)	26	2.9%				
Multi-Family Residential (R-3)	27	3.0%				
Suburban Residential (SR)	60	6.6%				
TOTAL	907	100%				
Noto: The gross land within the city limits is 1.097 acros. Remaining up zoned land includes streats, right of way						

Note: The gross land within the city limits is 1,087 acres. Remaining un-zoned land includes streets, right-of-way areas, portions of Interstate 82, the SVID canal, and remote, extremely limited areas.

Residential areas (single-family, two-family, multi-family, and suburban) are the largest zoning total within the City, comprising approximately 362 acres (40% of the land within the city limits). Of the residentially zoned lands, single-family residential makes up the largest area, approximately 249 acres (27.5%) of the total area within the City.





CITY OF ZILLAH General Sewer Plan

EXISTING ZONING MAP

LEGEND

Commercial (C-1) Commercial Tourism (CT) Light Manufacturing (M-1) Public Lands/Church Zone (PC) Planned Development (PD) Single Family Residential (R-1) Two Family Residential (R-2) Multi-Family Residential (R-3) Suburban Residential (SR)



01/06/2021 P:\arcview\2017\17063\FIG 1-3.mxd 2803 River Road Yakima, WA 98902 509.966.7000 Fax 509.965.3800 www.hlacivil.com

FIGURE 1-3



1.5 FUTURE SERVICE AREA

The City of Zillah and Yakima County updated the UGA for Zillah in 2006 as part of the Growth Management Act (GMA) planning process. The UGA, which includes an area of 609 acres outside the current city limits, represents the projected future retail service area within which the City may be able to provide and maintain service. Future land use within the UGA is presented in Table 1-3 and is shown on Figure 1-4 – Future Land Use Map. A proposed UGA is also shown on Figure 1-4 and is included in Table 1-3 calculations. This proposed boundary will help accommodate the future growth in the City of Zillah.

TABLE 1-3 – FUTURE LAND USE WITHIN ZILLAH'S UGA						
Land Use Category Total Acreage Percent of Total						
Mixed Land Use	234	13.7%				
Non-Residential	401	23.4%				
Residential	1,076	62.9%				
TOTAL 1,711 100.0%						
Note: The gross land within the UGA and Proposed UGA is 1,988 acres. Remaining un-zoned land includes						

streets, right-of-way areas, portions of Interstate 82, the SVID canal, and remote, extremely limited areas.

As shown on Table 1-3, residential areas are the largest land use designation within Zillah's UGA, comprising approximately 62.9% (1,076 acres) of the total land area within the UGA.







CITY OF ZILLAH General Sewer Plan

FUTURE LAND USE MAP

LEGEND

Zillah City LimitsZillah UGA BoundaryZillah Proposed UGAToppenish City LimitsToppenish UGA BoundaryMixed Land UseNon-ResidentialResidential



01/06/2021 P:\arcview\2017\17063\FIG 1-4.mxd 2803 River Road Yakima, WA 98902 509.966.7000 Fax 509.965.3800 www.hlacivil.com





1.6 POPULATION

1.6.1 Current Population

According to the U.S. Census Bureau, the 2010 population of the City of Zillah was 2,964, an increase of approximately 34.9% (or 766 people) since 2000. Zillah's growth rate for the period 2000-2010 was approximately 3.5% per year (34.9% for the ten-year period). Historical growth in Zillah has averaged 1.9% per year since 1920. Population trends for the City of Zillah, Yakima County, and the State of Washington for the period 1920 through 2010 are presented in Table 1-4.

TABLE 1-4 – POPULATION TRENDS*							
Year	City of Zillah		Yakima County		State of Washington		
	Population	Percent Change	Population	Percent Change	Population	Percent Change	
1920	647		63,710		1,356,621		
1930	728	12.5%	77,402	21.5%	1,563,396	15.2%	
1940	803	10.3%	99,109	27.9%	1,736,191	11.1%	
1950	911	13.4%	135,723	37.1%	2,378,963	37.0%	
1960	1,059	16.2%	145,112	6.9%	2,853,214	19.9%	
1970	1,138	7.5%	145,212	0.1%	3,413,244	19.6%	
1980	1,599	40.5%	172,508	18.8%	4,132,353	21.1%	
1990	1,911	19.5%	188,823	9.5%	4,866,692	17.8%	
2000	2,198	15.0%	222,581	17.9%	5,894,121	21.1%	
2010	2,964	34.9%	243,231	9.3%	6,724,540	14.1%	
* Source: U.S. Census Bureau							

The Washington Office of Financial Management (OFM) developed population estimates for the City of Zillah and Yakima County since the 2000 census and 2010 census as shown in Table 1-5.

TABLE 1-5 – OFM POPULATION ESTIMATES*						
Year City Population Estimate Yakima County Population Estim						
2010	2,964	243,231				
2011	3,000	244,700				
2012	3,035	246,000				
2013	3,115	247,250				
2014	3,140	248,800				
2015	3,140	249,970				
2016	3,145	250,900				
2017	3,150	253,000				
2018	3,165	254,500				
* Source: Washington State Office of Financial Management (OFM)						





Zillah's population growth has slowed in the last several years after an average of 2.4% growth per year from 2004 to 2009. The population of Zillah has increased 6.3% since 2010, with an estimated 2017 population of 3,150 persons. Reasons for the increase include the construction of the Zillah Lakes development and the continuing growth of the wine industry in the area.

1.6.2 Future Population

The Yakima County Planning Division has provided a review of the UGA for the City of Zillah in a staff report dated August 26, 2016. In this report, the population projections for Zillah for the year 2040 is projected to be 5,016. This equates to an annual increase of approximately 1.7%. However, the City believes that the population increase may be even larger with the continued build-out of the Zillah Lakes planned development. To forecast future loading and wastewater generation, this report used projections developed by the City as shown in Table 1-6.

TABLE 1-6 – CITY POPULATION PROJECTIONS							
Year	Future Population	% Increase from Previous Year	Year	Future Population	% Increase from Previous Year		
2018	3,165		2029	3,874	1.78%		
2019	3,226	1.91%	2030	3,943	1.75%		
2020	3,287	1.87%	2031	4,012	1.77%		
2021	3,349	1.90%	2032	4,083	1.76%		
2022	3,412	1.86%	2033	4,155	1.75%		
2023	3,476	1.85%	2034	4,228	1.74%		
2024	3,540	1.85%	2035	4,302	1.71%		
2025	3,606	1.84%	2036	4,375	1.73%		
2026	3,672	1.80%	2037	4,451	1.70%		
2027	3,738	1.82%	2038	4,526	1.70%		
2028	3,806	1.79%	2039	4,603	1.70%		





CHAPTER 2 -

PAST AND PROJECTED WASTEWATER LOADINGS





2.1 PREVIOUS INFLUENT WASTEWATER TRENDS

2.1.1 Background

The City of Zillah provides wastewater collection, treatment, and disposal services to the residences, businesses, public facilities, and industries within the City's existing service area. Municipal sewage, consisting of wastewaters from residential and commercial users, schools, and one fruit packing operation (Stadelman Fruit LLC) flows by gravity to the main plant for treatment. A detailed description of Zillah's wastewater treatment process is located in Chapter 5 of this Plan. The existing wastewater collection system contains two sewage lift stations that convey water to the WWTP. Both pump stations serve Drainage Basin No. 1, including the planned development, Zillah Lakes. The Zillah Lakes area is served by a low-pressure system with individual grinder pumps and wet wells installed at each home. A detailed description of the lift stations and existing collection system is located in Chapter 3 of this Plan.

Loading data of the past six years has not been affected by the City's growth. Zillah's population has steadily increased over this period and the loading data reflects this with slight increases over the past six years.

2.1.2 System Capacity

Zillah's current National Pollutant Discharge Elimination System (NPDES) permit, issued by the Washington Department of Ecology in 2017, specifies the following design criteria for the WWTP. The City of Zillah has provided wastewater treatment and disposal services and system capacity is governed by the WWTP design criteria, as given in Table 2-1.

TABLE 2-1 – ZILLAH WASTEWATER TREATMENT PLANT DESIGN CRITERIA					
Parameter Design Quantity					
Maximum Month Design Flow (MMDF)	0.49 MGD				
Peak Instantaneous Design Flow (PIDF)	1.02 MGD				
BOD₅ Loading for Maximum Month 1,064 lbs/day					
TSS Influent Loading for Maximum Month 1,107 lbs/day					

The upgrade to the facility in 2007 increased the capacity of the WWTP from 0.313 MGD to 0.490 MGD on a maximum monthly basis and was anticipated to serve the needs of the community through 2021.

2.1.3 Influent Wastewater Flows

Influent wastewater flows to Zillah's WWTP for the period 2011 through 2018 are presented in Table 2-2. "Summer flows" represent the average flows for the months of June through September, while "winter flows" represent the average flows for the months of December through February. During the analysis of the flow and loading data for this General Sewer Plan, it was discovered that the influent flow meter was not set up to capture flow events above 702 gpm. However, there is evidence that during peak fruit processing periods at Stadelman Fruit, there are times when the 702 gpm limit on the flow meter was being exceeded. The meter set-up was adjusted in April 2018 to capture peak flows. Therefore, 2016 and 2017 are low compared to water meter flow data. The timing of this correction factor corresponds to when Stadelman's new cherry packing facility was placed in service.





TABLE 2-2 – INFLUENT WASTEWATER FLOWS 2011-2018								
(Values are in MGD)								
	2011	2012	2013	2014	2015	2016	2017	2018
January	0.200	0.191	0.196	0.191	0.203	0.208	0.220	0.242
February	0.194	0.190	0.201	0.196	0.200	0.201	0.231	0.240
March	0.200	0.191	0.193	0.191	0.267	0.194	0.223	0.240
April	0.200	0.196	0.199	0.196	0.145	0.193	0.230	0.249
Мау	0.210	0.200	0.206	0.198	0.201	0.222	0.225	0.257
June	0.240	0.256	0.242	0.287	0.258	0.273	0.269	0.302
July	0.260	0.237	0.227	0.251	0.218	0.234	0.205	0.286
August	0.210	0.201	0.224	0.228	0.215	0.223	0.250	0.252
September	0.220	0.213	0.229	0.233	0.216	0.226	0.270	0.239
October	0.230	0.231	0.221	0.233	0.213	0.247	0.267	0.254
November	0.210	0.200	0.203	0.214	0.204	0.218	0.262	0.232
December	0.190	0.198	0.201	0.208	0.214	0.208	0.241	0.231
Average	0.214	0.209	0.212	0.219	0.213	0.221	0.241	0.252
Summer	0.237	0.231	0.231	0.255	0.230	0.243	0.241	0.280
Winter	0.205	0.190	0.198	0.196	0.204	0.207	0.220	0.241
Maximum Month	0.260	0.256	0.242	0.287	0.267	0.273	0.270	0.302
Maximum Day	0.392	0.700*	0.377	0.344	0.315	0.333	0.343	0.404
* Maximum day value in 2012 was abnormally high and attributed to a screen malfunction which backed up flow in the Parshall								

⁷ Maximum day value in 2012 was abnormally high and attributed to a screen malfunction which backed up flow in the Parshall flume resulting in an inaccurate reading.

Average annual influent flows to the WWTP have ranged from a low of 0.209 MGD in 2012 to a high of 0.252 MGD in 2018. Average influent summer flows have ranged from a low of 0.230 MGD in 2015, to a high of 0.280 MGD in 2018. Average influent winter flows have ranged from a low of 0.190 MGD in 2011-2012 to a high of 0.241 MGD in 2017-2018. The greatest maximum monthly flow occurred in 2018 when the treatment plant received an average of 0.302 MGD for the month of June. This influent flow represents 61.6% of the design hydraulic capacity (average flow for the maximum month) of the Zillah WWTP.

Despite the population increases, the hydraulic loading from 2010-2015 remained consistent. After 2015, Stadelman's new cherry packing facility began operations, accounting for the average annual increase of approximately 17% in years 2016, 2017, and 2018. Table 2-3 shows the population changes and the per capita hydraulic loading for the period 2011 through 2018.





TABLE 2-3 – PER CAPITA INFLUENT WASTEWATER HYDRAULIC LOADING 2011-2018 (Values are in gallons per person per day)								
	2011	2012	2013	2014	2015	2016	2017	2018
Population	3,000	3,035	3,115	3,140	3,140	3,145	3,150	3,165
Average Annual per Capita Flow	71.2	68.8	68.0	69.7	67.8	70.2	76.5	79.6
Average Summer per Capita Flow	77.5	74.7	74.0	79.5	72.2	76.1	78.9	85.2
Average Winter per Capita Flow	68.2	62.7	63.7	62.4	64.9	66.0	69.7	76.1
Maximum Month per Capita Flow	86.7	84.3	77.7	91.4	85.0	86.8	85.7	95.4
Maximum Day per Capita Flow	130.7	104.4	121.0	109.6	100.3	105.9	108.9	127.6

2.1.4 Influent Biochemical Oxygen Demand (BOD₅) Loadings

Influent BOD₅ loadings to Zillah's WWTP for the period 2011 through 2018 are presented on Table 2-4. "Summer loadings" represent the average loadings for the months June through September, while "winter loadings" represent the average loadings for the months December through February.

TABLE 2-4 – INFLUENT WASTEWATER BOD₅ LOADINGS 2011-2018								
		(Va	alues are in	pounds per	day)			
	2011	2012	2013	2014	2015	2016	2017	2018
January	368	332	284	371	449	360	439	613
February	367	305	283	410	369	451	651	578
March	354	353	325	389	657	487	671	659
April	414	335	398	440	353	528	501	650
Мау	423	309	376	360	376	474	460	618
June	437	374	309	385	467	521	532	621
July	488	295	254	316	358	580	438	677
August	361	225	319	274	360	461	659	654
September	420	345	531	233	331	380	565	526
October	378	370	459	591	451	443	479	731
November	383	314	442	464	354	433	570	716
December	336	244	407	541	331	387	567	738
Average	394	317	366	398	405	459	544	648
Summer	429	298	294	325	395	485	548	620
Winter	359	324	271	396	453	381	492	586
Maximum Month	488	374	531	591	657	580	671	738
Maximum Day	632	966	659	1,278	1,247	931	1,130	1,159





Average annual influent BOD₅ loadings to the treatment plant have ranged from a low of 317 lbs/day in 2012 to a high of 648 lbs/day in 2018. Average influent summer BOD₅ loadings have ranged from a low of 294 lbs/day in 2013, to a high of 620 in 2018. Average influent winter BOD₅ loadings have ranged from a low of 271 lbs/day in 2013-2014 to a high of 586 lbs/day in 2017-2018. The greatest maximum monthly BOD₅ loading occurred in 2018 when the treatment plant received an average of 738 lbs/day for the month of December. This influent loading represents 69.4% of the BOD₅ design capacity (loading for the maximum month) of the Zillah WWTP.

Table 2-5 shows the population changes and the per capita BOD₅ loading for the period 2011 through 2018.

TABLE 2-5 – PER CAPITA INFLUENT WASTEWATER BOD₅ LOADINGS 2011-2018 (Values are in pounds BOD₅ per capita per day)										
								2018	Average	
	2011	2012	2013	2014	2015	2016	2017		2011- 2018	2016- 2018
Population	3,000	3,035	3,115	3,140	3,140	3,145	3,150	3,165		
Average Annual per Capita BOD₅	0.131	0.104	0.117	0.127	0.129	0.146	0.173	0.205	0.142	0.174
Average Summer per Capita BOD ₅	0.143	0.098	0.094	0.104	0.126	0.166	0.172	0.206	0.139	0.181
Average Winter per Capita BOD ₅	0.120	0.107	0.087	0.126	0.144	0.121	0.156	0.185	0.131	0.154
Maximum Month per Capita BOD₅	0.163	0.123	0.170	0.188	0.209	0.184	0.213	0.233	0.186	0.210
Maximum Day per Capita BOD₅	0.211	0.318	0.212	0.407	0.397	0.296	0.359	0.366	0.321	0.340

The average since the new Stadelman cherry packing facility became operational (2015-2018) is noticeably higher than the years prior.

2.1.5 Influent Total Suspended Solids (TSS) Loadings

Influent TSS loadings to Zillah's WWTP for the period 2011 through 2018 are presented on Table 2-6. "Summer loadings" represent the average loadings for the months of June through September, while "winter loadings" represent the average loadings for the months of December through February.

Average annual influent TSS loadings to the treatment plant have ranged from a low of 306 lbs/day in 2012 to a high of 445 lbs/day in 2018. Average influent summer TSS loadings have ranged from a low of 298 lbs/day in 2015, to a high of 575 lbs/day in 2018. Average influent winter TSS loadings have ranged from a low of 309 lbs/day in 2011-2012 to a high of 417 lbs/day in 2015-2016. The greatest maximum monthly TSS loading occurred in 2018 when the treatment plant received an average of 648 lbs/day for the month of July. This influent loading represents 58.5% of the TSS design capacity (loading for the maximum month) of the Zillah WWTP.

Table 2-7 shows the population changes and the per capita TSS loading for the period 2011 through 2018. The per capita BOD_5 loading shown in Table 2.5, indicates only a minor increase in TSS loading since the connection of Stadelman's new cherry packing facility.





TABLE 2-6 – INFLUENT WASTEWATER TSS LOADINGS 2011-2018								
	(Values are in pounds per day)							
	2011	2012	2013	2014	2015	2016	2017	2018
January	276	278	335	322	435	423	284	394
February	319	304	313	322	367	376	252	382
March	393	324	315	451	367	372	219	456
April	375	280	325	298	238	319	324	389
Мау	305	262	333	324	240	341	357	421
June	385	322	359	254	273	410	399	478
July	473	263	303	358	236	318	315	648
August	354	322	372	329	386	218	357	599
September	317	307	363	385	418	185	378	407
October	302	370	413	383	519	212	390	386
November	326	297	376	334	333	249	476	350
December	346	347	406	331	453	281	416	428
Average	348	306	351	341	355	309	347	445
Summer	404	302	345	314	298	315	357	575
Winter	325	309	332	350	378	417	273	397
Maximum Month	473	370	413	451	519	423	476	648
Maximum Day	810	537	615	660	1,061	624	757	805

TABLE 2-7 – PER CAPITA INFLUENT WASTEWATER TSS LOADINGS 2011-2018 (Values are in pounds TSS per capita per day)										
	2011	2012	2013	2014	2015	2016	2017	2018	Ave 2011- 2018	rage 2016- 2018
Population	3,000	3,035	3,115	3,140	3,140	3,145	3,150	3,165		
Ave. Annual per Capita TSS	0.116	0.101	0.113	0.109	0.113	0.098	0.110	0.141	0.113	0.116
Ave. Summer per Capita TSS	0.135	0.100	0.111	0.100	0.095	0.100	0.113	0.182	0.117	0.132
Ave. Winter per Capita TSS	0.108	0.102	0.107	0.111	0.120	0.133	0.087	0.126	0.112	0.115
Max. Month per Capita TSS	0.158	0.122	0.133	0.144	0.165	0.134	0.151	0.205	0.151	0.163
Max. Day per Capita TSS	0.270	0.177	0.197	0.210	0.338	0.198	0.240	0.254	0.236	0.231





2.1.6 Significant Industrial Users

The only significant industrial user in the City of Zillah is the Stadelman Fruit Company, which owns and operates two fruit packing facilities that cover approximately 22 acres of light manufacturing, and two acres of commercially zoned land. Stadelman Fruit discharges wastewater to the City of Zillah under their National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge General Permit for the Fresh Fruit Packing Industry. They currently have authorization to discharge a combined total of about 11-million gallons per year, or 0.133 MGD, from two packing facilities. The historical flows listed in Table 2-6 reflect an increase in flows and loading due to Stadelman's expansion beginning in 2016 as discussed previously. However, since their expansion is on-going, more impacts are expected during the peak packing season. Their cherry packing operations run for approximately 45 days a year (from June to July) and their apple packing operations run for approximately 210 days a year (from August to May). Stadelman Fruit falls under the requirements of 40 CFR Part 403 as a Significant Industrial User (SIU) which requires additional monitoring per Section S6 of the City of Zillah's NPDES permit.

In October 2019, a sewer flow meter was installed at the Meade Stadelman facility which operates using its own potable water well for process water. The flow from this facility was not measured previously. Therefore, future data will show a more accurate impact of the Stadelman facilities on the City of Zillah WWTP.

2.2 FUTURE WASTEWATER LOADING PROJECTIONS

Forecasts for future wastewater generation in terms of flow, BOD₅, and TSS from the City of Zillah were developed using the following information and assumptions:

- Future sewer service populations are as presented in Table 1-6.
- The average annual, summer, winter, maximum month, and maximum day per capita flow values are as shown in Table 2-3.
- The average annual, summer, winter, maximum month, and maximum day per capita BOD₅ values are as shown in Table 2-5.
- The average annual, summer, winter, maximum month, and maximum day per capita TSS values are as shown in Table 2-7.

Forecasts for future wastewater generation in terms of flow, BOD₅, and TSS from the City of Zillah for the years 2024, 2029, 2034, and 2039 are presented in Table 2-8, Table 2-9, and Table 2-10.

TABLE 2-8 – FUTURE ZILLAH WASTEWATER FLOW PROJECTIONS (Values are in million gallons per day)							
	Year 2024	Year 2029	Year 2034	Year 2039			
Population	3,540	3,874	4,228	4,603			
Average Annual Flow	0.266	0.291	0.318	0.346			
Average Summer Flow	0.301	0.330	0.360	0.392			
Average Winter Flow	0.259	0.283	0.309	0.336			
Maximum Month Flow	0.315	0.345	0.376	0.410			
Maximum Day Flow	0.453	0.496	0.541	0.599			





TABLE 2-9 – FUTURE ZILLAH WASTEWATER BOD₅ PROJECTIONS (Values are in pounds per day)						
	Year 2024	Year 2029	Year 2034	Year 2039		
Population	3,540	3,874	4,228	4,603		
Average Annual BOD5	670	733	800	871		
Average Summer BOD ₅	639	700	763	831		
Average Winter BOD5	544	595	650	707		
Maximum Month BOD5	783	857	935	1,018		
Maximum Day BOD₅	1,201	1,314	1,434	1,561		

TABLE 2-10 – FUTURE ZILLAH WASTEWATER TSS PROJECTIONS (Values are in pounds per day)						
	Year 2024	Year 2029	Year 2034	Year 2039		
Population	3,540	3,874	4,228	4,603		
Average Annual TSS	377	413	450	490		
Average Summer TSS	465	509	555	604		
Average Winter TSS	405	444	484	527		
Maximum Month TSS	529	579	631	687		
Maximum Day TSS	815	892	973	1,060		

As stated in section 2.1.2, the current design standard for maximum monthly average flow for the City of Zillah is 0.490 MGD. Zillah's 2018 maximum month average daily flow was 0.302 MGD, as shown in Table 2-2, which leaves an available increase in maximum month average daily flow of 0.188 MGD. The maximum month flow is expected to reach 0.410 MGD by the year 2039, which is 83.6% the design rated flow capacity for the plant.

The NPDES permit requires the City to complete a plan to maintain adequate capacity when a level of 85% of the permitted maximum month design flow is reached for three consecutive months. This maximum month average is predicted to be reached by 2040. Likewise, an expansion to increase the plant capacity is expected to be required by 2044, based on the increased flow projections presented in Table 2-8.

The current design standard for maximum monthly average BOD₅ for the City of Zillah is 1,064 pounds per day. The 2018 maximum monthly average BOD₅ was 738 pounds per day (68.4% of design capacity), as shown in Table 2-4, which leaves an available increase of 326 pounds per day in the maximum month daily average of BOD₅. The BOD₅ maximum month daily average is projected to reach 1,018 pounds per day by the year 2039, as shown in Table 2-9 above. 85% of BOD₅ design capacity is expected to be reached by 2033, and 90% is expected to be reached in 2036. However, changes in the industrial loading may affect these dates significantly as indicated by the BOD₅ loading increases measured since the new cherry packing facility was placed into operation in 2016.

The current design standard for maximum monthly average TSS for the City of Zillah is 1,107 pounds per day. Zillah's 2018 maximum monthly average TSS was equal to 648 pounds per day, as shown in Table 2-6, which leaves an available increase in maximum month average daily TSS of 459 pounds per day. Maximum month average daily TSS is projected to reach 687 pounds per day by the year 2039, as shown in Table 2-10 above.





CHAPTER 3 -

EXISTING COLLECTION SYSTEM





3.1 GENERAL DESCRIPTION

The Zillah wastewater collection system consists of approximately 98,950 linear feet of pipe, with 80,820 consisting of gravity sewer pipe and 18,130 consisting of forcemain pipe. Most of the pipe is 8-inch diameter. The approximate lengths of various pipe sizes are shown in Table 3-1.

TABLE 3-1 – ZILLAH SEWER SYSTEM PIPING				
Pipe Size and Type	Length (Linear Feet)			
4-inch Gravity Sewer	970			
6-inch Gravity Sewer	1,690			
8-inch Gravity Sewer	71,720			
10-inch Gravity Sewer	5,780			
12-inch Gravity Sewer	660			
2-inch Forcemain	2,550			
3-inch Forcemain	1,420			
4-inch Forcemain	3,140			
6-inch Forcemain	11,020			
TOTAL	98,950			

The general layout of the City's existing collection system, including pipe sizes, is shown in Figure 3-1 – Sewer Collection System Map. The location of major water system components, including wells, reservoirs, and pump stations, is also shown on Figure 3-1 for reference.

3.2 COLLECTION SYSTEM BASINS

The existing collection system can be divided into six drainage basins for purposes of analyzing system performance. The six existing collection system basins are shown on Figure 3-2 – Existing Collection Basin Boundaries, and are discussed below.

Basin No. 1: The area within Basin No. 1 is zoned commercial tourism and planned development. Basin No. 1 is located in the southwest portion of the service area, below the steep bluff which separates it from the remainder of the City. Wastewater from the planned development area flows through 2-inch, 3-inch, 4-inch, and 6-inch force mains to the Vintage Valley lift station located near the Tuscan Sands Casino, on Vintage Valley Parkway. Wastewater collected east of Second Avenue flows to the Zillah West Lift Station, which discharges to the gravity sewer in Vintage Valley Parkway. Vintage Valley Parkway and Zillah West Drive contain gravity sewers that flow to the two lift stations. Wastewater from the Vintage Valley lift station is pumped through a 6-inch forcemain to the Basin 2 10-inch gravity sewer trunk main, then to the 12-inch trunk main before entering the WWTP. The area of this basin is approximately 311 acres.

<u>Basin No. 2</u>: The area within Basin No. 2 is zoned light manufacturing, commercial, residential, and public lands/church zone. It lies within the central portion of the service area. One of the Stadelman Fruit Company packing facilities, as discussed in section 2.1.6, is located in this basin. Wastewater from this basin flows to the 10-inch gravity sewer trunk main that follows the old railroad alignment from the west city limits to the 12-inch trunk main, which flows to the WWTP. The area of Basin No. 2 is approximately 229 acres.





CITY OF ZILLAH General Sewer Plan

SEWER COLLECTION SYSTEM MAP

LEGEND



- Zillah City Limits
 - Zillah UGA Boundary
 - Zillah Proposed UGA
 - Toppenish City Limits
 - Toppenish UGA Boundary
 - Lift Station
 - Gravity Sewer
- ----- Forcemain
 - Manhole

WATER SYSTEM COMPONENTS

- Pump Station
- Reservoir
- Well







FIGURE 3-1



<u>CITY OF ZILLAH</u> General Sewer Plan

EXISTING COLLECTION BASIN BOUNDARIES

LEGEND

	Zillah City Limits
	Zillah UGA Boundary
	Zillah Proposed UGA
[]	Toppenish City Limits
	Toppenish UGA Boundary
	Basin 1
	Basin 2
	Basin 3
	Basin 4
	Basin 5
	Basin 6
	Gravity Sewer
	Forcemain
•	Manhole
•	Manhole selection
•	Lift Station
	EXAMPLEA 2803 River Road Yakima, WA 98902 509.966.7000 Fax 509.965.3800

01-06-21 P:\arcview\2017\17063\FIG 3-2.mxd

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<u>Basin No. 3</u>: The area within Basin No. 3 is zoned residential, light manufacturing, public lands/church zone, and commercial. It encompasses the area immediately to the north and east of the WWTP. The other Stadelman Fruit Company packing facility is located in this basin. Wastewater from Basin No. 3 flows through an 8-inch gravity sewer trunk main to the 12-inch sewer trunk main, which flows to the WWTP. The area of this basin is approximately 37 acres.

<u>Basin No. 4</u>: The area within Basin No. 4 is zoned residential, public lands/church zone, commercial, and light manufacturing. It is located to the west and south of the SVID canal. Wastewater from this basin flows to an 8-inch gravity sewer main that connects to the 10-inch gravity trunk main in Basin 2. The area of this basin is approximately 102 acres.

<u>Basin No. 5</u>: The area within Basin No. 5 is zoned residential and public lands/church zone. It encompasses the area between Basin 4 and Basin 6 to the east city limits. Wastewater from this basin flows through 8-inch gravity sewer mains to the 8-inch sewer trunk main in Basin 3, which flows to the 12-inch trunk main and then to the WWTP. The area of this basin is approximately 150 acres.

Basin No. 6: The area within Basin No. 6 is zoned residential, light manufacturing, commercial, and public lands/church zone and is located east of the WWTP from First Avenue, north to Second Avenue. Wastewater from this basin flows through 8-inch gravity sewer mains to the 8-inch sewer trunk main in Basin 3, which flows to the 12-inch trunk main before entering the WWTP. The area of this basin is approximately 79 acres.

3.3 LIFT STATIONS

The existing wastewater collection system contains two sewage lift stations that convey wastewater to the Basin 2 collection system before flowing to the WWTP. Both lift stations serve Drainage Basin No. 1, which contains Zillah's western commercial development and the Zillah Lakes planned development. The following are characteristics of the two lift stations and their locations:

Vintage Valley Lift Station

Location:	Vintage Valley Road
Year Constructed:	2017
Number of Pumps:	2
Pump Type:	Self-Priming Centrifugal
Manufacturer:	Gorman Rupp
Wet Well Capacity:	952 gallons
Pump No. 1 Flow:	350 gal/min
Pump No. 2 Flow:	350 gal/min
Horsepower:	25 bhp
Auxiliary Generator:	No

Zillah West Lift Station

Location:	Zillah West Road
Year Constructed:	1994
Number of Pumps:	2
Pump Type:	Submersible
Manufacturer:	F.E. Myers – A Pentair Co. in Ashland, Ohio
Wet Well Capacity:	1,056 gallons
Pump No. 1 Flow:	298 gal/min
Pump No. 2 Flow:	313 gal/min
Horsepower:	3 bhp
Auxiliary Generator:	No




<u>Vintage Valley Lift Station</u>: This lift station is located on Vintage Valley Parkway and receives wastewater from the Zillah Lakes development through a network of low-pressure sewer force mains. It also receives gravity flow from commercial businesses along Vintage Valley Parkway and pumped flow from the Zillah West Lift Station. In addition to the information listed above, this lift station has an available storage volume of 4,200 gallons, when considering upstream sewer pipes and manholes. To address system reliability and maintenance issues, the lift station was replaced in November 2017, which included the addition of a standby generator.

<u>Zillah West Lift Station</u>: This lift station is located on Zillah West Road and receives wastewater from commercial businesses along Zillah West Road through a gravity sewer main. Wastewater from this lift station is pumped to the Vintage Valley Road gravity sewer. In addition to the information listed above, this lift station has an available storage volume of 2,950 gallons, when considering upstream sewer pipes and manholes.

3.3.1 Lift Station Deficiencies

Both existing lift stations have adequate hydraulic capacity to serve the existing Basin 1 collection system flows, as discussed in Section 3.4.5. The Vintage Valley Lift Station was upgraded in November 2017. However, an odor study performed in 2019 confirmed high levels of H2S in the wastewater coming from the Zillah Lakes area due to the long force main and the low number of services currently connected to the system. Therefore, a bioxide system is being recommended to be installed at the beginning of the common force main to reduce the H2S levels in the sewer discharging into the Vintage Valley Lift Station. The bioxide system and coating of the lift station wet well is scheduled to be completed during 2021 as part of the Vintage Valley Parkway extension project.

The City has a portable engine generator that can be used at the Zillah West Lift Station, and with the addition of the generator at the Vintage Valley Lift Station, both stations can be operated simultaneously in the event of a power failure.

The Zillah West Lift Station was installed in 1994 and has reached the end of it service life as evidenced by the corroded pump rails and is scheduled for a pump replacement in 2021.

3.3.2 Planned Development Low Pressure Sewer

As discussed previously, the Zillah Lakes planned development is served by a low-pressure sewer system, in which individual lift stations discharge to a network of sewer forcemain piping that is connected to the Vintage Valley Lift Station. Each lift station contains a semi-positive displacement grinder pump that is controlled by levels in the sump of the individual station. The basis of design for the Zillah Lakes low pressure sewer system is the Model 2010 grinder pump station, as manufactured by the Environmental One (E/One) Corporation. The Zillah Lakes low pressure sewer system, including the forcemain network and individual lift stations, was designed specifically to serve the current and future needs of the planned development area and, therefore, was not analyzed further as part of this Plan.

Each property owner is responsible for installation and power costs required for their individual lift station. The City assumes responsibility for repair and maintenance of the individual lift stations and forcemain piping network once installed, in accordance with paragraph B of the Zillah Municipal Code Chapter 13.16.118, a copy of which is provided in the Appendix of this Plan. Services with individual lift stations are also charged an additional monthly fee to cover the City's costs for operation and maintenance.

Currently, due to the long detention time in the forcemain from the Zillah Lakes planned development to the Vintage Valley Lift Station, odor complaints are common at, and downstream of the lift station. These complaints may decrease as the Zillah Lakes development flows are increased, decreasing duration time





wastewater is in the forcemain before being discharged into the lift station wet well. However, it is likely a treatment system will need to be installed to reduce the release of H2S at, and downstream of the lift station to fully address odor complaints associated with the Zillah Lakes development.

3.4 EXISTING SEWER SYSTEM HYDRAULIC ANALYSIS

A hydraulic analysis of the existing City of Zillah collection system was performed to evaluate the capacity of the system and identify specific hydraulic loading problem areas within the system. The computer-assisted analysis involves utilizing information such as pipe sizes and slopes to develop a model of the main trunk lines of the sewer system.

Record drawings and field-verified data were used when possible to determine pipe slopes, but minimum slopes were used where information was not available or where topography did not depict otherwise. Much of Zillah is situated on a hillside with slopes greater than 3%, so using strictly minimum slopes would result in excessively deep sewers in the hydraulic model. Therefore, reasonable sewer depths (approximately 10 feet) were maintained throughout the collection system network, which is consistent with the field-verified depths of manholes at the ends of the collection system.

Wastewater loadings, based on flow rates for different land uses, were then assigned to the model junctions (manholes) as described in the following sections. The following assumptions were made in running the existing system model:

- Pipe slopes (where data was not available, or topography did not depict otherwise) are based upon providing minimum full flow velocities of 2.0 feet per second, as described in the Washington State Department of Ecology, "Criteria for Sewage Works Design."
- A roughness coefficient (Mannings "n") of 0.013 was used for all pipelines in the analysis.
- The following peaking factor equation, suggested by Metcalf & Eddy, was used to analyze the collection system at peak flows.

QPeak = K (QAverage)^{0.9}

Q represents flow in MGD, and K represents the peaking factor.

The peaking factor value for K was determined based upon WWTP flow records. The peak day flow for Zillah is equal to 0.418 MGD, as described in Chapter 2 of this Plan. This total peak flow would result in a peaking factor of 1.62, when applied to the peaking factor equation presented above. The WDOE <u>Criteria</u> for <u>Sewage Treatment Works</u>, December 1998 suggests a minimum peaking factor of 2.5 be used when determining the peak hourly flow from the average flow. Therefore, since there are no historical peak hour flow values for Zillah, a peaking factor of 2.5 is used, which results in a total peak flow of 0.645 MGD when applied to the peak flow equation.

3.4.1 Existing Land Use

As described in Chapter 1 of this Plan, most of the land within Zillah's city limits is zoned residential; however, a large amount of this area is either unserved or vacant. Therefore, an analysis of the total area of land currently served by the collection system is necessary to determine unit flow rates and to distribute existing system loadings. Table 3-2 summarizes the current area served, per zoning category, by the existing collection system as compared to the total acreage available within the city limits. The residential (R-1, R-2, R-3, and SR) and commercial (C-1 and CT) zoning categories were combined in Table 3-2 to simplify the number of unit flow rates to calculate.





TABLE 3-2 – ZILLAH EXISTING AREA SERVED						
Zoning Category	Existing Acreage Served	Total Acreage	Unserved/Vacant Acreage	Percent Currently Served		
Residential	236	362	126	65%		
Commercial	73	116	44	63%		
Light Manufacturing	64	72	8	89%		
Planned Development	10	230	220	4%		
Public	117	127	10	92%		
TOTAL	500	907	408	55%		
Note: These areas do no	Note: These areas do not include streets or the SVID canal.					

As compared with the zoning breakdown provided in Chapter 1, only about 55%, or 500 acres, are currently served by the existing collection system. This is largely due to the low percentage of the planned development area that is currently served.

3.4.2 Unit Flow Rates

The hydraulic analysis is based on unit flow rates from different land uses within the six existing collection system basins. The type of activity is taken from existing zoning maps, and flow rates discussed below are assigned based upon that activity. Commercial, light manufacturing, and public lands/church zone loadings were first calculated based upon specified standard loadings or historic water demand data, and then the remainder average day loading for the City of Zillah was used to determine the residential and planned development loading per acre.

<u>Commercial</u>: For general business (commercial) wastewater flow rates, *Wastewater Engineering: Treatment, Disposal, Reuse* (Metcalf & Eddy, Third Edition, 1991) suggests a range from 800 to 1,500 gpd/acre. The historical average water consumption for this user category was 50,000 gallons per day. Therefore, assuming all water consumption is discharged as wastewater, an average loading of 700 gpd/acre resulted. To be conservative, the minimum value suggested by Metcalf & Eddy of 800 gpd/acre will be used.

Light Manufacturing: For light manufacturing developments, Metcalf & Eddy suggests a range from 1,000 to 1,500 gpd/acre. However, this value would be too high, due to historical water demand from light manufacturing zoned areas in Zillah. A large portion of the light manufacturing zoned area is occupied by Zillah's most significant industrial user, Stadelman Fruit Company, which is a fresh fruit packing industry. According to Stadelman Fruit's General Wastewater Discharge NPDES Permit, the flow from their combined facilities can range from 20,000 gpd to 100,000 gpd with a total annual flow of nearly 11-million gallons annually, which is equivalent to 30,137 gallons per day (471 gallons per day per acre) discharged to the City's WWTP. Therefore, a value of 500 gpd/acre will be used for the light manufacturing areas.

<u>Public/Church</u>: Wastewater flow rates from public/church areas are based on a unit flow rate of 680 GPD/Acre, which was determined from the historical annual average daily water demand of 79,800 gallons divided by the 117 acres currently served. It is also assumed that all water is discharged as wastewater.

<u>Residential</u>: Zillah's zoning maps identify four different densities of residential development, but upon further examination of current housing densities, there appeared to be little difference in the number





of houses per acre for the various residentially zoned areas, except for suburban residential. However, most of suburban residential areas are currently un-served, so there was little effect on the overall existing housing density. There are currently 236 residential acres served, plus the nine acres within the planned development area. This acreage was divided by the remaining total historic average flow to the treatment plant resulted in a unit flow rate for all residential areas of 270 gpd/acre.

<u>Planned Development</u>: The calculated unit flow rate for residential and commercial areas within the City of Zillah were used to calculate the total unit flow rate for the planned development area. The planned development currently has 9 residential acres and one commercial acre in use. Although the total planned development area is 230 acres, 71 acres will be recreational and open space, and only 57 acres will be residential, and 87 acres will be commercial. Using the unit flow rates for residential and commercial of 270 gpd/acre and 800 gpd/acre, respectively, the flow from the total planned development acreage served is estimated to be 370 gpd/acre.

A summary of the zoning type basin areas and estimated average flow is presented in Table 3-3.

	TABLE 3-3 – EXISTING COLLECTION SYSTEM BASIN FLOWS					
Basin	Existing Zoning Category	Total Existing Area	Average Flow per	Total Estimated		
No.		(Acres)	Acre (gpd/acre)	Average Flow (MGD)		
1	Commercial	22	800	0.018		
	Public Lands/Church	2	680	0.001		
	Planned Development	10	160	0.002		
	Residential	0	270	0.000		
2	Commercial	31	800	0.025		
	Light Manufacturing	42	500	0.021		
	Public Lands/Church	81	680	0.055		
	Residential	23	270	0.006		
3	Commercial	6	800	0.005		
	Light Manufacturing	17	500	0.009		
	Public Lands/Church	9	680	0.006		
	Residential	1	270	0.000		
4	Public Lands/Church	11	680	0.007		
	Residential	73	270	0.020		
5	Commercial	4	800	0.003		
	Public Lands/Church	1	680	0.001		
	Residential	88	270	0.024		
6	Commercial	10	800	0.008		
	Light Manufacturing	5	500	0.003		
	Public Lands/Church	13	680	0.009		
	Residential	51	270	0.014		
	TOTALS	500		0.235		





3.4.3 Collection System Hydraulic Analysis

The existing sewer network hydraulics were modeled under current conditions with a total average day flow of 0.236 MGD and calculated peak hour flow of 0.682 MGD. Pipe slope, roughness coefficient and peaking factor values used in the hydraulic model were as described above. Based on the hydraulic analysis of the existing collection system, no pipe capacities are exceeded at current average day or peak hourly flows. Results of the existing hydraulic analysis are provided in the Appendix.

3.4.4 Lift Station Hydraulic Analysis

Another element of the hydraulic analysis was review of the lift station capacities and their ability to meet system demands. Information on the lift stations was presented earlier in this chapter. Results of the collection system hydraulic analysis were compared with the maximum station capacity, considering one pump (largest pump) out of service. The results of the comparison of station capacity with current modeled peak flow are presented in Table 3-4.

TABLE 3-4 – CURRENT SEWAGE LIFT STATION PEAK FLOWS					
Lift Station	Lift Station Capacity ¹	Current Modeled Peak Flow			
Vintage Valley Lift Station	350 gpm	48 gpm			
Zillah West Lift Station	298 gpm	18 gpm			
¹ Capacity with largest pump out of service.					

As shown in Table 3-4, all existing lift stations have sufficient capacity to meet the existing system demands with one pump out of service.

City staff has reported that the Zillah West Lift Station is reaching the end of its service life and should be scheduled for replacement in the near future, even though it does not need additional capacity to meet future projected flows, per the model.

3.4.5 Force Main Hydraulic Analysis

A review of the force mains and their ability to meet the system demands was also completed as part of the hydraulic analysis. The force main hydraulic analysis was similar to the analysis of lift stations, using projected peak flow rates from the model and from actual known pumping rates. The desired velocity within a force main is between 2 and 8 feet per second. Velocities below 2 feet per second tend to lead to deposition of solids in the pipeline, while velocities above 8 feet per second can create excessive pumping costs. Current force main velocities are shown in Table 3-5.

TABLE 3-5 – CURRENT FORCE MAIN VELOCITIES							
Lift Station No.	Name	Current Pumping Rate ¹	Force Main Diameter (inches)	Desired Velocity	Current Velocity ¹		
1	Vintage Valley Lift Station	350 gpm	6-inch	2 to 8 feet/second	3.7 ft/sec		
2 Zillah West Lift Station 298 gpm 6-inch 2 to 8 feet/second 3.4 ft/sec							
¹ Pumping rate	¹ Pumping rate and velocity with largest pump out of service.						





As shown in Table 3-5, all existing force mains have the capacity to accommodate the current maximum flow capacity from its respective lift station. However, the City has received numerous odor complaints from locations near the discharge manhole, and manholes immediately downstream of the Vintage Valley Lift Station forcemain. These odor issues are likely due to the long residence time of sewage in the forcemain before it is discharged into the gravity sewer system. The current average day loading from Basin 1 is about 20,000 gallons, which equates to an average lift station run time of approximately 57 minutes per day (based upon a 350 gpm pump capacity). It may be necessary to treat wastewater pumped from the Vintage Valley Lift Station to reduce odor issues. Further evaluation of forcemain conditions and treatment options will be necessary prior to beginning treatment.

3.5 COLLECTION SYSTEM MAINTENANCE PROBLEMS

The City has identified several high maintenance sections of the existing collection system, where annual cleaning is required to prevent backups. These sections of the collection system have been identified for replacement but will need to be thoroughly inspected prior to repairs and/or replacement. The location of these high maintenance areas is identified on Figure 3-3.









In addition to the identified high maintenance areas of the collection system, there are several locations where there are manholes buried beneath the roadway surface, which makes those sections of gravity sewer piping inaccessible for routine inspection and maintenance. These locations are also identified on Figure 3-3 and will be scheduled to be raised to the roadway surface, to improve maintenance and access to these sections of the collection system.

3.6 COLLECTION SYSTEM INFILTRATION / INFLOW

Evaluation of collection system infiltration/inflow (I/I) is necessary to determine if there is excessive I/I and to identify system improvements that will be made to alleviate future I/I problems. Infiltration is defined as groundwater entering a sewer system by means of defective pipes and side sewers, pipe joints, and manhole walls. Inflow is defined as surface water or runoff that enters the collection system through constructed openings such as manhole covers, storm sewer cross-connections, and yard, basement, or roof drains.

Every sewer collection system has some level of I/I. Therefore, limits for non-excessive I/I levels, based upon national statistical data, have been established by the United States Environmental Protection Agency (EPA) in *I/I Analysis and Project Certification* (1985, Ecology Publication No. 97-03). Infiltration is considered by the EPA to be excessive if the average daily per capita dry weather flow (7-14-day average during periods of seasonal high groundwater, excluding major industrial and commercial flow greater than 50,000 gpd each) is more than 120 gallons per capita per day (gpcd). EPA considers inflow to be excessive if the average daily per capita flow during periods of significant rainfall (i.e., during storm events that create surface ponding or runoff) is more than 275 gpcd.

3.6.1 Infiltration

To determine the level of infiltration in the Zillah collection system, average monthly per capita flows during the dry summer months (June, July, and August) were evaluated. Zillah has one significant industrial user, as discussed in Section 2.1.6, but they do not discharge more than 50,000 gallons per day, so no adjustments have been made to the total system average monthly flows. The average monthly summer per capita flows between 2011 and 2018 are summarized in Table 3-6.

TABLE 3-6 – AVERAGE MONTHLY SUMMER PER CAPITA FLOWS 2011 - 2018									
	2011	2012	2013	2014	2015	2016	2017	2018	Average
Average Monthly Summer Flow (MGD)*	0.237	0.231	0.231	0.255	0.230	0.243	0.241	0.280	0.238
Average Monthly per Capita Flow (gpcd)*	78.9	76.2	74.20	81.3	73.4	77.4	76.6	88.5	78.3
* From Chapter 2 Table	* From Chapter 2 Table 2-2 and Table 2-3								

Table 3-6 shows that the per capita flows neither exceed nor approach the 120-gallon per capita per day limit that is considered by EPA to be excessive. Therefore, the City of Zillah collection system does not have an excessive infiltration.





3.6.2 Inflow

Collection system inflow was determined by evaluating the recorded and estimated daily flows during times of significant rainfall events. Again, rainfall is considered by EPA to be significant when ponding or runoff occurs. Given the type of soils in the Zillah service area and calculation of a weighted runoff curve number (CN) based upon zoning types within the service area, it was determined that a rainfall event (total daily precipitation) greater than 0.66 inches would be significant. Eight of the most significant precipitation events, the associated influent, and per capita flows on the same day are summarized in Table 3-7.

TABL	TABLE 3-7 – PER CAPITA FLOW DURING SIGNIFICANT PRECIPITATION EVENTS 2010-2018					
Year	Month	Day	Estimated Zillah Precipitation (inches) ¹	Total Influent Flow (MGD) ²	Total Per Capita Flow (gal/capita/day) ³	
2016	October	9	1.02	0.400	127	
2015	May	13	0.98	0.283	90	
2015	December	7	0.81	0.309	98	
2013	May	21	0.79	0.377	121	
2013	May	22	0.66	0.212	68	
2011	May	15	0.74	0.247	82	
2011	May	14	0.72	0.392	131	
2010	December	12	0.59	0.304	109	

¹ Daily precipitation data is courtesy of the Washington State University AgWeatherNet (AWN) from Buena station (closest weather station to the City of Zillah).

² From daily monitoring report (DMR) influent data.

³ Based upon OFM population estimates for each year as provided in Table 1-5 of Chapter 1.

⁴ No significant rainfall events occurred during 2017 and 2018.

The EPA threshold for excessive inflow of 275 gpcd was not exceeded during any of the events listed in Table 3-7 for the period 2011 through 2018. Therefore, the Zillah collection system would not be considered as having excessive inflow.





CHAPTER 4 -

FUTURE COLLECTIO SYSTEM





4.1 GENERAL DESCRIPTION

Forecasting expansion of the future sewer collection system is dependent upon type, nature, and location of future growth within City of Zillah and its UGA. Development of the future collection system is based upon the future land uses identified by the City, as shown on Figure 1-4, and future sewer system service population, as provided in Chapter 1 of this Plan.

One of the goals of this General Sewer Plan is to serve as a guide for growth of the City of Zillah's wastewater collection system as it expands beyond the current city limits into the UGA. To accomplish this goal, the following tasks are accomplished within this Chapter:

- Develop future collection system drainage basin boundaries to serve unsewered areas outside the existing city limits but within the City's UGA boundary.
- Estimate flows for the future drainage basins using zoning and land use designations and unit flow rates. For the purposes of this Plan, future zoning and land use within the City and UGA is based upon those uses presented on Figure 1-3 and Figure 1-4.
- Model flows from currently unsewered areas in the collection system. Additional flows from the future drainage basins are routed through the existing collection system to examine system capacity and determine potential problem areas.
- Identify needed improvements to the existing collection system to accommodate additional flows and analyze alternate routing for future drainage basin flows, as necessary.

In Chapter 3, the existing collection system was analyzed and modeled under current conditions for normal and peak flows. Estimates of future collection system flows are added to existing system analysis flows to determine the impacts of a full build-out scenario.

4.2 FUTURE COLLECTION SYSTEM BASINS

The collection system basins identified in Chapter 3 were analyzed with respect to future collection system drainage from UGA areas. The boundaries of four of the existing drainage basins were expanded to accommodate additional UGA areas, and one new drainage basin was created. Again, zoning and land use designations are as shown on Figure 1-3 and Figure 1-4. The future collection system basins are shown on Figure 4-1 – Future Collection System Basin Boundaries and discussed below.

Basin No. 1: Basin No. 1 is zoned commercial, tourism, and planned development, as discussed in Chapter 3 of this Plan. The additional area of future Basin No. 1, to the north of the existing city limits, is designated as non-residential, as shown on Figure 1-4. The total area of future Basin No. 1 is approximately 320 acres. Wastewater flow from future Basin No. 1 will be conveyed to Basin No. 2 in the same manner as described in Chapter 3.

Basin No. 2: The area within Basin No. 2 is primarily zoned light manufacturing, commercial, residential, and public lands/church zone, as discussed in Chapter 3. The additional area of future Basin No. 2, to the west and north of the existing city limits, is zoned residential as shown on Figure 1-4. The total area of future Basin No. 2 is approximately 377 acres. Future Basin No. 2 flow will be conveyed by gravity to the sewer trunk main that follows the old railroad alignment to the WWTP, as described in Chapter 3.





Basin No. 3: Basin No. 3 is predominately zoned residential, light manufacturing, public lands/church zone, and commercial and lies along the south-eastern section of First Avenue, as described in Chapter 3. The area of Basin No. 3 will not expand and will remain at a total of 37 acres, as described in Chapter 3. Flow from future Basin No. 3 will be conveyed to the sewer trunk main, as described in Chapter 3.

Basin No. 4: The majority of Basin No. 4 is zoned residential, public lands/church zone, commercial, and light manufacturing. Future Basin No. 4 lies west and south of the SVID canal and extends northeastward to the City's UGA boundary. Basin No. 4 is bordered by Basin No. 2 to the west and Basin No. 5 to the east. Wastewater flow from future areas of this basin will be conveyed by gravity to existing 8-inch gravity sewer mains within the basin, before entering the Basin No. 2 sewer trunk main. The total area of future Basin No. 4 is approximately 260 acres.

Basin No. 5: Basin No. 5 is predominantly zoned residential and public lands/church zone. Future Basin No. 5 encompasses the area between Basin No. 4 and Basin No. 6 to the City's UGA boundary. This Basin also serves most of the City proposed UGA area, as shown on Figure 4-1. The total area of future Basin No. 5 is approximately 294 acres. Flow from future basin areas, including those areas north and east of the SVID canal, will be conveyed by gravity to existing Basin No. 5 8-inch sewer mains before entering the Basin No. 3 sewer trunk main.

<u>Basin No. 6:</u> The area within future Basin No. 6 is zoned residential, non-residential, light manufacturing, commercial and public lands/church zone. This basin is located east of Basin No. 3 from First Avenue, north to Second Avenue. Future Basin No. 6 extends east to the City's UGA boundary and includes a small portion of the proposed UGA, north of the SVID canal. The total area of future Basin No. 6 is approximately 168 acres. Flow from future Basin No. 6 will be conveyed by gravity to existing Basin No. 6 8-inch gravity mains before entering the Basin No. 3 sewer trunk main.

Basin No. 7: Future Basin No. 7 is located north of Basin No. 1 and west of Basin No. 2 and extends from the existing city limits, north to the UGA boundary. The total area of future Basin No. 7 is approximately 246 acres. This basin will be primarily zoned residential and non-residential. Currently, none of this basin is served by Zillah's sewer collection system. Future Basin No. 7 encompasses an area that cannot be entirely served by gravity from Basin No. 2. Wastewater flow from this basin will be conveyed by gravity to the southeast and will then be pumped to the Basin No. 2 sewer trunk main before flowing by gravity to the WWTP.





CITY OF ZILLAH General Sewer Plan

FUTURE COLLECTION BASIN BOUNDARIES

LEGEND

Zillah City Limits Zillah UGA Boundary Zillah Proposed UGA Toppenish City Limits Toppenish UGA Boundary Basin 1 Basin 2 Basin 3 Basin 4 Basin 5 Basin 6 Basin 7 **Gravity Sewer** Forcemain Manhole Lift Station 509.966.7000 Fax 509.965.3800

04/12/2017 P:\arcview\2017\17063\FIG 4-1.mxd





4.3 FUTURE SEWER SYSTEM HYDRAULIC ANALYSIS

A hydraulic analysis of the existing Zillah collection system was performed to find what problems would be created by projected wastewater flows resulting from development of property within the City and the UGA at full build-out. Like the analysis presented in Chapter 3, analysis of the future system involves inputting information regarding pipe slopes, making assumptions about pipe friction losses, and assigning wastewater flows to the seven future collection system basins. The hydraulic capacity of the existing collection system is based on the location where future basin flows are discharged and the following assumptions:

- Wastewater flows from each basin are based upon the zoning and land use designations described in Chapter 2 and the unit flow rates for each as described in Section 4.3.1.
- Pipe slopes (where data was not available) are based upon providing minimum full flow velocities of 2.0 feet per second, as described in the Washington State Department of Ecology, "Criteria for Sewage Works Design."
- A roughness coefficient (Mannings "n") of 0.013 for all pipelines was used in the analysis.
- The following peaking factor equation, suggested by Metcalf & Eddy, was used to analyze the future collection system at peak flows:

 $Q_{Peak} = K (Q_{Average})^{0.9}$

Q represents flow in MGD, and K represent the peaking factor.

The same peaking factor value for K of 2.5 used to analyze the existing collection system peak flows is used to evaluate peak flows in the future.

Proposed future lift stations were not modeled or included in the hydraulic analysis. Future lift stations and associated force mains will be sized as necessary to meet the projected future peak hour demands. Flows from proposed future lift stations were input at the nearest existing manhole location to evaluate average and peak flows through the existing collection system.

4.3.1 Future Unit Flow Rates

The total projected average flow per basin is based on unit flow rates from different zoning designations within the future collection system basins. The unit flow rates for residential, commercial, public lands/church, and planned development zoned areas are identical to the ones used for the existing system in Chapter 3. Those unit flow rates are:

Residential	270 gpd/acre
Commercial	800 gpd/acre
Light Manufacturing	500 gpd/acre
Public Lands/Church	680 gpd/acre
Planned Development	370 gpd/acre

The light manufacturing (light industrial) unit flow rate for Zillah, as discussed in Chapter 3, is extremely low compared to the range of typical light industrial flows, as suggested by Metcalf & Eddy. However, it is assumed that future light industry will be similar to current industry in Zillah, which primarily consists of fresh fruit packing facilities.





4.3.2 Full Build-Out Basin Flow Summary

A summary of the projected future basin flows at full build-out, including land use type and acreage, average flow per acre, and total projected flow, is presented in Table 4-1. The land use categories in Table 4-1 have been broken down into known or anticipated zoning categories to be consistent with unit flow rate categories and correspond with projected future uses. The total acreage of all zoning categories within each basin, as shown in Table 4-1, only includes parcel areas and does not include right-of-way areas or roads. The projected flows from Table 4-1 were used in the future collection system hydraulic analysis.

TABLE 4-1 – FULL BUILD-OUT COLLECTION SYSTEM BASIN FLOWS					
Basin No.	Existing Zoning Category	Total Full Build-Out Area (Acres)	Average Flow per Acre (GPD/Acre)	Projected Average Full Build-Out Flow (MGD)	
1	Mixed Land Use Planned Development Non-Residential Commercial Public Lands/Church	230 74 2	370 800 680	0.085 0.059 0.001	
	Residential	14	270	0.004	
2	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	31 50 82 213	800 500 680 270	0.025 0.025 0.056 0.058	
3	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	6 17 9 6	800 500 680 270	0.005 0.009 0.006 0.002	
4	Non-Residential Public Lands/Church Residential	11 249	680 270	0.007 0.067	
5	Non-Residential Commercial Public Lands/Church Residential	4 10 280	800 680 270	0.003 0.007 0.076	
6	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	10 5 52 101	800 500 680 270	0.008 0.003 0.035 0.027	
7	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	13 37 36 160	800 500 680 270	0.010 0.019 0.024 0.043	
	TOTALS	1,702		0.663	





Figure 4-2 – Collection System at Full Build-Out, shows the layout of the future collection system within the city limits and UGA. The actual location of the future collection system may change depending on the timing and location of actual development. The projected average additional full build-out flows to the ends of the existing collection system are also shown on Figure 4-2.

4.3.3 Collection System Hydraulic Analysis Results

The existing collection system was analyzed under both projected average day and peak hour flow conditions at full build-out within the City and UGA. Flows from the future collection basin areas were routed through the existing collection system to examine system capacity and determine potential problem areas. Modeled total system average day and peak flows were equal to approximately 0.590 MGD and 1.555 MGD, respectively. Results of the full build-out hydraulic analysis are provided in the Appendix.

The full build-out hydraulic analysis resulted in capacity deficiencies along the City's existing sewer trunk main that follows the old railroad alignment. Deficiencies occurred under the peak hour flow scenario only, no deficiencies occurred under the average day flow condition. Figure 4-3 – Full Build-Out Collection System Deficiencies, shows the sections of existing sewer trunk main that will have insufficient capacity at full build-out.

Alternative routes of projected full build-out flows as shown on Figure 4-2 were considered, but there was little effect on the hydraulic analysis results since flows from all basins are routed to the City's 10-inch sewer trunk main, which is the limiting factor in the collection system's capacity.

4.3.4 Lift Station and Forcemain Hydraulic Analysis Results

The capacity of the existing lift stations and their ability to meet current system demands was discussed in Chapter 3. With the full build-out of the UGA, it is desirable to continue use of the existing stations to the extent possible. The full build-out lift station hydraulic analysis was similar to the analysis under existing flow conditions provided in Chapter 3. The projected flows for the full build-out condition and existing lift station capacities are summarized below in Table 4-2.

TABLE 4-2 – FULL BUILD-OUT SEWAGE LIFT STATION PEAK FLOWS					
Lift Station	Lift Station Capacity ¹	Current Modeled Peak Flow			
Vintage Valley Lift Station	350 gpm	181 gpm			
Zillah West Lift Station	298 gpm	25 gpm			
¹ Capacity with largest pump out of service.					

Table 4-2 shows that the existing lift stations will have sufficient capacity to meet projected peak flows even at full build-out of Basin No. 1, which includes the planned development area.

Like the lift stations, it is preferable to continue use of the current forcemains as long as possible. Since none of the projected peak flows at full build-out exceed the existing lift station capacities, as shown in Table 4-2, all current forcemains will have sufficient capacity as described in Chapter 3.









04/12/2017 P:\arcview\2017\17063\FIG 4-2.mxd 2803 River Road Yakima, WA 98902 509.966.7000 Fax 509.965.3800 www.hlacivil.com





- - - Future Deficiency Location



CHAPTER 5 -

YEAR 2039 COLLECTION SYSTEM





5.1 GENERAL DESCRIPTION

Zillah's existing sewer collection system, based upon current wastewater flows, was analyzed and evaluated in Chapter 3 of this Plan. In Chapter 4, the existing collection system was analyzed and evaluated based upon the full build-out of land within the city limits and UGA. In this chapter, the existing collection system will be analyzed and evaluated based upon accommodating projected future growth for the next 20 years (through the year 2039). The sewer service population by the year 2039 is projected to be 4,603. The following approach was used to evaluate sewer system performance related to growth through the year 2039:

- Future collection system drainage basins developed in Chapter 4 for unsewered areas outside the existing city limits but within the UGA were used again.
- Future flows were developed based upon future zoning and land use designations and unit flow rates. For the purposes of this Plan, future zoning and land use within the City and UGA is based upon those uses presented on Figure 1-3 and Figure 1-4.
- Rather than assuming complete development within the City and the UGA, year 2039 flows are based upon serving the projected future population of 4,603 as presented in Chapter 1 of this Plan. Assumptions are made as to where the future population will locate within the City and the UGA.
- Flows from currently unsewered areas in the collection system were added to the model. Additional flows from the future drainage basins are routed through the existing collection system to examine system capacity and determine potential problem areas.
- Improvements to the existing collection system to accommodate the additional flows were identified.

Similar to the Chapter 4 analysis, estimates of future collection system flows are added to the existing system analysis flows to determine the impacts of year 2039 flows, as compared to the full build-out scenario.

5.2 YEAR 2039 COLLECTION SYSTEM BASINS

The same collection system basins presented in Chapter 4 were used to develop the year 2039 sewer service area. The future collection system drainage basins are as shown on Figure 4-1. Zillah has a significant amount of land area (408 acres) within its city limits that is currently vacant or un-served, including the planned development area. When considering the future land area required to serve a projected future 20-year population of 4,603 persons, it was assumed that existing vacant or un-served areas would be utilized first before development extends into the UGA areas.

For the purposes of this Plan, existing land uses were projected to increase at the same growth rate as the City population. As described in Chapter 1, the 20-year population is based upon an estimated growth of approximately 2% per year. Through analysis of the required area to serve projected future uses, it was found that residential and commercial zoned areas within the existing city limits were sufficient to serve the projected 20-year needs, but there are not adequate light manufacturing and public/church zoned areas. Therefore, to accommodate projected future light manufacturing and public/church uses, and to remain consistent with designated future land uses, it is assumed that growth will occur within the City's UGA in future Basin 5, Basin 6, and Basin 7.





5.3 YEAR 2039 SEWER SYSTEM HYDRAULIC ANALYSIS

A hydraulic analysis of the existing Zillah collection system was performed to find problems resulting from the year 2039 development of property within the City and the UGA. Like the analysis presented in Chapter 3, analysis of the future system involves inputting information regarding pipe slopes, making assumptions about pipe friction losses, and assigning wastewater flows to the seven future collection system basins. The hydraulic capacity of the existing collection system is based on the location where future basin flows are discharged, and the following assumptions:

- Wastewater flows from each basin are based upon the zoning and land use designations described in Chapter 2 and the unit flow rates for each as described in Section 5.3.1.
- Pipe slopes (where data was not available) are based upon providing minimum full flow velocity of 2.0 feet per second, as described in the Washington State Department of Ecology, "Criteria for Sewage Works Design."
- A roughness coefficient (Mannings "n") of 0.013 for all pipelines was used in the analysis;
- The following peaking factor equation, suggested by Metcalf & Eddy, was used to analyze the existing collection system at peak flows:

QPeak = K (QAverage)^{0.9}

where Q represents flow in MGD, and K represent the peaking factor.

The same peaking factor value for K of 2.5 used to analyze the existing collection system is used to evaluate peak flows in the future.

Proposed future lift stations were not modeled or included in the hydraulic analysis. Future lift stations and associated force mains will be sized as necessary to meet the projected future peak hour demands. Flows from proposed future lift stations were input at the nearest existing manhole location to evaluate average and peak flows through the existing collection system.

5.3.1 Unit Flow Rates

The total projected average flow per basin is based on unit flow rates from different zoning designations within the future collection system basins. The unit flow rates for residential, commercial, public lands/church zone, and planned development zoned areas are identical to the ones used for the existing system in Chapter 3. Those unit flow rates are:

Residential	
Commercial	
Light Manufacturing	
Public Lands/Church	
Planned Development	

The light manufacturing (light industrial) unit flow rate for Zillah, as discussed in Chapter 3, is extremely low compared to the range of typical light industrial flows, as suggested by Metcalf & Eddy. However, it is assumed that future light industry will be similar to current industry in Zillah, which primarily consists of fresh fruit packing facilities.





5.3.2 Year 2039 Basin Flow Summary

A summary of the projected future basin flows in the year 2039, including land use type and acreage, average flow per acre, and total projected flow, is presented in Table 5-1. The land use categories in Table 5-1 have been broken down into known or anticipated zoning categories to be consistent with unit flow rate categories and correspond with projected future uses. The total acreage of all zoning categories within each basin, as shown in Table 5-1, only includes parcel areas and does not include right-of-way areas or roads. The projected flows from Table 5-1 were used in the future collection system hydraulic analysis.

	TABLE 5-1 – YEAR 2039 COLLECTION SYSTEM BASIN FLOWS					
Basin No.	Existing Zoning Category	Total Year 2039 Area (Acres)	Average Flow per Acre (GPD/Acre)	Projected Average Year 2039 Flow (MGD)		
1	Mixed Land Use Planned Development Non-Residential Commercial	220 62	370 800	0.081		
	Residential	2 0	680 270	0.001		
2	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	31 50 82 65	800 500 680 270	0.025 0.025 0.056 0.018		
3	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	6 17 9 1	800 500 680 270	0.005 0.009 0.006 0.000		
4	Non-Residential Public Lands/Church Residential	11 91	680 270	0.007 0.025		
5	Non-Residential Commercial Public Lands/Church Residential	4 10 136	800 680 270	0.003 0.007 0.037		
6	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	10 5 52 51	800 500 680 270	0.008 0.003 0.035 0.014		
7	Non-Residential Commercial Light Manufacturing Public Lands/Church Residential	0 37 36 0	800 500 680 270	0.000 0.019 0.024 0.000		
	TOTALS	988		0.456		





Table 5-1 shows the total projected average day flow is equal to 0.456 MGD. This value is higher than the 0.346 MGD flow projection for year 2039 provided in Chapter 2 of the Plan. The difference in values is primarily due to the historic averages for Zillah being lower that the published averages used in the model for Commercial (800 gpd/acre versus 700 gpd/acre) and the percentage of commercial to residential in Basin 1 being so much higher than the ratio in the existing area.

Figure 5-1 – Collection System by Year 2039 shows the layout of the future collection system within the city limits and UGA. The actual location of the future collection system may change depending on the timing and location of actual development. The projected average year 2039 flows include additional flows estimated to be added to the collection system that are extended to serve the zoning categories.

5.3.3 Collection System Hydraulic Analysis Results

The existing collection system was analyzed under both projected average day and peak hour flow conditions for the year 2039 within the City and UGA. Flows from the future collection basin areas were routed through the existing collection system to examine system capacity and determine potential problem areas. Modeled total system average day and peak flows were equal to approximately 0.385 MGD and 1.06 MGD, respectively. Results of the year 2039 hydraulic analysis are provided in the Appendix.

The year 2039 hydraulic analysis resulted in capacity deficiencies along the City's existing sewer trunk main that follows the old railroad alignment, similar to the full build-out deficiencies shown in Chapter 4. However, the year 2039 deficiencies only occurred east of Cheyne Road. Like the full build-out analysis, deficiencies occurred under the peak hour flow scenario only, no deficiencies occurred under the average day flow condition. Figure 5-2 – Year 2039 Collection System Deficiencies, shows the sections of existing sewer trunk main that will have insufficient capacity by the year 2039.

5.3.4 Lift Station and Forcemain Hydraulic Analysis Results

Capacity of the existing lift stations and their ability to meet existing system demands was discussed in Chapter 3 and Chapter 4. With the year 2039 projected flows, it is desirable to continue use of the existing stations to the extent possible. The year 2039 lift station hydraulic analysis was similar to the analysis under existing flow conditions and full build-out conditions as provided in Chapter 3 and Chapter 4. The projected flows for the year 2039 condition and existing lift station capacities are summarized below in Table 5-2.

TABLE 5-2 – YEAR 2039 SEWAGE LIFT STATION PEAK FLOWS				
Lift Station	Lift Station Capacity ¹	Current Modeled Peak Flow		
Vintage Valley Lift Station	350 gpm	181 gpm		
Zillah West Lift Station 298 gpm 25 gpm				
¹ Capacity with largest pump out of service.				

Table 5-2 shows that the existing lift stations will have sufficient capacity to meet projected peaks flows by the year 2039 for Basin No. 1, which includes the planned development area.

Like the lift stations, it is preferable to continue use of the current forcemains as long as possible. Since none of the projected peak flows at year 2039 exceed the existing lift station capacities, as shown in Table 5-2, all of the current forcemains will have sufficient capacity as described in Chapter 3.









CHAPTER 6 -

TREATMENT AND DISPOSAL FACILITIES





6.1 BACKGROUND AND HISTORY

The Zillah WWTP was originally constructed in 1977 at the site of an early 1950's treatment plant. The WWTP is located just north of the Yakima River and Interstate 82 on land that is currently leased from the Washington State Department of Natural Resources. Extensive upgrades of the treatment plant occurred in 1994 and again in 2007.

The original 1977 plant consisted of a headworks with a coarse bar screen and comminutor, an oxidation ditch with two brush rotor aerators, one secondary clarifier, a chlorine contact tank, sludge drying beds, and an operations building which housed the laboratory and electrical controls. In 1994, the treatment plant was upgraded through addition of gravity degritting channels, an additional secondary clarifier, an ultraviolet disinfection system, an aerobic digester, a digested sludge thickening system, an oxidation ditch mixer, and four 10 HP floating aerators. The 1994 treatment plant had a permitted capacity of 0.313 MGD, 700 lbs. BOD₅ per day, and 700 lbs. TSS per day.

The latest treatment plant improvements were completed in 2007 and included installation of a new influent fine screen, construction of a new aeration basin, upgrades to the existing oxidation ditch aerators and mixers, modification and rehabilitation of the existing secondary clarifiers and aerobic digester building, and installation of a new effluent pump station.

6.2 EXISTING WASTEWATER TREATMENT FACILITIES

The City of Zillah WWTP accomplishes secondary biological treatment of wastewater by means of an activated sludge process, utilizing an aeration basin in series with an oxidation ditch. The location of various components of Zillah WWTP is shown on Figure 6-1 – Treatment Plant Site Plan. A flow diagram of the current treatment process is shown on Figure 6-2 – Treatment Plant Process Flow Diagram.

Wastewater from the City's collection system is conveyed to the treatment plant through a 12-inch pipe that travels approximately 200 feet along the northern fence line of the treatment plant site to the plant headworks. Wastewater passes through a mechanical fine screen with 0.25-inch perforated screen openings, removing rags, plastics, fibrous material, and other miscellaneous non-degradable solids that could hinder downstream treatment processes. A secondary influent channel can be used to bypass the mechanical fine screen if necessary, for repair or maintenance. Wastewater exits the mechanical fine screen and flows through a degritting channel which allows sand and grit too small to be captured by the screen to settle by gravity before continuing through the treatment plant. Flow from the degritting channel then passes through a Parshall flume for influent flow measurement and sampling before passing to the aeration basin.

The aeration basin contains three anoxic biological selector zones designed to promote the growth of nonfilamentous microorganisms and an aerobic zone designed to promote breakdown of suspended solids in the wastewater. In the first anoxic zone, return activated sludge (RAS) from the secondary clarifiers is pumped into the wastewater to increase the food to microorganism (F/M) ratio. Combined with the lack of dissolved oxygen in these zones, the substrate-rich conditions favor the growth of non-filamentous microorganisms, resulting in a sludge that forms flocs and settles more effectively. A small amount of air is introduced into these zones through coarse bubble diffusers to mix the contents. The aerobic zone comprises most of the aeration basin and is intended to allow the microorganisms to oxidize BOD and nitrates. Air is continually pumped into the wastewater via fine bubble diffusers designed to offer efficient oxygen uptake. Wastewater flows over a weir at the end of the aeration basin and continues to the oxidation ditch.











The oxidation ditch operates in a similar fashion to the aeration basin, but aeration is accomplished with two brush rotors, which can be turned off manually to provide anoxic conditions. The site piping is arranged to also allow RAS to be pumped to the oxidation ditch. Wastewater flows clockwise around the elliptical ditch and exits over a weir at the southwest corner of the ditch.

Treated mixed liquor from the aeration basin and oxidation ditch flows by gravity to the secondary clarifiers. The clarifiers are 30-foot diameter tanks designed for solids separation and thickening. Clarified wastewater flows over v-notch weirs to the UV disinfection channels. RAS is pumped to the aeration basin or oxidation ditch as described above. Waste sludge is pumped both automatically and manually to one of two digester cells that are equipped with fine bubble diffusers. Digested sludge is disposed of by pumping to a sludge truck or the rotary drum thickener system in which polymer is added to thicken the sludge to approximately 10% solids by weight. The City then stores their class B biosolids in drying beds located on City-owned property along Bailey Road. Additional solids storage capacity is available with the sludge drying beds located on the WWTF site. Stockpiled biosolids are collected once a year by Natural Selection Farms.

Effluent from the secondary clarifiers flows through a UV disinfection system that consists of a concrete channel with two banks of UV lamps to disinfect the wastewater. The UV lamps are powered up and down automatically, depending upon UV dose required to ensure adequate disinfection. Treated effluent flows over a serpentine weir to the effluent pump station. During normal operation, the effluent pump station is inactive. Flow enters the concrete tank and passes through a flap gate into a head box with raised walls at the west end of the pump station. Flow from the head box then flows by gravity to the outfall, which then carries the plant effluent under Interstate 82 to the Yakima River. When the Yakima River is at flood elevations, the effluent must be pumped to the head box to fill it to a level that allows gravity flow to the Yakima River.

Table 6-1 provides a summary of design criteria for Zillah's WWTP, in accordance with their current National Pollutant Discharge Elimination System (NPDES) permit, issued by the Washington Department of Ecology in 2006. The design criteria presented in Table 6-1 are based upon the treatment plant improvements that were completed in 2007.

TABLE 6-1 – ZILLAH WASTEWATER TREATMENT PLANT DESIGN CRITERIA*			
Parameter	Design Quantity		
Average Flow for the Maximum Month	0.49 MGD		
Peak Instantaneous Design Flow (PIDF)	1.02 MGD (equivalent to 708.33 gpm)		
Maximum Monthly BOD₅ Influent Loading	1,064 lbs/day		
Maximum Monthly TSS Influent Loading	1,107 lbs/day		
* Source: November 1, 2017 NPDES Permit			





Provided in Table 6-2 – Treatment Component Summary, is a summary of the major treatment plant components, including facility and equipment types, dimensions, and approximate capacities. Refer to the City of Zillah Wastewater Treatment Plant Operation and Maintenance Manual for further information and detail of treatment plant components.

TABLE 6-2 – TREATMENT COMPONENT SUMMARY*				
Influent Headworks				
Number of Channels		2		
	Туре	Type: Self-Cleaning Rotary Fine Screen		
	Screen Opening	0.25 inch		
Influent Flow Screen (Main Channel)	Screen Diameter	12 inches		
	Capacity	1.1 MGD		
	Motor	1.5 HP, 480 volt, 3-phase		
Coarse Bar Screen (Bypass Channel)	Bar Spacing	3.5 inches		
Degritting Section Length		21 feet		
Degritting Section Width		20 inches		
Degritting Section Cross-Section		Rectangular		
Velocity Control Section		6" Parshall Flume		
Velocity Range (at 1.02 MGD)		0.81 ft/s to 1.11 ft/s		
	Туре	Single Action Diaphragm – Positive Displacement		
Drain Pumps (2 each)	Capacity	25 GPM at 25 feet TDH		
	Motor	0.5 HP		
Aeration Basin				
Length		145 feet		
Width	12 feet			
Depth	12 feet			
Sidewater Depth	10 feet			
Volume		130,000 gallons		
Design MLSS Concentration	4,000 mg/l			
Design Solids Retention Time	4.3 days			
Design Hydraulic Detention Time at MMF		6.4 hours		
	Dimensions	12' L x 6' W x 10' D		
Colortor Zono 1	Volume	5,300 gallons		
Selector Zone 1	F/M	6 lb BOD₅/lb MLSS/d		
	Required Air	15 SCFM		
	Dimensions	12' L x 6' W x 10' D		
Coloria Zana 2	Volume	5,300 gallons		
Selector Zone 2	F/M	3 lb BOD ₅ /lb MLSS/d		
	Required Air	15 SCFM		
	Dimensions	12' L x 12' W x 10' D		
Selector Zono 0	Volume	10,600 gallons		
Selector Zone 3	F/M	1.5 lb BOD ₅ /lb MLSS/d		
	Required Air	30 SCFM		





	Volume 109,000 gallons		
Aerobic Zone	Hydraulic Detention Time at MMF 5.3 hours		
	Actual Oxygen Required at MMF	1,190 lb O ₂ /d	
	Туре	Positive Displacement	
	Capacity (each)	700 SCFM	
Aeration Blowers (2 each)	Discharge Pressure	5.8 psig	
	Motor Size/Control	40 HP/VFD	
Oxidation Ditch			
Length		174 feet, 11 inches	
Channel Width		19 feet, 6 inches	
Center Wall Length		135 feet, 8 inches	
Sidewater Depth		5 feet	
Volume		235,000 gallons	
Hydraulic Retention Time at MMF		11.5 hours	
Design MLSS Concentration	4,000 mg/l		
Design Solids Retention Time		7.7 days	
Actual Oxygen Requirement at MMF		1,190 lb O ₂ /d	
	Туре	Brush Rotor	
	Rotor Length	18 feet	
Aerators (2 each)	Rotor Diameter	42 inches	
	Min./Max. Immersion Depth	6 inches/15 inches	
	Motor Size/Control	40 HP/VFD	
	Туре	Large Blade Propeller	
Mixers (Teach)	Motor	3.5 HP	
Secondary Clarifiers (2 each)			
Diameter	30 feet		
Sidewater Depth	11 feet		
Volume (each)	58,000 gallons		
Surface Area (each)	707 square feet		
Туре	Center Feed		
Design SVI	150 mL/g		
Design RAS Concentration	10,000 mg/L		
Design RAS Flowrate at AAF/MMF/PHF	0.28 MGD/0.33 MGD/0.37 MGD		
Surface Loading Rate at AAF/MMF/PHF	297 gpd/ft ² /347 gpd/ft ² /722 gpd/ft ²		
Solids Loading Rate at AAF/MMF/PHF	17 lb/d/ft²/19 lb/d/ft²/27 lb/d/ft²		
Detention Time at AAF/MMF/PHF	4.0 hours/3.5 hours/2.0 hours		
Motor Size	0.5 HP		
RAS Pumps (2 each)			
Туре	Dry Pit Submersible Centrifugal		
Capacity	225 GPM at 28 feet TDH		
Motor Size/Control	5 HP/VFD		
Flowmeter Type/Size	Magnetic/4-inch		





UV Disinfection Facility	UV Disinfection Facility				
Channel Depth		41 inches			
Channel Width	18 inches				
Channel Length	36 feet				
Flow Control Weir Length		15 feet			
UV Lamp Type	l	Low Pressure, Horizontal			
Number of UV Banks		2			
Number of UV Modules per Bank		2			
Number of UV Lamps per Module	4				
Total Number of Lamps		16			
Effluent Pumps (2 each)					
Туре	Submersible Centrifugal				
Capacity		840 GPM at 13 feet TDH			
Motor Size		5 HP			
Effluent Wet Well Volume		5,700 gallons			
Plant Drain/Scum Pump (1 each)	1				
Туре		Submersible Centrifugal			
Capacity	2	63 GPM at 13.5 feet TDH			
Motor Size	1.5 HP				
Aerobic Digester (2 each)					
Volume (each)	55,000 Gallons				
Solids Retention Time	43 days				
Solids Concentration (max)	3.5%				
	Туре	Positive Displacement			
Air Supply Blowers (2 each)	Capacity	260 SCFM			
	Discharge Pressure	6.0 psig			
	Motor Size	15 HP			
WAS Pump (1 each)	Ι				
Туре	Rotary Lobe				
Capacity	50 GPM at 18 feet TDH				
Motor Size	5 HP				
Flowmeter Type/Size	Magnetic/3-inch				
Digested Sludge Pump (1 each)					
Туре	Double Disc Positive Displacement				
Capacity	100 GPM at 17 feet TDH				
Motor Size/Control	7.5 HP/VFD				
Rotary Drum Thickener (1 each)					
Design Feed Solids Concentration	2%				
Hydraulic Capacity at 2% Feed Solids	50 GPM				
Solids Capacity	500 lb/hr				
Thickened Sludge Solids	6%				
Main Drive Motor Size	0.5 HP				
Blend Tank Motor Size	0.25 HP				
High Pressure Water Booster Pump Motor Size	2 HP				





Thickened Sludge Pump (1 each)			
Type Progressive Cavity Positive Displacement			
Capacity	40 GPM at 60 feet TDH		
Motor Size/Control	3 HP/VFD		
Polymer Feed System (1 each)			
Туре	Dispersion		
Liquid Polymer Pump Capacity	0.3 gph		
Sludge Drying Beds (4 each)			
Area (each)	1,100 square feet		
Total Area	4,400 square feet		
Auxiliary Generator (1 each)			
Туре	Diesel		
Rating	250 kW, 40/277 V, 60 Hz		
Tank Capacity	750 gallons		
* Source: City of Zillah WWTP Operations and Maintenance Manual, Gray & Osborne, July 2008.			

6.3 PERMIT EFFLUENT LIMITS AND EFFLUENT QUALITY

Effluent limits specified in a wastewater permit have a direct bearing on the degree of treatment that must be achieved by a wastewater treatment plant. The City of Zillah's current effluent limits are specified in National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA-002016-8, was issued with an effective date of November 1, 2017, and an expiration date of October 31, 2022, as presented in Table 6-3.

TABLE 6-3 – CITY OF ZILLAH CURRENT EFFLUENT LIMITS			
Parameter	Average Monthly ¹	Average Weekly ¹	
Biochemical Oxygen Demand (5-day)	30 mg/l; 122.6 lbs/day 85% removal of influent BOD	45 mg/l; 183.9 lbs/day	
Total Suspended Solids	30 mg/l; 122.6 lbs/day 85% removal of influent TSS	45 mg/l; 183.9 lbs/day	
Fecal Coliform Bacteria	200 colonies/100 ml	400 colonies/100 ml	
pH ²	Daily minimum ≥ 6 and daily maximum ≤ 9.0		
1. The overage monthly and weakly offluent limitations are based on the arithmetic mean of the complex taken with			

1. The average monthly and weekly effluent limitations are based on the arithmetic mean of the samples taken with the exception of fecal coliform, which is based on the geometric mean.

2. Indicates the range of permitted values. The instantaneous maximum and minimum pH shall be reported monthly.

Since the effective date of their latest NPDES Permit, the City has had no exceedances of their current effluent limits. Typical treatment plant removal of influent BOD₅ and TSS is greater than 95%, well above the permitted level.





6.4 EXISTING WASTWATER TREATMENT PLANT DEFICIENCIES

Headworks:

City staff has identified the existing headworks area in need of upgrades. The existing system does not provide grit or grease removal, and the manual screen is not a sufficient back-up to the automatic screen if it trips offline during non-staffed hours. The grit and grease are carried downstream causing additional maintenance and increase wear to mechanical equipment throughout the rest of the facility.

A combined screen with aerated grit and grease removal tanks is proposed to be installed upstream of the existing screen to provide the necessary improvements desired. Several manufactures can provide a combined treatment unit as described. Since Zillah's influent pipe is elevated above grade about five feet, it makes it an ideal candidate for this type of technology. Figure 6-3 shows the general arrangement of the equipment to be provided. The existing screen will remain in place as a secondary screen, and a back-up to the new system equipment.

Aeration Basin Blower Automation:

Currently, the aeration basin blowers are manually controlled by the operations staff. The quantity of air required for the process varies based on the influent flow rate and strength of the wastewater. To improve process control and energy efficiency, City staff desires to install automation for the aeration basin blowers.

Clarifier Isolation and Flow Control Valves:

Both valves upstream of the secondary clarifiers are stuck in their current position preventing the operations staff from isolating flow at each clarifier for maintenance, or to balance the flow between the two clarifiers. These valves need to be replaced to reinstate staff's ability to efficiently maintain and operate both secondary clarifiers.

Biosolids Dewatering:

The existing sludge dewatering process is a very high labor-hour activity. Currently sludge from the aerobic digesters is run through a rotary drum screen to thicken the sludge prior to loading into a tanker truck which transports the biosolids to on-site drying beds. Once these biosolids are dewatered enough in the on-site drying beds, the biosolids sludge is loaded into a dump truck with a backhoe and hauled to the City's off-site drying bed facility to complete the drying process prior to land application by Natural Selection Farms.

A new screw press is proposed to be installed to dewater the sludge from the aerobic digester. The cake from the screw press will be discharged directly into a dump truck for transport to the off-site drying beds. The existing rotary drum thickener will be used to thicken the waste activated sludge from the secondary clarifiers prior to entering the aerobic digester. Thickening the sludge prior to the digester will more than double the detention time in the digester. The additional detention time will comply with biosolids rules, allowing dewatered biosolids to be applied directly to an agricultural site, if desired or needed, without additional drying time in the drying beds.

The locations of these improvements are shown on Figure 6-3. Project costs for these improvements at the WWTP are included in Chapter 7.





6.5 FUTURE WASTEWATER LOADING PROJECTIONS

Forecasts for future loadings for flow, BOD, and TSS to the Zillah WWTF for the years 2024, 2029, 2034, and 2039 were previously presented in Chapter 2 of this Plan and are again presented in Table 6-4.

TABLE 6-4 – FUTURE WASTEWATER LOADING PROJECTIONS						
	Flow		BOD ₅		TSS	
Year	Average Monthly Flow (MGD)	Maximum Month Flow (MGD)	Average Monthly BOD₅ (lbs/day)	Maximum Month BOD₅ (lbs/day)	Average Monthly TSS (lbs/day)	Maximum Month TSS (lbs/day)
2024	0.266	0.315	670	783	377	529
2029	0.291	0.345	733	857	413	579
2034	0.318	0.376	800	935	450	631
2039	0.346	0.410	871	1,018	490	687

When compared to the design capacities provided in Table 6-1, the projected future wastewater loadings for the City of Zillah will not exceed the current facility capacity within the next 20 years. However, it should be noted that the maximum month flow, BOD_5 loading, and TSS loading are assumed to increase at a rate similar to the sewer service population, as discussed in Chapter 2. However, as mentioned in Chapter 2, changes by the City's SIU can dramatically change the timing of the treatment plant expansion requirements. Therefore, further evaluation of projected treatment plant loading should be assessed prior to any expansion or improvement to the existing treatment plant. Further evaluation of treatment plant capacity will also be required if there are any changes to projected future population or future sewer service area uses.






CHAPTER 7 -

CAPITAL IMPROVEMENT PLAN





7.1 GENERAL

The previous sections of this Plan identified deficiencies in the existing City of Zillah wastewater collection system. In Chapter 3, several maintenance-related improvements were identified. No capacity deficiencies were identified in the existing system under current flow conditions. In Chapter 4, the ability of the existing system to handle flows from full build-out of the UGA was examined. As expected, several deficiencies were identified since the system was not originally designed to serve the entire UGA. This analysis however was important to identify long-term piping needs of the system. In Chapter 5, the ability of the existing system to meet year 2039 demands was evaluated. Capacity-related deficiencies were again identified for the 20-year system.

Recommended improvements to the system that address both current and future capacity and maintenance related items, are summarized in this Chapter, along with estimated costs and a discussion of financing options.

7.2 EXISTING SYSTEM IMPROVEMENTS

The following Sections list recommended improvements and estimated costs to address maintenancerelated, future capacity related, and miscellaneous upgrades to the existing collection system. Full buildout flows were considered in sizing collection system improvements to address the 20-year capacity deficiencies. Again, the 20-year flows are based upon projected population increases and estimated future uses. Completion of these improvements may not be necessary, depending on projected growth and/or future land use changes.

Actual costs of recommended improvements will vary from those costs provided in this Plan, due to changes in the construction industry, the competitive bidding process, the availability of materials and equipment, and the timing of improvements. These preliminary cost estimates are made in 2020 dollars, so inflationary increases should be added for the expected date of construction. No cost estimates have been made for extending service into the UGA or to unserved properties within the city limits. The location of recommended system improvements are shown on Figure 7-1.

7.2.1 Maintenance Related Improvements

The City has identified several sections of sewer pipe within their collection system that require additional cleaning and maintenance. The cause of these maintenance issues is not known, but could possibly be related to inadequate or transverse pipe slopes, separated joints, or root and/or debris intrusion issues. All identified high-maintenance pipelines should be video inspected and further evaluated prior to design and construction, to clearly identify the problems and proper repair methods. The estimated costs for these maintenance related improvements is based upon full replacement of the pipeline section(s), however, alternative construction methods such as slip-lining or cured-in-place pipe liners may be possible in some locations which could reduce costs. These projects include Improvements 3, 4, 5, 6, and 7 in Table 7-4.

In addition to maintenance issues, excessive damage to manholes and piping in a portion of the sewer trunk main from the west city limits to Cheyne Road has been reported by the City (Improvement 1). This section of piping receives wastewater from the Vintage Valley Lift Station (Basin 1) force main. The long residence time of wastewater in this force main creates septic conditions that result in an elevated concentration of sewer gasses, contributing to odor issues and deterioration of manholes and piping. Replacement of this section of the City's sewer trunk main has been identified as a high-priority improvement. However, further evaluation of chemical treatment of wastewater pumped from Basin 1 may be necessary prior to completion of this improvement, as discussed in Section 3.4.5.

Similarly, the Zillah West lift station has experienced corrosion issues and needs the pumps and pump rails to be replaced (Improvement 2 in Table 7-4).



A few maintenance items have been identified that need to be performed at the WWTP (Improvement 10 in Table 7-4). Each of the WWTP improvements are discussed in Chapter 6. The identified improvements at the WWTP are considered by the City to have priority over the identified collection system improvements. Therefore, the WWTP improvements have been scheduled before the collection system projects in Table 7-4.

The City has identified approximately seven locations within the existing collection system, where manholes at angle points or intersections have been buried, as discussed in Chapter 3. These buried manhole locations have been grouped into a single maintenance-related improvement estimate and include full replacement of the manholes and connections to existing piping, since the actual manhole condition is unknown. The location and condition of these manholes should be further evaluated prior to replacement.





IMPROVEMENT 1: SEWER TRUNK MAIN REPLACEMENT (WEST CITY LIMITS TO CHEYNE ROAD)										
Item	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$30,000	\$30,000						
Project Temporary Traffic Control	LS	1	\$30,000	\$30,000						
PVC Sanitary Sewer Pipe, 15-inch	LF	1,300	\$100	\$130,000						
Manhole 48-inch Type 1	\$6,000	\$30,000								
Connection to Existing Piping	\$2,000	\$6,000								
Reconnect Existing Side Sewer	EA	2	\$650	\$1,300						
Shoring or Extra Excavation	LF	1,300	\$1.50	\$2,000						
Gravel Surface Repair	SY	100	\$25	\$2,500						
Asphalt Surface Repair	SY	500	\$60	\$30,000						
	Const	ruction Cos	st Subtotal	\$261,800						
		Т	ax (8.0%)	\$20,944						
			Subtotal	\$282,744						
		Continge	ncy (20%)	\$56,549						
			Subtotal	\$339,293						
	Desig	n Engineer	ing (15%)	\$50,884						
	Constructio	n Engineer	ing (15%)	\$50,884						
	Т	otal Estima	ated Cost	\$440,996						



IMPROVEMENT 3: 4 TH STREET, GLENWOOD DRIVE, AND WESTWIND DRIVE 8-INCH SEWER MAIN REPLACEMENT											
Item	Unit	Qty.	Unit Cost	Total Cost							
Mobilization	LS	1	\$40,000	\$40,000							
Project Temporary Traffic Control	LS	1	\$20,000	\$20,000							
PVC Sanitary Sewer Pipe, 8-inch Diam	LF	2,700	\$80	\$216,000							
Manhole 48-inch Diam Type 1	EA	14	\$6,000	\$84,000							
Connection to Existing Piping	EA	8	\$2,000	\$16,000							
Reconnect Existing Side Sewer	EA	36	\$650	\$23,400							
Shoring or Extra Excavation	LF	2,700	\$1.50	\$4,050							
Select Backfill, as Directed	CY	300	\$40	\$12,000							
Asphalt Surface Repair	SY	1,800	\$60	\$108,000							
	Consti	ruction Cos	t Subtotal	\$523,450							
		Т	ax (8.0%)	\$41,876							
			Subtotal	\$565,326							
		Continger	ncy (20%)	\$113,065							
			Subtotal	\$678,391							
	Desig	n Engineer	ing (15%)	\$101,759							
(Constructio	n Engineer	ing (15%)	\$101,759							
	То	otal Estima	ated Cost	\$881,909							



IMPROVEMENT 4: FIRST AVENUE 8-INCH SEWER MAIN REPLACEMENT (MAPLE WAY TO MEADE DRIVE AND MAPLE WAY TO PEARSON STREET)										
Item	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$30,000	\$30,000						
Project Temporary Traffic Control	LS	1	\$25,000	\$25,000						
PVC Sanitary Sewer Pipe, 8-inch Diam	LF	1,100	\$80	\$88,000						
Manhole 48-inch Diam Type 1	EA	5	\$6,000	\$30,000						
Connection to Existing Piping	EA	8	\$2,000	\$16,000						
Reconnect Existing Side Sewer	EA	7	\$650	\$4,550						
Shoring or Extra Excavation	LF	1,100	\$1.50	\$1,650						
Select Backfill, as Directed	CY	50	\$40	\$2,000						
Asphalt Surface Repair	SY	600	\$60	\$36,000						
	Const	ruction Cos	st Subtotal	\$233,200						
		Ţ	ax (8.0%)	\$18,656						
			Subtotal	\$251,856						
		Continge	ncy (20%)	\$50,371						
			Subtotal	\$302,227						
	Desig	gn Enginee	ring (15%)	\$45,334						
	Constructio	on Enginee	ring (15%)	\$45,334						
	Т	otal Estim	ated Cost	\$392,895						



IMPROVEMENT 5: ADAMS PARK 8-INCH SEWER MAIN REPLACEMENT (MAIN BETWEEN ADAMS PARK DRIVE AND SUNSET WAY)										
Item	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$20,000	\$20,000						
Project Temporary Traffic Control	LS	1	\$8,000	\$8,000						
PVC Sanitary Sewer Pipe, 8-inch Diam	LF	600	\$80	\$48,000						
Connection to Existing Manhole	EA	1	\$2,000	\$2,000						
Reconnect Existing Side Sewer	EA	12	\$650	\$7,800						
Shoring or Extra Excavation	LF	600	\$1.50	\$900						
Select Backfill, as Directed	CY	20	\$40	\$800						
Asphalt Surface Repair	SY	20	\$60	\$7,200						
Replace Existing Fencing	LF	600	\$50	\$30,000						
Miscellaneous Landscape Repair	LS	\$24,000	\$24,000							
	Constr	ruction Cos	st Subtotal	\$148,700						
		T	ax (8.0%)	\$11,896						
			Subtotal	\$160,596						
		Continge	ncy (20%)	\$32,119						
			Subtotal	\$192,715						
	Desig	n Engineer	ring (15%)	\$28,907						
(Constructio	n Engineer	ing (15%)	\$28,907						
	To	otal Estima	ated Cost	\$250,530						



IMPROVEMENT 6: ANN STREET AND WALNUT STREET 8-INCH SEWER MAIN REPLACEMENT										
Item	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$20,000	\$20,000						
Project Temporary Traffic Control	LS	1	\$12,000	\$12,000						
PVC Sanitary Sewer Pipe, 8-inch Diam	LF	700	\$80	\$56,000						
Manhole 48-inch Diam Type 1	EA	1	\$6,000	\$6,000						
Connection to Existing Piping	EA	1	\$2,000	\$2,000						
Connection to Existing Manhole	EA	2	\$2,400	\$4,800						
Reconnect Existing Side Sewer	EA	\$9,750								
Shoring or Extra Excavation	LF	700	\$1,050							
Select Backfill, as Directed	CY	150	\$6,000							
Asphalt Surface Repair	SY	500	\$60	\$30,000						
	Consti	ruction Cos	t Subtotal	\$147,600						
		Т	ax (8.0%)	\$11,808						
			Subtotal	\$159,408						
		Continger	ncy (20%)	\$31,882						
			Subtotal	\$191,290						
	Desig	n Engineer	ing (15%)	\$28,693						
(Constructio	n Engineer	ing (15%)	\$28,693						
	Тс	otal Estima	ated Cost	\$248.676						



IMPROVEMENT 7: BURIED MANHOLE REPLACEMENT										
ltem	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$12,000	\$12,000						
Project Temporary Traffic Control	LS	1	\$18,000	\$18,000						
Manhole 48-inch Diam Type 1	EA	7	\$8,000	\$56,000						
Connection to Existing Piping	EA	15	\$2,000	\$30,000						
Shoring or Extra Excavation	LS	1	\$1,500	\$1,500						
Asphalt Surface Repair	SY 200		\$60	\$12,000						
	Constr	ruction Cos	t Subtotal	\$129,500						
		Т	ax (8.0%)	\$10,360						
			Subtotal	\$139,860						
		Continger	ncy (20%)	\$27,972						
			Subtotal	\$167,832						
	Desig	n Engineer	ing (15%)	\$25,175						
(Constructio	n Engineer	ing (15%)	\$25,1 <u>75</u>						
	То	otal Estima	ated Cost	\$218,182						

7.2.2 Capacity Related Improvements

As described in Chapter 3 of the Plan, the hydraulic analysis model of the existing collection system identified no areas where current capacity at existing peak wastewater flows is insufficient.

Capacity deficiencies within the existing collection system were identified in Chapter 4 and Chapter 5 for the full build-out and 20-year flow scenarios. As described in these chapters, deficiencies were isolated to the City's sewer trunk main that follows the old railroad alignment from west city limits to the WWTP. The section of piping from the west city limits to Cheyne Road was not determined as having insufficient capacity within the next 20 years but has been identified as a maintenance-related improvement (Improvement No. 1), as described in Section 7.2.1. The replacement sewer main for this section of piping will be up-sized to account for potential changes in the location of future development. To allow for adequate future capacity, the recommended replacement pipe sizes are based upon handling the estimated full build-out peak flow capacities.

The City has some current development activities west of the City in the Zillah Lakes area. Other developers are showing interest in the UGA west of the City, but there are no definite schedules or developers extension agreements in place currently the City is obligated to meet. Therefore, the improvement projects (Improvement 1 and Improvement 8) have been included in the financial plan but are not planned to be started within the next 6 years.



IMPROVEMENT 8: SEWER TRUNK MAIN REPLACEMENT (CHEYNE ROAD TO WWTP)										
Item	Unit	Qty.	Unit Cost	Total Cost						
Mobilization	LS	1	\$60,000	\$60,000						
Project Temporary Traffic Control	LS	1	\$50,000	\$50,000						
PVC Sanitary Sewer Pipe, 15-inch Diam	LF	5,400	\$100	\$540,000						
Manhole 48-inch Diam Type 1	EA	17	\$6,000	\$102,000						
Connection to Existing Piping	EA	5	\$2,000	\$10,000						
Reconnect Existing Side Sewer	EA	20	\$650	\$13,000						
Shoring or Extra Excavation	LF	5,400	\$1.50	\$8,100						
Gravel Surface Repair	SY	300	\$25	\$7,500						
Asphalt Surface Repair	SY	2,100	\$60	\$126,000						
Lawn Repair	SY	1,000	\$15	\$15,000						
	Constr	uction Cos	t Subtotal	\$871,600						
		Т	ax (8.0%)	\$69,728						
			Subtotal	\$941,328						
		Continger	ncy (20%)	\$188,266						
			Subtotal	\$1,129,594						
	Desig	n Engineer	ing (15%)	\$169,439						
(Constructio	n Engineer	ing (15%)	\$169,439						
	Тс	otal Estima	ated Cost	\$1.468.472						



7.2.3 Miscellaneous Collection System Improvements

In Chapter 3 of the Plan, miscellaneous improvements to the existing lift stations were identified, which include a replacement of the pumps at the Zillah West Lift Station due to extensive corrosion that has occurred inside the wet well. An evaluation of the wet well was performed on the pumps currently planned to be replaced as part of the Vintage Valley Road extension project. Therefore, the costs for this project are not included in this Plan.

7.2.4 WWTP Related Improvements

The City has identified several maintenance and process deficiencies at the WWTP. These items include the following:

- 1. Replacement of clarifier inlet valves are needed.
- 2. Influent screen reliability is not acceptable.
- 3. Sludge thickener reliability is not acceptable.
- 4. Thickened sludge pump issues.
- 5. Limited digester capacity available.
- 6. Grit collection and removal system is ineffective.

The inlet valves for the two clarifiers are inoperable. Consequently, the flow to the clarifiers cannot be balanced or isolated for maintenance purposes by these plugged valves. Therefore, they need to be replaced to restore the operational functionality for flow control and proper clarifier maintenance.

The influent screen is over 20 years old and prone to failure. A bypass channel with a manually raked bar screen is used when the screen is out of service. The screen should be replaced or modified, and only used for back-up purposes after installing a new screen in the adjacent channel for system reliability.

The digested sludge thickener and associated polymer feed system has also reached the end of its useful life. The system has undergone several modifications to keep it functioning at some level, but it is not reliable. The consequence of poor thickener performance is the additional quantity of sludge to be transferred to the City's drying bed facility located approximately two miles outside of town, and costs associated with the additional use of polymer.

The thickened sludge pump has been unreliable, and a portable pump has been set up to load a truck to transfer sludge to the drying beds. The pump needs to be replaced to allow the system to run reliably. With improved thickener and polymer system operation, the thickened sludge system will be able to be automated, requiring less operator attention.

The two aerobic digesters are a limiting capacity for the process, and proper digestion cannot be achieved when one of the two is taken out of service for maintenance. Options to address this restriction include:

- 1. Thickening the sludge prior to feeding the digester to reduce the volume input to the digesters;
- 2. Adding a third digester tank; or
- 3. Converting the existing digesters to an anaerobic type which will cut the required detention time in half.

The lowest cost option is to thicken the sludge prior to feeding the digester. It may be possible to repurpose the existing thickener for this use if it is replaced with a screw press to dewater the sludge prior to hauling it off site. This approach is expected to reduce the quantity of sludge entering the digester to one-half or possibly one-third of the existing feed volume, and the quantity of sludge after dewatering by a screw press would be reduced to about one-tenth of existing volume, significantly reducing the number of loads hauled to the drying bed site.

A small grit collection system is installed just downstream of the existing influent fine screen. The size of the grit tank is small and grit removal is difficult. One option is to install a combination grit removal system



with a tank and initial course screen ahead of the existing fine screen. This would upgrade the grit system and decrease the loading of the exiting fine screen minimizing the screen overflow events.

The costs for the WWT	P projects described	above are estimated b	ased on the following:

IMPROVEMENT 10: WWTP MAINTENANCE AND PROCESS IMPROVE									
Item	Unit	Qty.	Unit Cost	Total Cost					
Mobilization	LS	1	\$50,000	\$40,000					
Replace Clarifier Inlet Valves	LS	2	\$30,000	\$60,000					
Headworks Equipment - installed	LS	1	\$245,000	\$245,000					
Headworks Equipment Foundations	LS	1	\$30,000	\$30,000					
Sewer Connection (includes pipe, fittings and valves).	LS	1	\$25,000	\$25,000					
Screw Press Equipment - installed	LS	1	\$110,000	\$110,000					
Dewatered Sludge Pumps	LS	1	\$20,000	\$20,000					
Pump and Piping Modifications	LS	1	\$10,000	\$10,000					
Electrical, Instrumentation & Controls	LS	\$100,000	\$100,000						
	Const	truction Co	st Subtotal	\$640,000					
			Tax (8.0%)	\$51,200					
			Subtotal	\$691,200					
		Continge	ency (20%)	\$138,240					
			Subtotal	\$829,440					
	Desig	gn Enginee	ering (15%)	\$124,416					
	Constructio	on Enginee	ering (15%)	\$124,4 <u>16</u>					
	Т	otal Estim	nated Cost	\$1,078,272					

It is anticipated the WWTP Improvements could be completed in two consecutive years. This will improve plant operations and reduce risk of an equipment failure that may result in performing work under an emergency situation, and a possible permit violation.

The aeration automation project described in Chapter 6 was not included in these costs as it was not identified as a priority by the City. However, this project may be able to be included as part of these projects and performed as an energy efficiency project with rebate incentives from the power utility. Therefore, it should be considered as a possible addition to the WWTP improvements when the preliminary design begins.

7.3 CAPITAL IMPROVEMENT PLAN

The City has placed a priority on the collection system projects. Therefore, projects considered as highest priority are planned to be scheduled first in Table 7-4. These highest priority improvements are as follows:

- Improvement 9, Vintage Valley and Zillah West Lift Station Improvements. Scheduled to be completed in 2021 as part of the Vintage Valley Parkway project.
- Improvement 10, WWTP Projects (Headworks equipment, dewatering equipment, clarifier valve replacement, and aeration equipment automation). Scheduled for 2021-2022.
- Improvement 5, Adams Park 8-inch sewer main replacement. Scheduled for 2022-2023.



- Improvement 3, 4th Street, Glenwood Drive, and Westwind Drive 8-inch sewer main replacement. Scheduled for 2024-2025.
- Improvement 6, Ann Street and Walnut Street 8-inch sewer main replacement. Scheduled for 2025-2026.
- Improvement 4, First Avenue 8-inch sewer main replacement (Maple Way to Meade Drive and Maple Way to Pearson Street). Scheduled for 2027-2028.
- Improvement 8, Sewer trunk main replacement from Cheyne Road to WWTP. Scheduled for 2028-2029.
- Improvement 7, Buried Manhole Replacement. Scheduled for 2029-2030.
- Improvement 1, Sewer trunk main replacement from west city limits to Cheyne Road. Scheduled for 2031-2033.

The schedule for improvements is based on current priorities and completing the projects with revenues from sewer rates without loans. Monitoring of the needs should be reviewed annually to confirm and adjust improvement priorities accordingly. This annual check may require additional projects to be included in the list, loans to be secured to fund the projects to meet the revised schedules, and/or sewer rates to be adjusted, accordingly.

The estimated costs for each of these improvements are listed separately in Table 7-1 using 2021 dollars. An annual escalation factor of 3% is included in the financial model based on the year the project is scheduled.

	TABLE 7-1 – SCHEDULE O	F RECOMME	NDED IMPRO	OVEMENTS	
Improvement No.	Improvement Description	Estimated Cost in 2020 Dollars	Completion Year	Estimated Cost*	Funding Source
1	Sewer Trunk Main Repl. (West city limits to Cheyne Road)	\$440,996	2032	\$629,000	City
2	Vintage Valley Rd. 8-inch Sewer Main Repl.	In Progress	2021	NA	NA
3	4 th St., Glenwood Dr., & Westwind Dr. 8- inch Sewer Main Repl.	\$881,909	2026	\$1,053,000	City
4	First Ave. 8-inch Sewer Main Repl.	\$392,895	2029	\$513,000	City
5	Adams Park 8-inch Sewer Main Repl.	\$250,530	2024	\$282,000	City
6	Ann St. & Walnut St. 8-inch Sewer Main Repl.	\$248,676	2027	\$306,000	City
7	Buried Manhole Repl.	\$218,182	2031	\$302,000	City
8	Sewer Trunk Main Repl. (Cheyne Road to WWTF)	\$1,468,472	2030	\$1,974,000	City
9	Lift Station Improvements	In Progress	2021	NA	NA
10	WWTP projects	\$1,078,272	2022	\$1,144,000	City
	TOTAL COSTS	\$4,878,844		\$6,203,000	
	* Estimated future improvement costs beyor	nd year 2020 inc	clude 3% inflati	on per year.	



7.4 SEWER RATE REVISIONS

The existing rate structure was reviewed as part of this General Sewer Plan Update. The rate analysis revealed an inequity between the classification of rate payers. The new rate structure ordinance included in the appendix was developed to provide a method to charge customers for both a flow and loading component based on typical loadings for residential, three classes of commercial type customers, schools, and industrial facilities served by the City. The revised rate structure was used in the projected revenue calculations to determine additional funding needs to complete the identified capital improvement projects.

The City's desire is to complete the identified improvements without the need to seek outside funding sources via loans. Therefore, Table 7-4 shows the project implementation as scheduled in Table 7-1 with the estimated revenue projections and project cost estimates. Using this approach, all the identified projects are projected to be able to be completed in twelve years. After this time, \$750,000 is expected to be available each year for capital improvement projects within the collection system or at the WWTP based upon current revenue projections after revising the sewer rates in 2019.

7.5 FUNDING SOURCES

Funds may be available for financing the proposed improvements from several sources. Those considered in this section are listed below:

- 1. Local Public Enterprise Funds.
- 2. Use of Local Public Powers.
- 3. State Assisted or Guaranteed Resources.
- 4. Federally Assisted or Guaranteed Resources.
- 5. Private Development.

Available funding is limited in a number of these five sources. Many also restrict the use of funds to certain projects, while other sources limit their participation to a percentage of the total cost. Each of these categories are described briefly below.

7.5.1 Local Public Enterprise Funds

Reserves in the Enterprise Fund are accumulated from sewer user fee revenues. The amount of reserves will depend on the balance of operation and maintenance costs of the system versus total revenue generated by fees. These reserves may be used to finance any sewer system related project approved by the City Council.

Funds for a future project may be generated by increases in user fees, thus building reserves in the Enterprise Fund. With this method of financing, often called the "pay-as-you-go" approach, the City is collecting interest on reserves as opposed to paying interest on a loan balance. One method used by some communities to accumulate reserves is through development of a capital recovery charge system. This approach is similar to assessing connection fees, except the amount is based on capital costs of constructing collection system trunk lines and treatment facilities, and the collected funds are usually set aside as capital reserves for future projects.

7.5.2 Use of Local Public Powers

The use of local public powers consists of three primary bonding techniques, including general obligation bonds, special assessment bonds, and revenue bonds. There are advantages and disadvantages to each. The type of bond issued to finance a community improvement depends in part on custom and in part on the circumstances of a particular offering. General information about the three principal types of municipal bonds follows:

GENERAL OBLIGATION BONDS pledge the unlimited taxing power and the full faith and credit of the issuing government to meet the required principal and interest payments.



SPECIAL ASSESSMENT BONDS (LID or ULID Bonds) are used to finance improvements where the property specially benefitted can be identified. Special assessment bonds are frequently used to make capital improvements in a neighborhood. Principal and interest payments for these bonds are made by the special assessment on the property benefitting from the improvement. Before special assessment bonds are issued, estimated costs are mailed to property owners, and a public hearing is held to allow the affected property owners to say whether they want the improvements. During a subsequent 30-day protest period, property owners may protest the improvements prior to City Council action formally establishing the project. Debt financed by special assessment bonds is not subject to debt limitations. This type of financing is typically not suited to treatment plant improvement projects or for construction of trunk sewers within a collection system. However, it is often used to finance extension of sewers into a new service area.

REVENUE BONDS are frequently used to finance City-owned utilities, industrial parks, and other municipal public facilities. The bonds pledge the revenue from a revenue source to meet the principal and interest payments. Revenue bonds are appropriate debt instruments when the enterprise fund can be expected to generate sufficient revenue to meet both operating and debt service costs. Revenue bonds generally do not become a general obligation of the government issuing them. Communities may have to pay higher rates of interest on these bonds than on general obligation bonds, because revenue bonds are considered less secure. However, revenue bonds also have an important advantage over general obligation bonds: the amount of the revenue bonds is not included in the amount of indebtedness subject to state debt limitations. The legal requirements for issuing revenue bonds are more complex than those for issuing general obligation bonds. When revenue bonds are issued, a special authority (Sewer Fund) operates the facility, and a special revenue fund receives and disburses all funds. A trust agreement to provide for the monthly reimbursement of revenues and containing provisions to protect the bond holders must be formulated.

7.5.3 State Assisted or Guaranteed Resources

Three types of state administered funding sources are available for domestic wastewater system projects: the Centennial Clean Water Fund Program (administered by the Washington Department of Ecology), the State Revolving Fund Loan Program (administered by the Washington Department of Ecology), and the Public Works Trust Fund (administered by the Department of Community, Trade, and Economic Development).

The CENTENNIAL CLEAN WATER FUND was established in 1986, obtaining its money from a tax on tobacco products. Funds from this program are used for grants and loans to local governments for measures to prevent and control water pollution. Up to two-thirds of the funds in this program can be used for activities and facilities related to point source discharges. The Centennial Program will fund up to 50% of the total eligible project costs. Applications are accepted once a year. However, rules for these funds prohibit their use on projects where state or federal grants were previously awarded, and the same objective achieved.

The STATE REVOLVING FUND provides low-interest loans to local governments for projects which improve and protect the state's water quality. Up to 100% of eligible project costs are fundable through this program. Applications are accepted once a year, concurrent with the Centennial Clean Water Fund applications.

The PUBLIC WORKS TRUST FUND was created in 1985 to provide loans for replacement of public works facilities. Applications for construction funds may be submitted once each year, and applications for preconstruction funds (for items such as engineering design, bid document preparation, right-of-way acquisition, environmental studies, and infiltration/inflow studies) may be submitted any time during the year. Current allocations of funds have been for a wide variety of projects, including domestic wastewater projects. The interest rate on PWTF loans ranges from 0.5% to 2% depending on the amount of matching money provided by the City.



7.5.4 Federally Assisted or Guaranteed Resources

Three federally financed funding sources are available for domestic wastewater system construction: the USDA's Rural Development Program, the Economic Development Administration's Public Works Grants and Loans Program, and the Department of Housing and Urban Development's Community Development Block Grants administered by the State Department of Community, Trade, and Economic Development.

The USDA RURAL DEVELOPMENT PROGRAM is one of several programs established by USDA to provide public works assistance to small communities in rural areas. Public entities such as municipalities, counties, special purpose districts or authorities, Indian tribes, and nonprofit corporations or cooperatives are eligible in areas under 10,000 population. Priority will be given to public entities in areas smaller than 5,500 people to improve, enlarge, or modify a wastewater facility. Preference will also be given to requests that involve the merging of small facilities and those serving low-income communities. Loans and grant funds may be used to construct, repair, improve, expand, or otherwise modify rural wastewater collection and treatment systems. Targeted at the neediest communities, grants are designed to keep costs economical. Grants are limited to reducing the facility's per user annual costs for debt service to a minimum of 1% of the area's median family income. Loans in the past have also been available at a 5% to 10% interest rate for the useful life of the facility, the statutory limit on the applicant's borrowing authority, or for a maximum of 40 years.

The PUBLIC WORKS GRANTS AND LOANS PROGRAM funded by the Economic Development Administration (EDA) is used to encourage long-range development gains in jurisdictions where economic growth is lagging or where the economic base is shifting. The program provides public works and development facilities needed to attract new industry and provide business expansion. Financial aid may be used to acquire and develop land and improvements for public works and to acquire, construct, rehabilitate, alter, expand, or improve such facilities, including related machinery and equipment. When completed, such projects are expected to bring additional private investment to the area. Zillah has successfully used these funds for past water and wastewater system upgrades by showing demonstrable benefits to the local industries.

Under the U.S. Department of Housing and Urban Development (HUD), COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM administered by the State Department of Community, Trade, and Economic Development (CTED), communities under 50,000 can apply for grants to undertake activities in providing adequate housing, expanded economic opportunities, and correcting deficiencies in public facilities which affect the public safety and health of area or community residents. The program is designed to aid low-and moderate-income people and is also directed to have maximum impact on stated community problems. Its primary focus is to assist blighted communities, or communities suffering a community or economic development problem. Sanitary sewer system projects in low-income areas of the City could be eligible for funding under this program.

7.5.5 Private Development

Expansion of domestic wastewater facilities to newly developing areas outside the existing service area is a common requirement of private developments. Installation of public utilities within housing subdivisions is normally financed entirely by the developer.

Although funding has been curtailed in several programs within the last few years, some projects statewide are still receiving financing. Competition for available funds, however, has increased significantly. Projects showing the greatest need and that have the largest local funding participation, or benefit to low-income families, are receiving most financing from these programs. Careful planning and packaging of the project is necessary so that through effective dollar use, including local participation, a funding agency may obtain the maximum benefit for the greatest number of people.



Table 7-2 provides a summary of funding sources and projects that are eligible under each program.

TABLE 7-2 – FUNDING SOURCE SUMMARY							
Funding Source	Eligible Projects						
Sewer Enterprise Fund	All wastewater system projects						
General Obligation Bond	All wastewater system projects						
Revenue Bond	All wastewater system projects						
Special Assessment Bond	Local Improvement District projects						
Centennial Clean Water Fund	All wastewater system projects not previously funded with state or federal funds; limited eligibility for growth- and industrial-related projects						
State Revolving Fund	All wastewater system projects; limited eligibility for industrial-related projects						
Public Works Trust Fund	Replacement of existing wastewater system facilities; service to previously unsewered areas						
USDA Rural Development Sewer Grant	All wastewater system projects once maximum level of indebtedness is reached						
USDA Rural Development Sewer Loan	All wastewater system projects						
EDA Public Works Grant	Water system projects to attract new industries and provide for business expansion						
EDA Public Works Loan	Wastewater system projects to attract new industries and provide for business expansion						
HUD Community Development Block Grant	Wastewater system projects which directly benefit low- and moderate-income families						
Private Development	All wastewater system projects necessary for new housing and/or commercial developments						

No future loans or financial assistance is anticipated to be necessary in the next six years, but if funding is required for future improvements to be completed, further investigation of loan/grant program availability, and terms and conditions will be necessary to proceed with the recommended improvements.

7.6 RECOMMENDED PROJECT FINANCING

Provided in Table 7-3 and Table 7-4 is a proposed financial program for Zillah's sewer operating and reserve funds, which incorporates projected future revenue, operating costs, and loan costs (if necessary) for the planning period. The values for 2020 are based on 2020 budget amounts adopted by the City in 2019.

The projected future sewer service fees include recommended revenue increases for that year. Revenue increases are a combination of rate increases and sewer service growth. If no growth or reduced growth occurs in any of the proposed financial program years, the program will have to be revised or additional rate increases will need to be implemented to account for the reduced revenue. The City has adopted sewer rate increases of 3% per year through 2024 (Zillah Municipal Code Chapter 13.16.090).

Future sewer department expenses were estimated based upon an average inflation rate of 5% per year, as shown in Table 7-3. Investment interest amounts are based upon 3.5% of the beginning fund balance, to provide an average of potential investment interest revenue for that year.



The City of Zillah will continue annual reviews of the sewer system's financial program during their budget preparation process. The financial program will also be reviewed and revised as needed during the next General Sewer Plan update. This continued review will allow for modifications to the proposed rate and revenue increases, should financial conditions change.

TABLE 7-3 PROPOSED SEWER OPERATING FUND (403) FINANCIAL PROGRAM																			
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
BEGINNING FUND BALANCE	460,235	837,888	800,000	800,000	800,000	800,000	800,001	800,000	800,000	800,000	800,000	800,000	800,000	800,001	800,000	800,001	800,000	799,998	799,995
REVENUES:	2020 Budge	t																	
Sewer Service Fees (Includes projected		Ī																	
revenue increase of 5%)	800,000	840,000	882,000	926,100	972,405	1,021,025	1,072,077	1,125,680	1,181,964	1,241,063	1,303,116	1,368,271	1,436,685	1,508,519	1,583,945	1,663,143	1,746,300	1,833,615	1,925,295
Sewer Service Fees - Pump Stations																			
(Includes projected revenue increase)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utility Tax - 32% - Sewer	240,000	247,200	254,616	262,254	270,122	278,226	286,573	295,170	304,025	313,146	322,540	332,216	342,183	352,448	363,022	373,912	385,130	396,683	408,584
Other Utility Fees & Changes	5,400	5,562	5,729	5,901	6,078	6,260	6,448	6,641	6,841	7,046	7,257	7,475	7,699	7,930	8,168	8,413	8,665	8,925	9,193
SUBTOTAL - REVENUE	1,045,400	1,092,762	1,142,345	1,194,255	1,248,605	1,305,511	1,365,097	1,427,491	1,492,830	1,561,254	1,632,913	1,707,962	1,786,567	1,868,897	1,955,135	2,045,468	2,140,095	2,239,223	2,343,072
MISC. REVENUES																			
Investment Interest	3,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Bond Gan/Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insurance Recovery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewer-Surplus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating Transfers - IN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL - MISC-REVENUES	3,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
TOTAL REVENUES	1,048,600	1,093,962	1,143,545	1,195,455	1,249,805	1,306,711	1,366,297	1,428,691	1,494,030	1,562,454	1,634,113	1,709,162	1,787,767	1,870,097	1,956,335	2,046,668	2,141,295	2,240,423	2,344,272
TOTAL SEWER FUND	1,508,835	1,931,850	1,943,545	1,995,455	2,049,805	2,106,711	2,166,298	2,228,692	2,294,030	2,362,454	2,434,113	2,509,163	2,587,767	2,670,098	2,756,335	2,846,669	2,941,295	3,040,421	3,144,267
EXPENSES:																			
General Sewer Operating Expenses																			
(including 5% inflation per year)	638,547	670,474	703,998	739,198	776,158	814,966	855,714	898,500	943,425	990,596	1,040,126	1,092,132	1,146,739	1,204,076	1,264,279	1,327,493	1,393,868	1,463,561	1,536,739
Sewer - Capital Improvements	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reserve (403) Transfers Out / USDA	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400			
Reserve (403) Transfers Out for CIPs		428,975	407,147	423,857	441,247	459,345	478,183	497,792	518,205	539,458	561,587	584,630	608,628	633,622	659,655	686,775	747,429	776,865	807,537
SUBTOTAL - EXPENSES	670,947	1,131,849	1,143,545	1,195,455	1,249,805	1,306,711	1,366,297	1,428,692	1,494,030	1,562,454	1,634,113	1,709,162	1,787,767	1,870,098	1,956,334	2,046,668	2,141,297	2,240,426	2,344,276
ENDING FUND BALANCE	837,888	800,000	800,000	800,000	800,000	800,001	800,000	800,000	800,000	800,000	800,000	800,000	800,001	800,000	800,001	800,000	799,998	799,995	799,991
Net Increase (Decrease)	377,653	(37,887)	0	0	0	0	0	0	0	0	0	0	0	0	0	(1)	(2)	(3)	(4)
Draioctad Bayanya Increase at Start of Vear**	622.26	622.22	621.22	¢25.26	626 A2	¢27 Ε1	620 C1	¢20.90	¢40.00	¢12.22	¢42.40	¢44.70	¢16 11	647 E2	¢ 4 9 0 E	¢E0 40	¢E1 02	¢E2.40	ά ΓΕ 00
Euturo Paco Mothly Pato	۶۵۲.۵۵	کە.دەد ا	ې54.35	۶۵.۵۵¢	ې50.42	۲۵٬۱۵۲	ې30.04	٥٥.٤٦٤ کې	ې40.99 ا	۶42.22	45.49 <u>ب</u>	ې <u>44.79</u>	ې40.14 ا	۲۲.۵ <u>۲</u>	740.95	30.42	52.72¢	ې52.49	302.09
* Voor 2020 values are two times actual		uroc through	lung of 2020																
** Devenue ingrange of 20/ nervices actual revenu	es/expenditl	the of 20% opening	June of 2020.																
revenue increase of 3% per year, and an esti	maleu growt	ui oi 2% annu	idily.																

					TABLE	7-4 PROPOS	SED SEWER RI	SERVE FUND	(430) FINAN	CIAL PROGRA	М								
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
	340,725	368,512	402,877	72,347	453,387	670,596	988,597	555,112	901,743	1,484,189	1,459,180	359,476	598,864	899,166	1,652,237	2,429,965	3,233,278	4,095,540	4,985,352
Physical Environment																			
Sewer Service Charges - Pump Stations	12,000	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657	16,127	16,611	17,109	17,622	18,151	18,696	19,256	19,834	20,429
Subtotal Physical Environment:	12,000	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657	16,127	16,611	17,109	17,622	18,151	18,696	19,256	19,834	20,429
Interest and Other:	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000
Investment Interest Bond Gain/Losses	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Interest Interfund Loan (from 101)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Interest and Other:	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Rents Leases and Concessions:																			
Lease Payment on Bailey RD	12,300	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500	10,500
Subtotal Rents Leases and Concessions:	13,500	11,700	11,700	1,200	11,700	11,700	11,700	11,700	11,700	11,700	1,200	11,700	11,700	11,700	11,700	1,200	1,200	1,200	11,700
Sewer Services:	,			,	,								,			,			,
Connection Charges	48,600	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,001	27,002	27,003	27,004
Ordinance 907 Sewer Improvement Charge	104,000	106,080	108,202	110,366	112,573	114,824	117,121	119,463	121,853	124,290	126,775	129,311	131,897	134,535	137,226	139,970	142,770	145,625	148,538
Other Miscellaneous Revenues:	152,000	155,060	155,202	137,300	159,575	141,024	144,121	140,405	140,055	151,290	155,775	150,511	130,097	101,555	104,220	100,971	109,772	172,020	175,542
Miscellaneous/Refund of Irrigation/Bailey	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500
Refund from DNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Other Miscellaneous Revenue:	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500	18,500
TOTAL REVENUES	198,600	177,640	180,132	182,678	185,279	187,936	190,650	193,422	196,254	199,147	202,102	205,122	208,206	211,357	214,577	217,867	221,228	224,662	228,171
Transfer IN from 403/USDA Loan	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	32.400	0	0	0
Transfer in from 403 CIP Projects	0	428,975	407,147	423,857	441,247	459,345	478,183	497,792	518,205	539,458	561,587	584,630	608,628	633,622	659,655	686,775	747,429	776,865	807,537
Subtotal Transfers IN	32,400	461,375	439,547	456,257	473,647	491,745	510,583	530,192	550,605	571,858	593,987	617,030	641,028	666,022	692,055	719,175	747,429	776,865	807,537
Total Revenues and Transfers IN	231,000	639,015	619,679	638,935	658,926	679,681	701,233	723,614	746,859	771,005	796,089	822,152	849,234	877,379	906,632	937,042	968,657	1,001,527	1,035,708
(Beginning Balance+Revenue):	571,725	1,007,527	1,022,556	711,283	1,112,313	1,350,277	1,689,830	1,278,726	1,648,601	2,255,194	2,255,270	1,181,628	1,448,098	1,776,546	2,558,869	3,367,007	4,201,936	5,097,067	6,021,060
SEWER PLANT RESERVE EXPENDITURES:																			
Utilities and Environment																			
Admin salaries, benefits, & supplies; CPF spplies,	2,541	2,668	2,801	2,942	3,089	3,243	3,405	3,575	3,754	3,942	4,139	4,346	4,563	4,791	5,031	5,283	5,547	5,824	6,115
grinder pump supplies, admin Professional Services	3 150	3 308	3 473	3 647	3 829	4 020	A 221	A A 3 2	4 654	4 887	5 131	5 388	5 657	5 940	6 237	6 549	6 876	7 220	7 581
Irrigation Assessment - RID (Includes 5% inflation	3,130	3,300	3,473	5,047	5,025	7,020	7,221	7,732	-,03-	-,007	3,131	5,500	5,057	3,340	0,237	0,545	0,070	7,220	7,501
per year)	22,050	23,153	24,310	25,526	26,802	28,142	29,549	31,027	32,578	34,207	35,917	37,713	39,599	41,579	43,657	45,840	48,132	50,539	53,066
WWTP Repairs	5,250	5,513	5,788	6,078	6,381	6,700	7,036	7,387	7,757	8,144	8,552	8,979	9,428	9,900	10,395	10,914	11,460	12,033	12,635
Subtotal Utilities and Environment:	32,991	34,641	36,373	38,191	40,101	42,106	44,211	46,422	48,743	51,180	53,739	56,426	59,247	62,209	65,320	68,586	72,015	75,616	79,397
Interfund Loan 430 to 302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamilton Project/City Contrib to 210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Expenditures:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest and Debt	12 072	12 072	12 072	12 072	12 072	12 072		0	0	0	0		0	0	0	0	0	0	0
USDA Loan	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	0	0	0
Capital Project Loan Payment (2% for 40 years)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PWTF/WWTP Loan Prin (208)	110,000	109,000	108,000	107,000	106,000	105,000	104,000												
Subtotal Interest and Debt:	154,472	153,472	152,472	151,472	150,472	149,472	136,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400	0	0	0
Capital Equipment - Sewer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewer Comp Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewer - CFP Update	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cap Imp - Sewer Equipment	10,500 5 250	11,025 5 513	11,576 5 788	12,155 6 078	12,763 6 381	13,401	14,0/1	14,775	15,513	16,289 8 1 <i>44</i>	17,103 8 552	17,959 8 979	18,856	19,799 9 900	20,789	21,829	22,920	24,066	25,270
Machinery & Equip/WWTP	0	0	<i>3,700</i> 0	0,070	0,501	0,700	0	0	0	0,144	0,552	0,575	0	0	10,555	10,514	11,400 0	12,055	12,000
WWTP Pumps	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin Capital Purch - Vision	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Capital Expenditures: Proposed Repair & Lingrade Projects	15,750	16,538	17,364	18,233	19,144	20,101	21,107	22,162	23,270	24,433	25,655	26,938	28,285	29,699	31,184	32,743	34,380	36,099	37,904
1 - Swr Trnk Main Rplcmnt (W to Cheyne Rd)												200,000	429,000						
2 - Vintage Valley Rd 8" Swr Main Replmnt	Completed	as part of Vi	intage Valley R	oad extensio	n project														
3 - 4th St, Glenwood Dr, & Westwind Dr. 8" Swr Rplt						150,000	903,000		~~~~~~										
4 - First Ave 8-Inch Sewer Main Replacement				50.000	232 000				60,000	463,000									
6 - Ann St & Walnut St 8" Swr Main Rplt				50,000	232,000		30,000	276,000											
7 - Buried Manhole Replacement											35,000	267,000							
8 - Swr Trunk Rplt (Cheyne Rd to WWTP)	Carriel I.									225,000	1749000								
9 - LIT Station Improvements	completed	as part of Vi	TAGE Valley R	oad extension	n project														
Subtotal Proposed Repair & Upgrade Projects:	0	400,000	744,000	50,000	232,000	150,000	933,000	276,000	60,000	688,000	1,784,000	467,000	429,000	0	0	0	0	0	0
SEWER PLANT RESERVE EXPENDITURES:	203,213	604,650	950,209	257,896	441,717	361,679	1,134,718	376,983	164,413	796,013	1,895,794	582,764	548,932	124,308	128,904	133,729	106,395	111,715	117,301
ENDING FUND BALANCE	368,512	402,877	72,347	453,387	670,596	988,597	555,112	901,743	1,484,189	1,459,180	359,476	598,864	899,166	1,652,237	2,429,965	3,233,278	4,095,540	4,985,352	5,903,759
Net Increase (Decrease)	27,787	34,365	(330,530)	381,040	217,209	318,001	(433,485)	346,630	582,446	(25,008)	(1,099,705)	239,388	300,302	753,071	777,728	803,313	862,262	889,812	918,407
Future base Mourning Kate * Year 2020 values are budgeted numbers adopted in	2019																		
** Recommended future system improvements. See S	ections 7.2	and 7.3 for in	mprovement d	escriptions a	nd completio	n schedule.													

** Recommended future system improvements. See Sections 7.2 and 7.3 for improvement descriptions and completion schedule.



APPENDIX



APPENDIX DOCUMENTS

State Environmental Policy Act (SEPA) Checklist SEPA Determination of Non-Significance (DNS) National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA-002016-8 City of Zillah Municipal Sewer Code

- Chapter 13.04Joint Operation of Water, Sewer and Garbage SystemsChapter 13.16Sewer SystemChapter 13.30Utility Reimbursement AgreementChapter 13.34Utility Tax DiscountCity of Zillah Sewer Construction StandardsHydraulic Analysis ResultsMap A Existing Sewer System Map
- Map B Hydraulic Analysis Node and Pipe Map



SEPA CHECKLIST



SEPA ENVIRONMENTAL CHECKLIST

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the <u>SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D)</u>. Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

- 1. Name of proposed project, if applicable: NA
- 2. Name of applicant: *City of Zillah*
- 3. Address and phone number of applicant and contact person:

John Simmons, Public Works Director City of Zillah 503 First Avenue Zillah, WA 98953 (509) 829-5457

- 4. Date checklist prepared: January 2021
- 5. Agency requesting checklist: NA
- 6. Proposed timing or schedule (including phasing, if applicable): NA

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Yes, the General Sewer Plan will be used for planning future sewer and wastewater treatment related projects to meet the City's growth and maintenance needs.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. *NA*

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. *No*

10. List any government approvals or permits that will be needed for your proposal, if known. Washington State Department of Ecology will review and approve the General Sewer Plan.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

General Sewer Plan, including Wastewater Treatment Plant, which identifies existing and future maintenance and capacity wastewater needs for the City's service area.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

All resulting projects will be completed within the City of Zillah UGA.

B. Environmental Elements

1. Earth

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____

b. What is the steepest slope on the site (approximate percent slope)?

TBD – Expected to be less than 5%.

- c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.
- d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. *NA*
- e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

TBD with project design

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

TBD with project design

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

TBD with project design

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

TBD with project design

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature:							
Name of signee	!						
Position and Agency/Organization							
Date Submitted	:						

D. Supplemental sheet for nonproject actions [HELP]

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

Projects derived from the General Sewer Plan will increase the discharge of treated wastewater from the WWTP due to increased growth in the service area. Increased noise will be produced in the areas of the projects during the construction period.

Proposed measures to avoid or reduce such increases are:

Construction activities will be limited from 7:00 AM to &:00 PM to mitigate noise issues. Silt fencing and other typical construction activity methods will be implemented and monitored during the projects to prevent the erosion and the release of toxic or hazardous substances typically found at sewer construction sites. 2. How would the proposal be likely to affect plants, animals, fish, or marine life?

There will be minimal to no impact to plants, animals, fish or marine life since the projects generated from the General Sewer Plan will be located in existing roadways and development areas.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

No special measures are anticipated to be needed, but will be reviewd on a project by project basis.

3. How would the proposal be likely to deplete energy or natural resources?

The impact to energy and natural resources will be minimal and primarily during the construction portion of the projects generated from the General Sewer Plan.

Proposed measures to protect or conserve energy and natural resources are:

No special measures are proposed to be taken during the construction of the projects generated from the General Sewer Plan.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

There will be minimal to no impact to protected areas since the projects generated from the General Sewer Plan will be located in existing roadways and development areas.

Proposed measures to protect such resources or to avoid or reduce impacts are:

NA

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

No impact

Proposed measures to avoid or reduce shoreline and land use impacts are:

NA

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

The projects generated from the General Sewer Plan are a result of growth in the Zillah UGA and are necessary to provided the increased demand on the sewer utility.

Proposed measures to reduce or respond to such demand(s) are:

NA

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

NA



DNS



DETERMINATION OF NONSIGNIFICANCE (DNS)

Description of Proposal:

City of Zillah General Sewer Plan

Proponent.

City of Zillah

Location of proposal, including street address, if any:

City of Zillah Public Works Department 503 First Avenue Zillah, WA 98953

Lead Agency:

City of Zillah

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

____ There is no comment period for this DNS.

X This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by

__July 15, 2021__.

 Responsible Official:
 Ardele Steele

 Position/title:
 Planning & Community Development Director; City of Zillah

 Address:
 503 First Avenue

 Zillah, WA 98953
 Signature:

 Date:
 6/27/2021

 Signature:
 Ardele Steele



NPDES PERMIT NO. WA-002016-8



Page 1 of 44 Permit No. WA0020168

Issuance Date: September 26, 2017 Effective Date: November 1, 2017 Expiration Date: October 31, 2022

National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0020168

State of Washington DEPARTMENT OF ECOLOGY Central Regional Office 1250 West Alder Street Union Gap, WA 98903

In compliance with the provisions of The State of Washington Water Pollution Control Law Chapter 90.48 Revised Code of Washington and The Federal Water Pollution Control Act (The Clean Water Act) Title 33 United States Code, Section 1342 et seq.

CITY OF ZILLAH PUBLICLY-OWNED TREATMENT WORKS PO BOX 475 ZILLAH, WASHINGTON 98953

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 740 Railroad Avenue Zillah, Washington 98953 Receiving Water: Yakima River Mile 90 46.397602 120.259515

Treatment Type: Aerobic Basin, Oxidation Ditch, Secondary Clarification, Aerobic Sludge Digestion

nuen

David B. Bowen Section Manager Water Quality Program Central Regional Office Washington State Department of Ecology

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Summary of Permit Report Submittals

Refer to the Special and General Conditions of this permit for additional submittal requirements. The following table is for quick reference only. Enforceable submittal requirements are contained in the permit narrative.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A	Discharge Monitoring Report (DMR) Monthly	Monthly	December 15, 2017
S3.A	Annual DMR	Annually	January 15, 2019
S3.F	Reporting Permit Violations	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S4.E	Infiltration and Inflow Evaluation	1/permit cycle	March 31, 2019
S4.F	Wasteload Assessment	1/permit cycle	March 31, 2019
S5.F	Bypass Notification	As necessary	
S5.G	Operations and Maintenance Manual Update	As necessary	
S8.	Application for Permit Renewal	1/permit cycle	October 31, 2021
G1.	Notice of Change in Authorization	As necessary	
G4.	Reporting Planned Changes	As necessary	
G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Notice of Permit Transfer	As necessary	
G10.	Duty to Provide Information	As necessary	
G20.	Compliance Schedules	As necessary	
G21.	Contract Submittal	As necessary	

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Special Conditions

S1. Discharge limits

S1.A. Effluent limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

Beginning on **November 1, 2017**, the Permittee may discharge treated domestic wastewater to the Yakima River at the permitted location subject to compliance with the following limits:

Effluent Limits: Outfall 001 Latitude 46.397602 Longitude 120.259515						
Parameter Average Monthly ^a Average Weekly ^b						
Bio	chemical Oxygen	30 milligrams/liter (mg/L)	45 mg/L			
De	mand (5-day) (BOD₅)	122.6 pounds/day (lbs/day)	183.9 lbs/day			
		85% removal of influent BOD ₅				
Tot	tal Suspended Solids (TSS)	30 mg/L	45 mg/L			
		122.6 lbs/day	183.9 lbs/day			
		85% removal of influent TSS				
	Parameter	Minimum	Maximum			
рН		6.0 standard units	9.0 standard units			
_	Parameter	Monthly Geometric Mean	Weekly Geometric Mean			
Fee	cal Coliform Bacteria c	200 CFU/100 milliliter (mL)	400 CFU/100 mL			
	Parameter	Daily Minimum	Daily Maximum "			
	рН	6.0 Standard Units	9.0 Standard Units			
An	nmonia (as NH3-N)	N/A	8.2 mg/L			
а	Average monthly effluent limit month. To calculate the discha discharge measured during a c discharges measured. See for	means the highest allowable average arge value to compare to the limit, yo calendar month and divide this sum b pringte c for fecal coliform calculations	e of daily discharges over a calendar u add the value of each daily by the total number of daily			
 Average weekly discharge limit means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges' measured during that week. See footnote c for fecal coliform calculations. 						
 Ecology provides directions to calculate the monthly and the weekly geometric mean in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: http://www.ecy.wa.gov/pubs/0410020.pdf 						
^d Maximum daily effluent limit is the highest allowable daily discharge. The daily discharge is the average discharge of a pollutant measured during a calendar day. For pollutants with limits expressed in units of mass, calculate the daily discharge as the total mass of the pollutant discharged over the day. This does not apply to pH or temperature.						

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S1.B. Mixing zone authorization

Mixing zone for Outfall 001

The following paragraphs define the maximum boundaries or flow-volume restriction of the mixing zones:

Chronic mixing zone

The mixing zone is 301 feet long by 40 wide. The mixing zone extends from the bottom to the top of the water column. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The mixing zone is 30 feet long by 12 feet wide. The mixing zone extends from the bottom to the top of the water column. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Available Dilution (dilution factor)				
Acute Aquatic Life Criteria	16.2			
Chronic Aquatic Life Criteria	51.2			

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

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F	Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type			
(1) Wa	(1) Wastewater influent						
Wastev Sample returns	Wastewater Influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.						
Flow	· · · · ·	MGD	Continuous ^a	Measurement			
Bioche Demar	mical Oxygen nd (BOD₅)	mg/L	2/week	24-hour composite ^b			
Bioche Demar	mical Oxygen nd (BOD₅)	lbs/day	2/week	Calculation			
Total S Solids	Suspended (TSS)	mg/L	2/week	24-hour composite			
Total S Solids	Suspended (TSS)	lbs/day	2/week	Calculation			
(2) Fin	al wastewater ef	fluent					
Final W this is a Permiti taken a	Vastewater Efflue after or at the exit tee may take efflu after, the Permitte	nt means wastewater exiting th from the chlorine contact chan lent samples for the BOD₅ anal le must dechlorinate and resee	ne last treatment process of nber or other disinfection lysis before or after the dis d the sample.	or operation. Typically, process. The sinfection process. If			
BOD ₅ °	;	mg/L	2/week	24-hour composite			
BOD ₅		lbs/day	2/week	Calculation			
BOD ₅		% removal	1/month	Calculation			
TSS		mg/L	2/week	24-hour composite			
TSS		lbs/day	2/week	Calculation			
TSS		% removal ^d	1/month	Calculation			
Fecal Coliform ^e		# /100 ml	2/week	Grab ^f			
рН		Standard Units	5/week	Grab			
Tempe	erature ^g	Degrees centigrade (°C)	5/week	Measurement			
Dissolv	/ed Oxygen	mg/L	5/week	Grab			
Total A	mmonia	mg/L as N	2/month	24-hour composite			
Total A	mmonia	lbs/day	2/month	Calculation			
(6) Per	mit renewal app	lication requirements – final	wastewater effluent				
The Pe collects	ermittee must reco s the sample for p	ord and report the wastewater t priority pollutant testing with the	reatment plant flow discha	arged on the day it port.			
Total K Nitroge	(jeldahl en	mg/L as N	Once per year	24-hour composite			
Nitrate	plus Nitrite	mg/L as N	Once per year	24-hour composite			
Oil and	l Grease	mg/L	Once per year	Grab			
Phospl	horus (Total)	mg/L as P	Once per year	24-hour composite			
Total Dissolved Solids		mg/L	Once per year	24-hour composite			
Total H	lardness	mg/L	Once per year	24-hour composite			
а	^a Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance. The time interval for the associated data logger must be no greater than 30 minutes.						
b	24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.						

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	Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type		
С	Take effluent sar after, dechlorinat	nples for the BOD₅ analysis be te and reseed the sample.	fore or after the disinfection	on process. If taken		
d	³ % removal = <u>Influent concentration (mg/L) – Effluent concentration (mg/L)</u> x 100 Influent concentration (mg/L)					
	Calculate the per	rcent (%) removal of BOD₅ and	I TSS using the above equ	uation.		
e	Report a numerical value for fecal coliforms following the procedures in Ecology's <i>Information</i> <i>Manual for Wastewater Treatment Plant Operators</i> , Publication Number 04-10-020 available at: <u>http://www.ecy.wa.gov/programs/wq/permits/guidance.html</u> . Do not report a result as too numerous to count (TNTC).					
f	Grab means an individual sample collected over a fifteen (15) minute, or less, period.					
g	Temperature gra temperature, whi the Permittee mu 24-hour period. (and the Permitte	b sampling must occur when the ich usually occurs in the late af ust determine and report a daily Continuous monitoring instrume e must verify accuracy annuall	he effluent is at or near its ternoon. If measuring tem y maximum from half-hour ents must achieve an accu y.	daily maximum perature continuously, measurements in a uracy of 0.2 degrees C		

S2.B. Sampling and analytical procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501-503]) unless otherwise specified in this permit . Ecology may only specify alternative methods for parameters without permit limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement and continuous monitoring devices

The Permittee must:

- 1. Select and use appropriate flow measurement and continuous monitoring devices and methods consistent with accepted scientific practices.
- 2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.

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- 3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records. The Permittee:
 - a. May calibrate apparatus for continuous monitoring of dissolved oxygen by air calibration.
 - b. Must calibrate continuous pH measurement instruments using a grab sample analyzed in the lab with a pH meter calibrated with standard buffers and analyzed within 15 minutes of sampling.
 - c. Must calibrate continuous chlorine measurement instruments using a grab sample analyzed in the laboratory within 15 minutes of sampling.
- Calibrate micro-recording temperature devices, known as thermistors, using protocols from Ecology's Quality Assurance Project Plan Development Tool (*Standard Operating Procedures for Continuous Temperature Monitoring of Fresh Water Rivers and Streams Version 1.0 10/26/2011*). This document is available online at: <u>http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_Cont_Temp_Mon_A</u> <u>mbient_v1_0EAP080.pdf</u>

Calibration as specified in this document is not required if the Permittee uses recording devices certified by the manufacturer.

- 5. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.
- 6. Establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer.
- 7. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
- 8. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*.

Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S3. Reporting and recording requirements

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The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S3.A. Discharge monitoring reports

The first monitoring period begins on **November 1, 2017** (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic discharge monitoring report (DMR) form provided by Ecology within the Water Quality Permitting Portal. Include data for each of the parameters tabulated in Special Condition S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.

To find out more information and to sign up for the Water Quality Permitting Portal go to: <u>http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html</u>

- 2. Ensure that DMRs are electronically submitted no later than the dates specified below, unless otherwise specified in this permit.
- 3. The Permittee must also submit an electronic copy of the laboratory report as an attachment using WQWebDMR. The contract laboratory reports must also include information on the chain of custody, QA/QC results, and documentation of accreditation for the parameter.
- 4. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, quarterly, annual, etc.) at the reporting schedule identified below. The Permittee must:
 - a. Submit **monthly** DMRs by the 15th day of the following month.
 - b. Submit **annual DMRs**, unless otherwise specified in the permit, by January 15 for the previous calendar year. The annual sampling period begins **January 1, 2018** with DMR due **January 15, 2019**.
- 5. Enter the "No Discharge" reporting code for an entire DMR, for a specific monitoring point, or for a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.

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- 6. Report single analytical values below detection as "less than the detection level (DL)" by entering < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum DL and quantitation level (QL) identified in the permit, report the actual QL and DL in the comments or in the location provided.</p>
- 7. Report single analytical values between the detection level (DL) and the quantitation level (QL) by entering the estimated value, the code for estimated value/below quantitation limit (j) and any additional information in the comments. Submit a copy of the laboratory report as an attachment using WQWebDMR.
- 8. **Not** report zero for bacteria monitoring. Report as required by the laboratory method.
- 9. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
- 10. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using:
 - a. The reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If the Permittee takes multiple samples in one day it must use the arithmetic average for the day in the geometric mean calculation.
 - b. The detection value for those samples measured below detection.
- 11. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A.
- 12. Calculate average values and calculated total values (unless otherwise specified in the permit) using:
 - a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.
 - b. One-half the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.
 - c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for the reporting period.

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13. Report single-sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detected, detection limit (DL) (as necessary), and laboratory quantitation level (QL) (as necessary).

S3.B. Permit Submittals and Schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all other written permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard-copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

Water Quality Permit Coordinator Department of Ecology Central Regional Office 1250 West Alder Street Union Gap, WA 98903

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

- 1. The date, exact place, method, and time of sampling or measurement.
- 2. The individual who performed the sampling or measurement.
- 3. The dates the analyses were performed.
- 4. The individual who performed the analyses.
- 5. The analytical techniques or methods used.
- 6. The results of all analyses.

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S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

- 1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
- 2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

a. Immediate reporting

The Permittee must <u>immediately</u> report to Ecology and the Local Health Jurisdiction (at the numbers listed below), all:

- Failures of the disinfection system.
- Collection system overflows.
- Plant bypasses resulting in a discharge.
- Any other failures of the sewage system (pipe breaks, etc).

Central Regional Office	509-575-2490
Yakima Health District	509-575-4040

Additionally, for any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4), the Permittee must notify the appropriate MS4 owner or operator.

The Permittee must <u>immediately</u> report to Ecology, the Department of Health, Drinking Water Program, and the Yakima Health District (at the numbers listed below), all:

- Failures of the disinfection system.
- Collection system overflows discharging to a water body that may be used for drinking water.
- Plant bypasses discharging to a water body used as a source of drinking water.

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• Any other failures of the sewage system (pipe breaks, etc)

Central Regional Office	509-575-2490	
Department of Health,	800-521-0323	(business hours)
Drinking Water Program	877-481-4901	(after business hours)
Yakima Health District	509-575-4040	

b. Twenty-four-hour reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

- 1. Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.
- 2. Any unanticipated bypass that causes an exceedance of an effluent limit in the permit (See Part S5.F, "Bypass Procedures").
- 3. Any upset that causes an exceedance of an effluent limit in the permit (See G.15, "Upset").
- 4. Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Section S1.A of this permit.
- 5. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

c. Report within five days

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under subparts a or b, above. The report must contain:

- 1. A description of the noncompliance and its cause.
- 2. The period of noncompliance, including exact dates and times.
- 3. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
- 4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
- 5. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

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d. Waiver of written reports

Ecology may waive the written report required in subpart c, above, on a case-by-case basis upon request if the Permittee has submitted a timely oral report.

e. All other permit violation reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in subpart c, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

S3.G. Other reporting

a. Spills of Oil or Hazardous Materials

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm.

b. Failure to submit relevant or correct facts

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S3.H. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility loading

S4.A. Design criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

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Maximum Month Design Flow (MMDF)	0.49 MGD
Peak Instantaneous Design Flow (PIDF)	1.02MGD
BOD ₅ Loading for Maximum Month	1064 lb/day
TSS Influent Loading for Maximum Month	1107 lb/day

S4.B. Plans for maintaining adequate capacity

a. Conditions triggering plan submittal

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

- 1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.
- 2. The projected plant flow or loading would reach design capacity within five years.

b. Plan and schedule content

The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan.

- 1. Analysis of the present design and proposed process modifications
- 2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system
- 3. Limits on future sewer extensions or connections or additional waste loads
- 4. Modification or expansion of facilities
- 5. Reduction of industrial or commercial flows or waste loads

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

S4.C. Duty to mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

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S4.D. Notification of new or altered sources

- 1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
 - a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
 - b. Is not part of an approved general sewer plan or approved plans and specifications.
 - c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.
- 2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42(b)].

S4.E. Infiltration and inflow evaluation

- 1. The Permittee must conduct an infiltration and inflow evaluation. Refer to the U.S. EPA publication, I/I Analysis and Project Certification, available as Publication No. 97-03 at: http://www.ecy.wa.gov/programs/wg/permits/guidance.html
- 2. The Permittee may use monitoring records to assess measurable infiltration and inflow.
- 3. The Permittee must prepare a report summarizing any measurable infiltration and inflow. If infiltration and inflow have increased by more than 15 percent from that found in the previous report based on equivalent rainfall, the report must contain a plan and a schedule to locate the sources of infiltration and inflow and to correct the problem.
- 4. The Permittee must submit a report summarizing the results of the evaluation and any recommendations for corrective actions by **March 31, 2019.**

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S4.F. Wasteload assessment

The Permittee, once per permit cycle, must conduct an assessment of its influent flow and waste load and submit a report to Ecology by **March 31, 2019.** The report must contain:

- 1. A description of compliance or noncompliance with the permit effluent limits.
- 2. A comparison between the existing and design:
 - a. Monthly average dry weather and wet weather flows.
 - b. BOD₅ loading.
 - c. Total suspended solids loadings.
- 3. The percent change in the above parameters since the previous report (except for the first report).
- 4. The present and design population or population equivalent.
- 5. The projected population growth rate.
- 6. The estimated date upon which the Permittee expects the wastewater treatment plant to reach design capacity, according to the most restrictive of the parameters above.

Ecology may modify the interval for review and reporting if it determines that a different frequency is sufficient.

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class 2 plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class I plant must be in charge during all regularly scheduled shifts. The Permittee must notify Ecology when the operator in charge

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at the facility changes. It must provide the new operator's name and certification level and provide the name of the operator leaving the facility.

S5.B. Operation and maintenance program

The Permittee must:

- 1. Institute an adequate operation and maintenance program for the entire sewage system.
- 2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
- 3. Make maintenance records available for inspection at all times.

S5.C. Short-term reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out according to the approved O&M manual or as otherwise approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

- 1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
- 2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

S5.D. Electrical power failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

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The Permittee must maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant. Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but must be sufficient to maintain the biota.

S5.E. Prevent connection of inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However the Permittee must comply with the monitoring requirements specified in special condition S2.B.

2. Anticipated bypasses for non-essential maintenance

Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.

- a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:
 - A description of the bypass and the reason the bypass is necessary.

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- An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
- A cost-effectiveness analysis of alternatives.
- The minimum and maximum duration of bypass under each alternative.
- A recommendation as to the preferred alternative for conducting the bypass.
- The projected date of bypass initiation.
- A statement of compliance with SEPA.
- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.
- b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.
- c. Ecology will determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:
 - If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
 - If the bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.
 - If feasible alternatives to the bypass exist, such as:
 - The use of auxiliary treatment facilities.
 - o Retention of untreated wastes.

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- Stopping production.
- Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.
- Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

a. O&M manual submittal and requirements

The Permittee must:

- 1. Update the Operations and Maintenance (O&M) Manual, as necessary, that meets the requirements of 173-240-080 WAC.
- 2. Review the O&M Manual at least annually.
- 3. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
- 4. Keep the approved O&M Manual at the permitted facility.
- 5. Follow the instructions and procedures of this manual.

b. O&M manual components

In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Table G1-3 in the *Criteria for Sewage Works Design* (Orange Book), 2008. The O&M Manual must include:

- 1. Emergency procedures for cleanup in the event of wastewater system upset or failure.
- 2. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
- 3. Wastewater system maintenance procedures that contribute to the generation of process wastewater.
- 4. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
- 5. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).

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- 6. The treatment plant process control monitoring schedule.
- 7. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

S6.A. General requirements

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

S6.B. Duty to enforce discharge prohibitions

- 1. Under federal regulations (40 CFR 403.5(a) and (b)), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC 173-216-060.
- 2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
 - a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).
 - b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
 - c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.
 - d. Any pollutant, including oxygen-demanding pollutants, (BOD₅, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
 - e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.
 - f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

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- g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities such that the temperature at the POTW headworks exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.
- h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.
- i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).
- 3. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:
 - a. Noncontact cooling water in significant volumes.
 - b. Stormwater and other direct inflow sources.
 - c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.
- 4. The Permittee must notify Ecology if any industrial user violates the prohibitions listed in this section (S6.B), and initiate enforcement action to promptly curtail any such discharge.

S6.C. Wastewater discharge permit required

The Permittee must:

- 1. Establish a process for authorizing non-domestic wastewater discharges that ensures all SIUs in all tributary areas meet the applicable state waste discharge permit (SWDP) requirements in accordance with chapter 90.48 RCW and chapter 173-216 WAC.
- 2. Immediately notify Ecology of any proposed discharge of wastewater from a source, which may be a significant industrial user (SIU) [see fact sheet definitions or refer to 40 CFR 403.3(v)(i)(ii)].
- 3. Require all SIUs to obtain a SWDP from Ecology prior to accepting their nondomestic wastewater, or require proof that Ecology has determined they do not require a permit.
- 4. Require the documentation as described in S6.C.3 at the earliest practicable date as a condition of continuing to accept non-domestic wastewater discharges from a previously undiscovered, currently discharging and unpermitted SIU.

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- 5. Require sources of non-domestic wastewater, which do not qualify as SIUs but merit a degree of oversight, to apply for a SWDP and provide it a copy of the application and any Ecology responses.
- 6. Keep all records documenting that its users have met the requirements of S6.C.

S6.D. Identification and reporting of existing, new, and proposed industrial users

- 1. The Permittee must take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewer system (see **Appendix C** of the fact sheet for definitions).
- 2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be a significant industrial user (SIU), the Permittee must notify such user by registered mail that, if classified as an SIU, they must apply to Ecology and obtain a State Waste Discharge Permit. The Permittee must send a copy of this notification letter to Ecology within this same 30-day period.
- 3. The Permittee must also notify all Potential SIUs (PSIUs), as they are identified, that if their classification should change to an SIU, they must apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

S7. Solid wastes

S7.A. Solid waste handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S7.B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee must apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

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S8. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by **October 31**, **2021**.

The Permittee must also submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

General Conditions

G1. Signatory requirements

- 1. All applications submitted to Ecology must be signed and certified.
 - a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
 - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
 - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
 - b. In the case of a partnership, by a general partner.
 - c. In the case of sole proprietorship, by the proprietor.
 - d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

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Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

- 2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - a. The authorization is made in writing by a person described above and submitted to Ecology.
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
- 3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
- 4. Certification. Any person signing a document under this section must make the following certification:

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.

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- 2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
- 3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
- 4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

- 1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
 - a. Violation of any permit term or condition.
 - b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
 - c. A material change in quantity or type of waste disposal.
 - d. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.
 - e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.
 - f. Nonpayment of fees assessed pursuant to RCW 90.48.465.
 - g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.
- 2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:
 - a. A material change in the condition of the waters of the state.
 - b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
 - c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
 - d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

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- e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.
- f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
- g. Incorporation of an approved local pretreatment program into a municipality's permit.
- 3. The following are causes for modification or alternatively revocation and reissuance:
 - a. When cause exists for termination for reasons listed in 1.a through 1,g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.
 - b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

- 1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).
- 2. A significant change in the nature or an increase in quantity of pollutants discharged.
- 3. A significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of

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construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

- a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.
- b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.
- c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This

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requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars (\$10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

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Any person who violates the terms and conditions of a waste discharge permit may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars (\$10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

- 1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
- 2. The permitted facility was being properly operated at the time of the upset.
- 3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
- 4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

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G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

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Appendix A LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a quantitation limit (QL) to Ecology with appropriate laboratory documentation.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122.), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

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CONVENTIONAL POLLUTANTS

Pollutant	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ μg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B ³		2 mg/L
Fecal Coliform		SM 9221E,9222	N/A	Specified in method - sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
рН		SM4500-H⁺ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as CaCO3
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-CI B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 CI G		50.0
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units

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NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as CaCO3
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N _{org} B/C and SM4500NH ₃ - B/C/D/EF/G/H		300
NWTPH Dx ⁴		Ecology NWTPH Dx	250	250
NWTPH Gx ⁵		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO ₄)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S ² F/D/E/G		0.2 mg/L
Sulfite (as mg/L SO ₃)		SM4500-SO3B		2 mg/L
Temperature (max. 7-day avg.)		Analog recorder or Use micro- recording devices known as thermistors		0.2º C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5

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NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
Total Coliform		SM 9221B, 9222B, 9223B	N/A	Specified in method - sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total dissolved solids		SM2540 C		20 mg/L

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
METALS, CYANIDE & TOTAL PHENOL	S				
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10

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PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified	
METALS, CYANIDE & TOTAL PHENOLS						
Phenols, Total	65		EPA 420.1		50	

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
ACID COMPOUNDS					
2-Chlorophenol	24	95-57-8	625	1.0	2.0
2,4-Dichlorophenol	31	120-83-2	625	0.5	1.0
2,4-Dimethylphenol	34	105-67-9	625	0.5	1.0
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625/1625B	2.0	4.0
2,4 dinitrophenol	59	51-28-5	625	1.5	3.0
2-Nitrophenol	57	88-75-5	625	0.5	1.0
4-Nitrophenol	58	100-02-7	625	1.0	2.0
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625	1.0	2.0
Pentachlorophenol	64	87-86-5	625	0.5	1.0
Phenol	65	108-95-2	625	2.0	4.0
2,4,6-Trichlorophenol	21	88-06-2	625	2.0	4.0

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified		
VOLATILE COMPOUNDS							
Acrolein	2	107-02-8	624	5	10		
Acrylonitrile	3	107-13-1	624	1.0	2.0		
Benzene	4	71-43-2	624	1.0	2.0		
Bromoform	47	75-25-2	624	1.0	2.0		

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PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ μg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
VOLATILE COMPOUNDS			· · · · · · · · · · · · · · · · · · ·		
Carbon tetrachloride	6	56-23-5	624/601 or SM6230B	1.0	2.0
Chlorobenzene	7	108-90-7	624	1.0	2.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624	1.0	2.0
Chloroform	23	67-66-3	624 or SM6210B	1.0	2.0
Dibromochloromethane (chlordibromomethane)	51	124-48-1	624	1.0	2.0
1,2-Dichlorobenzene	25	95-50-1	624	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624	4.4	17.6
Dichlorobromomethane	48	75-27-4	624	1.0	2.0
1,1-Dichloroethane	13	75-34-3	624	1.0	2.0
1,2-Dichloroethane	10	107-06-2	624	1.0	2.0
1,1-Dichloroethylene	29	75-35-4	624	1.0	2.0
1,2-Dichloropropane	32	78-87-5	624	1.0	2.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) ⁶	33	542-75-6	624	1.0	2.0
Ethylbenzene	38	100-41-4	624	1.0	2.0
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624	1.0	2.0
Methylene chloride	44	75-09-2	624	5.0	10.0
1,1,2,2-Tetrachloroethane	15	79-34-5	624	1.9	2.0
Tetrachloroethylene	85	127-18-4	624	1.0	2.0
Toluene	86	108-88-3	624	1.0	2.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624	1.0	2.0
1,1,1-Trichloroethane	11	71-55-6	624	1.0	2.0
1,1,2-Trichloroethane	14	79-00-5	624	1.0	2.0
Trichloroethylene	87	79-01-6	624	1.0	2.0
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0
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PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
BASE/NEUTRAL COMPOUNDS (comp	ounds ir	bold are Ecolo	gy PBTs)		•
Acenaphthene	1	83-32-9	625	0.2	0.4
Acenaphthylene	77	208-96-8	625	0.3	0.6
Anthracene	78	120-12-7	625	0.3	0.6
Benzidine	5	92-87-5	625	20	40
Benzyl butyl phthalate	67	85-68-7	625	0.3	0.6
Benzo(a)anthracene	72	56-55-3	625	0.3	0.6
Benzo(b)fluoranthene (3,4-benzofluoranthene) ⁷	74	205-99-2	610/625	0.8	1.6
Benzo(j)fluoranthene ⁷		205-82-3	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) 7	75	207-08-9	610/625	0.8	1.6
Benzo(r,s,t)pentaphene		189-55-9	625	1.3	5.0
Benzo(a)pyrene	73	50-32-8	610/625	0.5	1.0
Benzo(<i>ghi</i>)Perylene	79	191-24-2	610/625	0.5	1.0
Bis(2-chloroethoxy)methane	43	111-91-1	625	5.3	21.2
Bis(2-chloroethyl)ether	18	111-44-4	611/625	0.3	1.0
Bis(2-chloroisopropyl)ether	42	39638-32-9	625	0.5	1.0
Bis(2-ethylhexyl)phthalate	66	117-81-7	625	0.3	1.0
4-Bromophenyl phenyl ether	41	101-55-3	625	0.3	0.5
2-Chloronaphthalene	20	91-58-7	625	0.3	0.6
4-Chlorophenyl phenyl ether	40	7005-72-3	625	0.3	0.5
Chrysene	76	218-01-9	610/625	0.3	0.6
Dibenzo (a,h)acridine		226-36-8	610M/625M	2.5	10.0
Dibenzo (a,j)acridine		224-42-0	610M/625M	2.5	10.0
Dibenzo(a- <i>h</i>)anthracene (1,2,5,6- dibenzanthracene)	82	53-70-3	625	0.8	1.6
Dibenzo(a,e)pyrene		192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene		189-64-0	625M	2.5	10.0
3,3-Dichlorobenzidine	28	91-94-1	605/625	2.0	14.0
Diethyl phthalate	70	84-66-2	625	1.9	7.6
Dimethyl phthalate	71	131-11-3	625	1.6	6.4

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PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ μg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
BASE/NEUTRAL COMPOUNDS (comp	ounds ir	h bold are Ecolo	gy PBTs)		
Di-n-butyl phthalate	68	84-74-2	625	0.5	1.0
2,4-dinitrotoluene	35	121-14-2	609/625	1.0	2.0
2,6-dinitrotoluene	36	606-20-2	609/625	1.0	2.0
Di-n-octyl phthalate	69	117-84-0	625	0.3	0.6
1,2-Diphenylhydrazine (as Azobenzene)	37	122-66-7	1625B	5.0	20
Fluoranthene	39	206-44-0	625	0.3	0.6
Fluorene	80	86-73-7	625	0.3	0.6
Hexachlorobenzene	9	118-74-1	612/625	0.3	0.6
Hexachlorobutadiene	52	87-68-3	625	0.5	1.0
Hexachlorocyclopentadiene	53	77-47-4	1625B/625	2.0	4.0
Hexachloroethane	12	67-72-1	625	0.5	1.0
Indeno(1,2,3-cd)Pyrene	83	193-39-5	610/625	0.5	1.0
Isophorone	54	78-59-1	625	0.5	1.0
3-Methyl cholanthrene		56-49-5	625	2.0	8.0
Naphthalene	55	91-20-3	625	0.4	0.75
Nitrobenzene	56	98-95-3	625	0.5	1.0
N-Nitrosodimethylamine	61	62-75-9	607/625	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625	1.0	2.0
Perylene		198-55-0	625	1.9	7.6
Phenanthrene	81	85-01-8	625	0.3	0.6
Pyrene	84	129-00-0	625	0.3	0.6
1,2,4-Trichlorobenzene	8	120-82-1	625	0.3	0.6

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PRIORITY POLLUTANT	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
DIOXIN					
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
PESTICIDES/PCBs					
Aldrin	89	309-00-2	608	0.025	0.05
alpha-BHC	102	319-84-6	608	0.025	0.05
beta-BHC	103	319-85-7	608	0.025	0.05
gamma-BHC (Lindane)	104	58-89-9	608	0.025	0.05
delta-BHC	105	319-86-8	608	0.025	0.05
Chlordane ⁸	91	57-74-9	608	0.025	0.05
4,4'-DDT	92	50-29-3	608	0.025	0.05
4,4'-DDE	93	72-55-9	608	0.025	0.05
4,4' DDD	94	72-54-8	608	0.025	0.05
Dieldrin	90	60-57-1	608	0.025	0.05
alpha-Endosulfan	95	959-98-8	608	0.025	0.05
beta-Endosulfan	96	33213-65-9	608	0.025	0.05
Endosulfan Sulfate	97	1031-07-8	608	0.025	0.05
Endrin	98	72-20-8	608	0.025	0.05
Endrin Aldehyde	99	7421-93-4	608	0.025	0.05
Heptachlor	100	76-44-8	608	0.025	0.05
Heptachlor Epoxide	101	1024-57-3	608	0.025	0.05
PCB-1242 ⁹	106	53469-21-9	608 - Modified	0.05	0.2
PCB-1254	107	11097-69-1	608 - Modified	0.05	0.2
PCB-1221	108	11104-28-2	608 - Modified	0.05	0.2
PCB-1232	109	11141-16-5	608 - Modified	0.05	0.2

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PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL) ¹ µg/L unless specified	Quantitation Level (QL) ² µg/L unless specified
PESTICIDES/PCBs					
PCB-1248	110	12672-29-6	608 - Modified	0.05	0.2
PCB-1260	111	11096-82-5	608 - Modified	0.05	0.2
PCB-1016 ⁹	112	12674-11-2	608 - Modified	0.05	0.2
Toxaphene	113	8001-35-2	608	0.24	0.5

- 1. <u>Detection level (DL)</u> or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
- Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10ⁿ, where n is an integer. (64 FR 30417).

ALSO GIVEN AS:

The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

- 3. <u>Soluble Biochemical Oxygen Demand</u> method note: First, filter the sample through a Millipore Nylon filter (or equivalent) pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.
- 4. <u>NWTPH Dx⁻</u>Northwest Total Petroleum Hydrocarbons Diesel Extended Range see <u>http://www.ecy.wa.gov/biblio/97602.html</u>
- 5. <u>NWTPH Gx</u> Northwest Total Petroleum Hydrocarbons Gasoline Extended Range see <u>http://www.ecy.wa.gov/biblio/97602.html</u>

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- 6. <u>1, 3-dichloroproylene (mixed isomers)</u> You may report this parameter as two separate parameters: cis-1, 3-dichloropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).
- 7. <u>Total Benzofluoranthenes</u> Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.
- 8. <u>Chlordane</u> You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 0.025/0.050.
- 9. PCB 1016 & PCB 1242 You may report these two PCB compounds as one parameter called PCB 1016/1242.



CITY OF ZILLAH MUNICIPAL SEWER CODE



Sections:

- 13.16.010 Definitions.
- 13.16.020 Use of public sewers required.
- 13.16.030 Private wastewater disposal.
- 13.16.040 Building sewers and connections.
- 13.16.042 Side sewer connection fee.
- 13.16.044 General facility charge.
- 13.16.045 Backflow check valves.
- 13.16.050 Stormwater runoff.
- 13.16.060 Prohibited discharges.
- 13.16.070 Remedies for improper discharges.
- 13.16.080 Inspection.
- 13.16.090 Rates for connection to sewer system.
- 13.16.091 Late payment penalties.
- 13.16.092 Additional charge to be paid monthly by users of public sewer system.
- 13.16.094 Additional charge for individual pump stations.
- 13.16.100 Effluent testing.
- 13.16.110 Annual review.
- 13.16.120 Violation Penalty.

13.16.010 Definitions.

Unless the context specifically indicates otherwise, the meaning of terms used in this chapter shall be as follows:

1. "Applicant" means the owner or authorized agent of the property to be served, and said applicant shall be the responsible person for payment of bills for sewer service.

2. "Biochemical oxygen demand (BOD)" means the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five days at 20 degrees Celsius, expressed in milligrams per liter.

3. "Building drain" means that part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer, beginning five feet (1.5 meters) outside the inner face of the building wall.

4. "Building sewer" means the extension from the building drain to the public sewer or other place of disposal, also called house connection.

5. "City" means city of Zillah.

6. "Commercial or business" means a commercial or business establishment that does not meet the definition of "food service establishments (FSEs)" or discharges "industrial wastes."

7. "Cooling water" or "uncontaminated cooling water" or "noncontact cooling water" means water used for cooling purposes which does not come into direct contact with any raw material, intermediate product, waste product, or finished product, and that contains no additives, pollutants, toxics, or dangerous wastes.

8. "Combined sewer" means a sewer intended to receive both wastewater and stormwater or surface water.

9. "Easement" means an acquired legal right for the specific use of land owned by others.

10. "Food service establishments (FSEs)" means those establishments engaged in the activity of preparing, serving, or otherwise making food available for consumption by the public, which use one or more of the following preparation methods: cooking by frying (all methods), baking (all methods), grilling, sauteing, rotisserie cooking, broiling (all methods), boiling, blanching, roasting, toasting, infrared heating, searing, barbecuing, and any other method of food preparation that produces or may produce hot, nondrinkable food product in or on a receptacle that requires washing. These establishments include, but are not limited to, restaurants, bakeries, commercial kitchens, caterers, hotels, schools, religious institutions, hospitals, prisons, correctional facilities, and care institutions.

11. "Floatable oil" is oil, fat, or grease in a physical state such that it will separate by gravity from wastewater by treatment in an approved pretreatment facility. A wastewater shall be considered free of floatable fat if it is properly pretreated and the wastewater does not interfere with the collection system.

12. "Garbage" means the animal and vegetable waste resulting from the handling, preparation, cooking, and serving of foods.

13. "Industrial wastes" means any solid, liquid or gaseous substance discharged or permitted to be discharged to the sewage works from any industrial or manufacturing establishment as distinct from sewage.

14. "May" is permissive (see "shall," subsection (25) of this section).

15. "Natural outlet" means any outlet, including storm sewers and combined sewer overflows, into a watercourse, pond, ditch, lake, or other body of surface or ground water.

16. "Noncity user" or "outside user" means a person connected to and a user of the city sewage works whose physical location is outside the city limits.

17. "Person" means any individual, firm, company, association, society, corporation, or group.

18. "pH" means the logarithm of the reciprocal of the hydrogen-ion concentration. The concentration is the weight of hydrogen ions, in grams, per liter of solution. Neutral water, for example, has a pH value of seven and a hydrogen-ion concentration of 10-7.

19. "Private sewer" means the sewer line and disposal system constructed, installed, or maintained where connection with the public sewer system is not required herein.

20. "Properly shredded garbage" means the wastes from the preparation, cooking, and dispensing of food that have been shredded to such a degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers, with no particle greater than one-half inch (1.27 centimeters) in any dimension.

21. "Public sewer" means a common sewer controlled by a governmental agency or public utility, which carries sewage and industrial waste, and to which stormwaters, surface waters and ground waters are not intentionally admitted.

22. "Public works director" means the director of wastewater facilities, and/or of wastewater treatment works, and/or of water pollution control of the city, or his authorized deputy, agent, or representative.

23. "Sewage" means the spent water of a community. The preferred term is "wastewater," as set out in subsection (31) of this section.

24. "Sewer" means a pipe or conduit that carries sewage.

25. "Shall" is mandatory (see "may," as set out in subsection (14) of this section).

26. "Slug" means any discharge of water or wastewater which in concentration of any given constituent or in quantity of flow exceeds for any period of duration longer than 15 minutes more than five times the average 24-hour concentration of flows during normal operation and shall adversely affect the collection system and/or performance of the wastewater treatment works.

27. "Standard methods" means the examination and analytical procedures set forth in the most recent edition of Standard Methods for the Examination of Water, Sewage, and Industrial Wastes, published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation.

28. "Storm drain" (sometimes termed "storm sewer") means a drain or sewer that carries storm, surface and ground water drainage, but excludes sewage and industrial wastes other than unpolluted cooling water.

29. "Suspended solids" means total suspended matter that either floats on the surface of, or is in suspension in, water, wastewater, or other liquids, and that is removable by laboratory filtering as prescribed in Standard Methods for the Examination of Water and Wastewater and referred to as nonfilterable residue.

30. "Unpolluted water" means any water or liquid containing none of the following: free or emulsified grease or oil; acids or alkalis; substances that may impart taste-and-odor or color characteristics; toxic or poisonous substances in suspension, colloidal state or solution; odorous or otherwise obnoxious gases.

31. "Wastewater" means a combination of the liquid or water carried wastes removed from residences, institutions, commercial, and industrial establishments, together with such ground water, surface water, and stormwater as may be present.

32. "Wastewater facilities" means the structures, equipment, and processes required to collect, carry away, and treat domestic and industrial wastes and dispose of the effluent.

33. "Wastewater treatment works" means an arrangement of devices and structures for treating wastewater, industrial wastes, and sludge. Sometimes used as synonymous with "waste treatment plan" or "wastewater treatment plant" or "water pollution control plant."

34. "Watercourse" means a natural or artificial channel for the passage of water either continuously or intermittently. (Ord. 1495 § 2, 2019)

13.16.020 Use of public sewers required.

A. The owner(s) of all houses, buildings, or properties used for human occupancy, employment, recreation, or other purposes, situated within the city and abutting on any street, alley, or right-of-way in which there is now located or may in the future be located a public sanitary or combined sewer of the city, is required at the owner's(s') expense to install suitable toilet facilities therein, and to connect such facilities directly with the proper public sewer in accordance with the provisions of this chapter, within 120 days after date of official notice to do so; provided, that said public sewer is within 300 feet (91.4 meters) of the property line development.

B. Pretreatment. Where required, in the opinion of the city council, to modify or eliminate wastes that are harmful to the structures, processes, or operation of the sewage works, the person shall provide at his/her expense such preliminary treatment or processing facilities as may be determined necessary to render his/her wastes acceptable for admission to the public sewers. Plans, specifications, and any other pertinent information relating to proposed preliminary treatment or processing facilities shall be submitted for approval to the city council prior to the start of their construction if the effluent from such facilities is to be discharged into the public sewers. (Ord. 1495 § 2, 2019)

13.16.030 Private wastewater disposal.

A. Where a public sanitary or combined sewer is not available under the provisions of ZMC 13.16.020(B), the building sewer shall be connected to a private wastewater disposal system complying with the provisions of this chapter.

B. Before commencement of construction of a private wastewater disposal system the owner(s) shall first obtain a written permit signed by the public works director and approval by the Yakima County health district. The application for a city permit shall be made on a form furnished by the city, which the applicant shall supplement by any plans, specifications, and other information as are deemed necessary by the public works director. A permit and inspection fee of \$100.00 shall be paid to the city at the time the application is filed.

C. A permit for a private wastewater disposal system shall not become effective until the installation is completed to the satisfaction of the public works director and Yakima County health district. The public works director shall be allowed to inspect the work at any stage of construction, and, in any event, the applicant for the permit shall notify the public works director when the work is ready for final inspection, and before any underground portions are covered. The inspection shall be made within 24 hours of the receipt of notice by the public works director or their designee.

D. The type, capacities, location, and layout of a private wastewater disposal system shall comply with all requirements of the Yakima County health district. No permit shall be issued for any private wastewater disposal system employing subsurface soil absorption facilities where the area of the lot is less than four acres. No septic tank or cesspool shall be permitted to discharge to any natural outlet.

E. At such time as a private wastewater disposal system fails, as provided in subsection (D) of this section, the property owner will be required to make a direct connection to the public sewer in compliance with this chapter, and any septic tanks, cesspools, and similar private wastewater disposal facilities shall be cleaned of sludge and filled with suitable material.

F. The owner(s) shall operate and maintain the private wastewater disposal facilities in a sanitary manner at all times, at no expense to the city. Sludge removal from private disposal systems shall be performed by licensed operators and disposed of according to Yakima County health district regulations.

G. No statement contained in this chapter shall be construed to interfere with any additional requirements that may be imposed by the Yakima County health district. (Ord. 1495 § 2, 2019)

13.16.040 Building sewers and connections.

A. A connection charge will be imposed on the property owner/applicant of any detached single-family, two-family dwellings, or multiple single-family dwellings (townhouses) with a separate means of egress, or a facility to be connected to the domestic sewer system and has not paid a domestic sewer connection charge for such dwelling(s) or facility. The cost of a new service connection(s) shall be the responsibility of the property owner/applicant. No sewer service will be provided until the connection fee(s) and general facility charge have been paid in full for each unit or facility. No subsequent service connection(s) will be allowed until all previous connection fees have been paid in full.

B. No unauthorized person(s) shall uncover, make any connections with or opening into, use, alter, or disturb any public sewer or appurtenance thereof without first obtaining a permit from the city building department.

C. There shall be three classes of building sewer categories: (1) residential, (2) commercial service with four subcategories (A, B, C, and schools), and (3) for service to establishments producing industrial wastes. In either case, the owner(s) or their agent shall make application on a connection form furnished by the city. The application shall be supplemented by any plans, specifications, or other information considered pertinent in the judgment of the public works director.

D. All costs and expenses incidental to the installation and connection of the building sewer shall be borne by the owner(s). The owner(s) shall indemnify the city from any loss or damage that may directly or indirectly be occasioned by the installation of the building sewer.

E. A separate and independent building sewer shall be provided for every detached single-family, two-family dwelling, or multiple single-family dwelling (townhouse) with a separate means of egress, or facility. The front building may be extended to the rear building and the whole considered as one building sewer, but the city does not and will not assume any obligation or responsibility for damage caused by or resulting from any such single connection aforementioned.

F. Old building sewers may be used in connection with a new building project only when they are found, on examination and test by the public works director, to meet all requirements of this chapter.

G. The size, slope, alignment, materials of construction of a building sewer, and the methods to be used in excavating, placing of the pipe, jointing, testing, and backfilling the trench, shall all conform to the requirements of the International Building Code and Uniform Plumbing Code or other applicable rules and regulations of the city. In the absence of code provisions or in amplification thereof, the materials and procedures set forth in appropriate specifications of the most recent Washington State Department of Ecology "Criteria for Sewage Works Design," Publication No. 98-37 WQ, or as it may be amended, shall apply. The pipe used in the installation thereof shall be equal in quality to the pipe used in the general sewer system, and not less than four inches in diameter. The jointing compound, where mechanical joints are not used, shall be equal in quality to that used in the general or public sewer system. All such connections shall be made gastight and watertight and verified by proper testing. Any deviation from the prescribed procedures and materials must be approved in writing by the public works director before installation.

H. Whenever possible, the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be lifted by an approved means and discharged to the building sewer.

I. All excavations for building sewer installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the city.

J. Grease, oil, and sand interceptors shall be provided for the proper handling of liquid wastes containing floatable grease or any flammable wastes, sand, or other harmful ingredients; except that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by the public works director, and shall be located as to be readily and easily accessible for cleaning and inspection. In the maintaining of these interceptors, the owner(s) shall be responsible for the proper removal and disposal by appropriate means of the captured material and shall maintain records of the dates and means of disposal which are subject to review by the public works director. Any removal and hauling of the collected materials not performed by owner's(s') personnel must be performed by currently licensed waste disposal firms.

K. Where pretreatment or flow-equalizing facilities are provided or required for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the owner(s) at his expense.

L. When required by the public works director, the owner of any property serviced by a building sewer carrying industrial wastes shall install a suitable structure together with such necessary meters and other appurtenances in the building sewer to facilitate observation, sampling, and measurement of the wastes. Such structure, when required, shall be accessibly and safely located and shall be constructed in accordance with plans approved by the public works director. The structure shall be installed by the owner at his expense and shall be maintained by him so as to be safe and accessible at all times. (Ord. 1495 § 2, 2019)

13.16.042 Side sewer connection fee.

The cost for making a new side sewer service connection shall be the responsibility of the applicant. No sewer service will be provided until a side sewer connection fee and general facility charge have been paid in full, and no second or subsequent service connections will be allowed unless all previous connections have been paid. The fee for each side sewer connection to the city's sewer system shall be \$300.00. The city shall issue a side sewer permit and inspect for each side sewer connections to the city's sewer system. For all commercial and industrial side sewer connections a sampling manhole or similar sampling station shall be required to be installed in an external location accessible to the city 24 hours a day.

A. Any time the city or an individual makes application for and complies with the provisions of Chapter <u>13.30</u> ZMC, Utility Reimbursement Agreements, and the city council so authorizes, any person or agency connecting to the sewer system in a reimbursement area shall be responsible to pay for reimbursement costs associated with sewer system improvements to a particular geographic area. (Ord. 1495 § 2, 2019)

13.16.044 General facility charge.

A. The sewer general facility charge (GFC) is based on a sewer equivalent residential unit (ERU). A sewer ERU consists of a flow component, a BOD component and a TSS component as defined in the most recent Zillah general facility charge study. If a sewer connection requires more than one ERU it shall be charged for the greater of its sewer flow, BOD or TSS component.

The equivalent residential unit (ERU) shall be equal to \$2,700 based on flow, BOD and TSS components established in the Zillah facility charge study. For nonresidential and nonstandard residential connections discharging more than one ERU, the following shall apply:

1. For connections requiring more than one ERU, an initial evaluation of the GFC will be made. The required sewer service ERU shall be estimated by the developer and approved by the public works director based on the Department of Ecology's or the Department of Health's estimates, as defined in their most recent respective design guidelines. Wastewater flow data from similar connections may be used for the initial evaluation with city concurrence.

2. The applicant for the sewer service shall pay a GFC based on the initial evaluation (e.g., if a nonresidential or nonstandard residential customer produces 20 times the flow of the average household, this would be expressed as 20 ERUs). This number shall be rounded to the nearest one-tenth ERU and the GFC paid accordingly.

3. Following the initial evaluation, sewer use will be recorded on a monthly basis for 12 months and be used in part to determine the actual sewer flow as determined by metered water use. Additional sampling frequency and sampling methodology for BOD and TSS shall be at the discretion of the city. At a minimum two grab samples shall be taken during the 12-month period to determine actual BOD and TSS from the site. Sampling testing costs shall be the responsibility of the user and may be billed on their regular monthly sewer bill. If at the end of the 12 months the number of actual ERUs is greater than the number of estimated ERUs then the connection shall pay to the connection the computed difference within 60 days. If at the end of the 12 months the number of actual ERUs is less than the number of estimated ERUs then the connection the computed difference within 60 days.

B. In the event that a material change in usage of any connection is made so that it increases the number of ERUs for a sewer service, then an additional GFC shall be charged based on a 12-month monitoring from the date that such additional usage is recorded by the city. Monitoring shall be consistent with subsection (D)(3) of this section.

C. The fees and charges established herein may be amended from time to time by ordinance of the city council. Any such amendments shall be based on changes in the city's costs of connecting, monitoring, testing, planning, designing or maintaining domestic water service to the city's service area.

D. The city council reserves the right to negotiate GFCs for activities or uses that are determined to use greater than 20 ERUs that can clearly show a substantial increase in property value to the city's service area. The following criteria shall be used in determining a GFC reduction:

1. Following the completion of subsection (A)(1) of this section an applicant, being determined as needing more than 20 ERUs in the initial evaluation, may initiate in writing a request to negotiate the GFC.

2. If the applicant chooses to negotiate the GFC they shall submit relative and factual information in writing regarding the proposed property value increase. The city shall verify the applicant's information and may also provide additional information on the proposed property value increase and set a date for the city council to review and consider a reduction in the GFC.

3. For every \$1,000,000 of proposed property value increase the city may reduce the GFC by one ERU that is above the initial 20 ERUs. At no time shall an activity generating more than 20 ERUs be charged less than 20 ERUs.

4. In addition to the requirements of subsection (D)(3) of this section, the city shall at the same time use Yakima County tax assessor and building permit information to verify the subject property's value with those stated in the negotiated GFC. Assessor and building permit data shall be nonnegotiable and not open to debate. If true property values or true ERU data, as found through subsection (D)(3) of this section, is different than the initial evaluation the GFC shall be adjusted accordingly.

E. For Activities That Generate Greater Than 50 ERUs.

1. For activities that generate greater than 50 ERUs the city may also negotiate the GFC on employment opportunities that the site would generate. In this case in addition to other required information in this section the applicant shall also submit any available information on number of potential employees and wages related to the site and its impact to the city. If reduction in the GFC is granted through this subsection it shall also be verified at 12 and 24 months. If true employment projections or true ERU data, as found through subsection (A)(3) of this section, is different than the initial evaluation, the GFC shall be adjusted accordingly.

2. Any such granting of reducing a determined GFC shall include a finding of fact that clearly indicates the reasons for such a reduction and its approval by the city council. (Ord. 1495 § 2, 2019)

13.16.045 Backflow check valves.

A. All residences or buildings connected to the public sewer system which have basements in which sewer fixtures are located shall be required to install and maintain backflow check valves as approved by the public works department of the city of Zillah, Washington.

B. Failure to install or maintain a backflow check valve by any person owning a residence or other building in the city with a basement in which sewer facilities are located shall be deemed a civil infraction/violation. The penalty for this violation will be that any damage caused to the residence or building by a backflow of sewage shall be borne by the building or property owner and the city shall not be responsible or liable for the sewage backflow damage when backflow check valves are required. (Ord. 1495 § 2, 2019)

13.16.050 Stormwater runoff.

A. No person(s) shall discharge or cause to be discharged any unpolluted waters such as stormwater, groundwater, roof runoff, subsurface drainage, or cooling water to any sewer, except stormwater runoff from limited areas, which stormwater may be polluted at times, may be discharged to the sanitary sewer by written permission of the public works director.

B. Stormwater other than that exempted under subsection (A) of this section, and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as combined sewers or storm sewers approved by the public works director and other regulatory agencies. Unpolluted industrial cooling water or process waters may be discharged, on approval of the public works director, to a storm sewer or combined sewer. (Ord. 1495 § 2, 2019)

13.16.060 Prohibited discharges.

No person(s) shall discharge or cause to be discharged any of the following described waters or wastes to any public sewers unless written permission has been provided:

A. No person shall discharge or cause to be discharged any stormwater, surface water, ground water, roof runoff, subsurface drainage, or noncontact cooling water to any sanitary sewer.

B. No person shall discharge or cause to be discharged any substances that, in the opinion of the public works director, may harm either the sewage works, the sewage treatment process, or equipment; have an adverse effect on the receiving stream; or can otherwise endanger life, limb, public property, or constitute a nuisance. No person shall discharge or cause to be discharged any of the following described waters or wastes to any public sewer:

1. Any waters or wastes (such as any gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquid, solid, or gas) which by reason of their nature or quantity are, or may be sufficient either alone, or by interaction, to: (a) create a fire or explosion hazard in the sewage treatment plant (including, but not limited to, waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade); (b) create a public nuisance or hazard to life; (c) prevent entry into the sewage works for its maintenance or repair; or (d) be injurious in any other way to the sewage works or its personnel;

2. Any waters or wastes having a pH lower than 6.0 or higher than 9.0, or having any other corrosive property capable of causing damage or hazard to structures, equipment, or personnel of the sewage works;

3. Heat in amounts that will inhibit biological activity in the sewage treatment plant which causes, or may cause, pass-through interference, but in no case heat in such quantities such that the temperature at the sewage treatment plant headworks exceeds 104 degrees Fahrenheit or 40 degrees Centigrade;

4. Any waters or wastes including oxygen demanding pollutants (BOD, etc.) and suspended solids (TSS, etc.) released in either a slug load or continuous discharge of such volume, flow rate, and/or concentration which will cause, or may cause, pass-through or interference of the sewage treatment plant;

5. Any waters or wastes in amounts that cause, or may cause, obstruction to the flow in the sewage works, does not meet the definition of properly shredded garbage, or otherwise interfere with the operations or maintenance of the sewage works;

6. Petroleum oil, nonbiodegradable cutting oil, or products of mineral origin in amounts that will cause, or may cause, pass-through or interference of the sewage treatment plant;

7. Any waters or wastes which result in the presence of toxic gases, vapors, or fumes within the sewage works in a quantity which causes, or may cause, acute worker health and safety problems;

8. Any trucked or hauled pollutants without prior written approval by the public works director, except at discharge points designated by the public works director;

9. Noncontact cooling water in significant amounts, unpolluted stormwater, or any other direct water inflow sources which do not require treatment or would not be afforded a significant degree of treatment by the sewage treatment plant;

10. Any waters or wastes containing dangerous waste, as prohibited by Chapter 173-303 WAC; and

11. Any waters or wastes containing substances which are not amenable to treatment by the sewage treatment plant, or are amenable to treatment only to such degree that the sewage treatment plant effluent cannot meet the requirements of its waste discharge permit or of other agencies having jurisdiction over discharge to the receiving waters. (Ord. 1495 § 2, 2019)

13.16.070 Remedies for improper discharges.

A. If any waters or wastes are discharged or are proposed to be discharged to the public sewers, which waters contain the substances or possess the characteristics which in the judgment of the public works director may have a deleterious effect upon the wastewater facilities, processes, equipment, or receiving waters, or which otherwise create a hazard to life or constitute a public nuisance, the public works director may:

1. Reject the wastes;

2. Require pretreatment to an acceptable condition for discharge to the public sewers;

3. Require control over the quantities and rates of discharge; and/or

4. Require payment to cover added cost of handling and treating the wastes not covered by existing taxes or sewer charges under the provisions of ZMC 13.16.090.

When considering the above alternatives, the public works director shall give consideration to the economic impact of each alternative on the discharger. If the public works director permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to the review and approval of the public works director and the Washington State Department of Ecology.

B. The public works director may require a user of sewer services to provide information needed to determine compliance with this chapter. These requirements may include:

1. Wastewaters discharge peak rate and volume over a specified time period;

- 2. Chemical analyses of wastewaters;
- 3. Information on raw materials, processes, and products affecting wastewater volume;
- 4. Quantity and disposition of specific liquid, sludge, oil, solvent, or other materials important to sewer use control;
- 5. A plot plan of sewers of the user's property showing sewer and pretreatment facility location;
- 6. Details of wastewater pretreatment facilities;
- 7. Details of systems to prevent and control the losses of materials through spills to the municipal sewer.

C. No statement contained in ZMC <u>13.16.050</u> and <u>13.16.060</u> and this section shall be construed as preventing any special agreement or arrangement between the city and any industrial concern whereby an industrial waste of unusual strength or character may be accepted by the city for treatment. (Ord. 1495 § 2, 2019)

13.16.080 Inspection.

A. The public works director and other duly authorized employees of the city bearing proper credentials and identification shall be permitted to enter all private properties through which the city holds a duly negotiated easement for the purposes of, but not limited to, inspection, observation, measurement, sampling, repair, testing pertinent to discharge to the community system in accordance with the provisions of this chapter, and maintenance of any portion of the wastewater facilities lying within said easement. All entry and subsequent work, if any, on said easement shall be done in full accordance with the terms of the duly negotiated easement pertaining to the private property involved.

B. The public works director or other duly authorized employees are authorized to obtain information concerning industrial processes which have a direct bearing on the kind and source of discharge to the wastewater collection system. The industry may withhold information considered confidential. The industry must establish that the revelation to the public of the information in question might result in an advantage to competitors.

C. While performing the necessary work on private properties referred to in subsection (A) of this section, the public works director or duly authorized employees of the city shall observe all safety rules applicable to the premises established by the company, and the company shall be held harmless for injury or death to the city employees, and the city shall indemnify the company against loss or damage to its property by city employees and against liability claims and demands for personal injury or property damage asserted against the company and growing out of the gauging and sampling operation, except as such may be caused by negligence or failure of the company to maintain safe conditions as required in ZMC <u>13.16.050</u> through <u>13.16.070</u>. (Ord. 1495 § 2, 2019)

13.16.090 Rates for connection to sewer system.

A. Monthly Rates for Public Sewer. The city shall maintain a schedule of current rates, fees and charges and make them available to all interested persons. The charges for use of the public sewer system within the city of Zillah, Washington, shall be as follows:

1. Residences, including single-family homes, apartment units, trailer houses and other single-family dwelling units shall be assessed a charge per month, per dwelling unit as follows:

	2020	2021	2022	2023	2024	
SEWER						
Residential						
Base Rate	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge, per 100 CF ¹	\$1.86	\$1.92	\$1.97	\$2.03	\$2.09	
Additional Pump Fee for Zillah Lakes	\$16.00	\$16.48	\$16.97	\$17.48	\$18.00	
Rate Increase	3%	3%	3%	3%	3%	
1 – Usage charge based on water meter reading in cubic feet (CF) for each service unless a sewer meter is installed.						

In the rare case the city has provided sewer service but not water service to a utility customer and there is no water meter installed on the water source to capture the water usage, a flat rate will be charged for sewer based on usage that equates to one equivalent residential unit (ERU) and as follows:

SEWER ONLY ACCOUNTS	2020	2021	2022	2023	2024
Residential					

SEWER ONLY ACCOUNTS	2020	2021	2022	2023	2024	
Base Rate	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge per 100 cu. ft.	\$1.86	\$1.92	\$1.97	\$2.03	\$2.09	
Usage Charge x ERU rounded	\$13.02	\$13.44	\$13.79	\$14.21	\$14.63	
Rate Increase	3%	3%	3%	3%	3%	
Flat Rate Charge	\$35.52	\$36.62	\$37.66	\$38.80	\$39.95	
Add flat rate, plus usage charge for 1 ERU (668 cu. ft. rounded)						

2. Commercial/business establishments shall be charged based on the volume and strength of wastewater discharged into the city sewage system per the following table.

a. The usage charge will be determined through metered water consumption, unless a sewer discharge meter is installed. The commercial category is based on the strength of wastewater typical for the type of business activity using the category descriptions below. For commercial business not listed in the categories below, the public works director shall determine which category is most closely related to the commercial/business account.

	2020	2021	2022	2023	2024	
SEWER						
Commercial A						
Base Rate per ERU ¹	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge, per 100 CF ²	\$1.86	\$1.92	\$1.97	\$2.03	\$2.09	
Commercial B						
Base Rate per ERU ¹	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge, per 100 CF ²	\$3.26	\$3.36	\$3.46	\$3.56	\$3.67	
Commercial C						
Base Rate per ERU ¹	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge, per 100 CF ²	\$5.21	\$5.37	\$5.53	\$5.69	\$5.86	
Schools						
Base Rate per ERU ¹	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32	
Usage Charge, per 100 CF ²	\$4.43	\$4.56	\$4.70	\$4.84	\$4.99	
Rate Increase	3%	3%	3%	3%	3%	
 1 - Commercial base rate is charged per ERU. Commercial ERUs are calculated using average monthly flow from previous year divided by 668 CF per month, rounded up to the nearest whole number. 2 - Usage charge based on water meter reading for each service unless a sewer meter is installed. 						

i. Category A. This category applies to those commercial and business establishments maintaining only restroom facilities for employees and the public, and for hotels and motels without a restaurant that discharges to the same service line. These establishments generally discharge wastewater with a strength of 200 mg/1 biochemical oxygen demand (BOD) and 200 mg/1 total suspended solids (TSS).

ii. Category B. This category applies to those commercial and business establishments such as convenience stores, sandwich shops, coffee shops, hotels and motels with a restaurant, and assisted living facilities. These establishments generally discharge wastewater with a strength of 400 mg/1 BOD and 400 mg/1 TSS.

iii. Category C. This category applies to those commercial and business establishments such as restaurants, pizza shops, bakeries, fast food/drive-in restaurants, and supermarkets. These establishments generally discharge wastewater with a strength of 800 mg/1 BOD and 800 mg/1 TSS.

iv. Schools. This category applies to schools. These establishments generally discharge wastewater with a strength of 400 mg/1 BOD and 600 mg/1 TSS. (Note: School administration and other office-type buildings that are separate from a school and discharge a wastewater strength typical for a commercial category A connection will be charged as a commercial A account.)

b. General Commercial User Conditions.

i. Where multiple commercial and business establishments are tenants in a single building and are served by a common water meter, and have a single account with the city, domestic waste charges shall be based upon metered water consumption and shall be at a rate determined by the city for the highest BOD and TSS values of the users discharging to the sewer.

ii. Where multiple commercial and business establishments are tenants in a single building and are served by a common water meter, and each establishment has a separate account with the city, domestic waste charges shall be based upon metered water consumption at the rate determined by the city for the highest BOD and TSS values of the users discharging to the sewer. Billing amounts in excess of the base rate shall be distributed equally between the establishments connected to the meter.

Example: An account with two commercial B establishments, and one commercial A establishment with a monthly flow volume of 4,000 CF, and average annual flow volume of 3,700 CF per month. The flow volume will be appropriated evenly between the three establishments as 1,333 CF. The ERU is calculated by dividing the average monthly flow volume as follows:

3,700/3 = 1,233 CF average annual flow volume for each establishment

1,233 CF/668 CF per ERU = 1.85 which is rounded up to 2 ERUs for each

Therefore, each will be charged at the commercial B rate, comprised of a base rate of 2 ERUs x \$22.50 = \$45.00, plus a usage charge based on 4,000 CF/3 = 1,333 CF for each, resulting in a usage charge of 1,333 CF/100 x \$3.26 = \$43.46, for a monthly charge of \$88.46 each, or a total monthly charge of \$265.38 for the account.

iii. Where residential and/or commercial uses are jointly served by a common water meter, each residential dwelling unit shall be charged at the residential rate per unit, per month, based on a minimum base rate usage volume of 668 CF. Likewise, each business establishment shall be charged based on a minimum base rate usage volume of 668 CF per month, with the excess flow volume attributed to the commercial account(s).

Example 1: An account with three residences and one commercial A establishment has a measured monthly flow volume of 2,000 CF, and average annual flow volume of 2,500 CF. The ERU for each residence is 1, and since the total annual average flow volume is less than 4 x 668 = 2,672 CF, the commercial A account ERU is also 1. Each of the three residences will be charged for a usage of 668 CF (668/100 x \$1.86 = \$12.42 plus a base rate of \$22.50 for a monthly charge of \$34.92 each). Likewise, the commercial A establishment will also be charged for a usage of 668 CF (668/100 x \$1.86 = \$12.42 plus a base rate of \$22.50 for a monthly charge for the account will therefore be equal to \$139.68.

Example 2: An account with three residences and one commercial A establishment has a measured monthly flow volume of 3,000 CF, and average annual flow volume of 2,500 CF. Each of the three residences will be charged for a usage of 668 CF. Therefore, the charges for the residences will be $668/100 \times \$1.86 = \12.42 , plus a base rate of \$22.50 for a monthly charge of \$34.92 each. The commercial A establishment will be charged for the remainder of the usage volume of 996 CF and the ERU calculation for the commercial A establishment is 1 since the residential allotment subtracted from the total is 2,500 CF – $(3 \times 668 \text{ CF}) = 496 \text{ CF}$. Therefore, the commercial A establishment will be charged a base rate of \$22.50 and a usage charge of $996/100 \times \$1.86 = \18.52 for a monthly charge of \$41.03. The total monthly charge for the account will be equal to \$145.79.

iv. Commercial/business users who lose water through evaporation, irrigation, or in production may request a reduction in their monthly sewer charge only if the difference between water consumed and wastewater discharged to the city is documented through the use of water meters and sewer meters. In such a situation, the monthly sewer charges will be based upon the volume of wastewater discharged to the city at the appropriate rate specified within this section, applying sewer meter readings.

v. Outside utility commercial/business sewer accounts shall pay 150 percent of the applicable sewer service rates charged to the city commercial/business users.

vi. In the event a water or sewer meter is broken or cannot be read, said commercial/business establishment's usage shall be estimated using data available to the city for periods of typical usage during a similar usage period at the discretion of the public works director.

3. a. Industrial users of the city wastewater facilities shall be charged based on the volume and strength of wastewater discharged into the city system per the following table based on typical industries discharging wastewater with a strength of 400 mg/1 BOD and 400 mg/1 TSS:

	2020	2021	2022	2023	2024
NDUSTRIAL SEWER					
Fruit Packer					

	2020	2021	2022	2023	2024		
Base Rate per ERU ¹	\$22.50	\$23.18	\$23.87	\$24.59	\$25.32		
Usage Charge, per 100 CF ²	\$3.26	\$3.36	\$3.46	\$3.56	\$3.67		
Rate Increase	3%	3%	3%	3%	3%		
1 – Industrial ERUs are calculated using average monthly flow from previous year divided by 668							
CF per month, rounded up to the nearest whole number.							

2 – Usage charge based on water meter reading for each service unless a sewer meter is

installed.

Industrial users shall be evaluated and determined by the city as to whether monitoring stations on wastewater discharges will be required. If monitoring stations are required by the city, the city shall designate when, where, and how many stations shall be placed. City-approved monitoring stations shall be installed and maintained continuously in satisfactory and effective operation by, and at the expense of, the industrial user, at the direction of the city. The base rate and usage charge may be adjusted based on the monitoring results to reflect the typical BOD and TSS concentrations of the wastewater discharged from each industrial facility.

For industries that do not match the concentrations set forth herein, the city reserves the right to set separate rates for flow, BOD, and TSS to pay for the cost of industrial wastewater collection, treatment, and disposal.

b. General Industrial User Conditions. The following conditions apply to all industrial users discharging to the city wastewater facilities:

i. There shall be no unmetered sources of water contributing wastewater to the city sewer system without the knowledge and prior written approval of the city.

ii. The city reserves the right to test, monitor, and control any wastewater discharged to any city facility at any time, including the right set forth in ZMC 13.16.100.

iii. The discharges of industrial users may be restricted to a capacity allocated in an industrial discharge contract with the city, or state or National Pollutant Discharge Elimination System (NPDES) waste discharge permit issued to the user by the Washington Department of Ecology, whichever results in the smaller capacity.

iv. Industrial users who lose water through evaporation, irrigation, or in the product, may request a reduction in their monthly sewer charge only if the difference between water consumed and wastewater discharged to the city is documented using water and sewer meters. In such a situation, the monthly sewer charges will be based upon the volume of wastewater discharged to city wastewater facilities at the appropriate rate specified within this section.

v. The pH of discharges from all industrial users discharging liquids into the public sewers other than the industrial pretreatment system shall not be lower than 6.0 nor greater than 9.0 as determined by monitoring station results. Any discharge of waste outside this range shall be subject to a penalty of \$2,000 per day. For the purposes of this monetary penalty, each day's discharge shall be considered a separate event.

vi. The city shall charge monetary penalties for any discharge from an industrial user that meets the criteria of an excessive industrial discharge as defined in ZMC <u>13.16.060</u>. For the purposes of charging monetary penalties, each day's discharge and each component (flow, BOD, and TSS) shall be considered a separate event. Monetary penalties shall include, but not necessarily be limited to, the following:

(A) All costs associated with providing treatment to the industrial slug discharge.

(B) All costs associated with repair of equipment damaged by, or associated with, providing treatment to the industrial sludge discharge.

(C) All costs associated with NPDES permit violations, federal or state government orders resulting from NPDES permit violations, penalties imposed by the federal or state government upon the city for NPDES permit violations, and all costs associated with any citizens lawsuit filed against the city for NPDES permit violations.

(D) Industrial slug discharges lasting five or more consecutive days shall be subject to the surcharge provisions of the general industrial user condition in subsection (A)(3)(b)(iii) of this section whether or not the industrial user's maximum monthly allocated capacity is exceeded.

vii. Outside utility industrial users shall pay 150 percent of the applicable sewer service rates charged to city industrial users.

viii. Industrial users not required to have metering and monitoring stations shall be charged at rates as determined by the public works director and based on typical BOD and TSS concentrations for the industry or by sampling and monitoring of the wastewater discharge.

ix. In the event a water or sewer meter is broken or cannot be read, said industrial establishment's usage shall be estimated using data available to the city for periods of typical usage during a similar usage period at the discretion of the public works director.

x. Reallocation of Capacity. The discharges of industrial users may be restricted to a capacity allocated in an industrial discharge contract with the city, or a state or NPDES waste discharge permit issued to the user by the Washington Department of Ecology, whichever results in the smaller capacity. Any industrial user desiring an increase in their allocation shall apply to the city in writing at least 90 days in advance of the date on which it is desired to commence the increased discharge. That written application shall demonstrate to the city that the industrial user has a reasonable expectation to use the new allocation.

Any industrial user desiring a decrease in their allocation shall notify the city in writing of its willingness to release capacity. All requests for capacity reallocation are subject to the approval of the city.

xi. Increased Charge or Extraordinary BOD Discharge. The city of Zillah reserves the right to make a special increased sewer assessment for users of the public sewer system discharging more than ordinary BOD amounts which are not adequately charged for and addressed under subsection (A)(2) of this section. This section shall also apply in circumstances where the user of the public sewer system does not use the public water supply from city sources. Sewer charges under this section will be determined on an annual basis to ensure the receipt of fair and adequate revenue to the city. (Ord. 1495 § 2, 2019)

13.16.091 Late payment penalties.

Any user not paying the sewer charge as assessed hereinabove by the fifteenth day of the month following the billing from the previous month shall be assessed a penalty in the amount of \$15.00. Said penalty along with the billed assessment must be paid within 10 days of the date of the delinquent notice or the users thereof will be subject to the enforcement remedies of the city as set forth in ZMC 13.08.040. (Ord. 1495 § 2, 2019)

13.16.092 Additional charge to be paid monthly by users of public sewer system.

In addition to the rates otherwise established by ordinance to be paid monthly by users of the public sewer system, there shall be added the sum of \$1.00 to the previous sum of \$6.00 to equal a total of \$7.00 per month. (Ord. 1495 § 2, 2019)

13.16.094 Additional charge for individual pump stations.

A. Purpose of Section. The Zillah city council has examined the monthly service charges for those city of Zillah customers who will be served by individual pump stations. It has been determined that an additional charge needs to be assessed because the city will incur added costs for maintenance and operation of the individual pump stations as compared to those customers receiving gravity service. Typical added costs would include annual pump inspection, emergency service calls when pump stations fail, and costs for eventual pump replacement. Since these costs are unique to individual pump station customers, council believes it is reasonable to establish a special monthly service charge for those customers in an effort to keep gravity-served customers from having to bear the added costs of the individual pump stations.

B. Installation and Maintenance. After it has been determined by the public works director that an individual pump station needs to be installed the individual pump station will be purchased and installed by the developer or individual customer. After installation is approved, the city will assume responsibility for ongoing maintenance and operation. Power cost will remain the responsibility of the customer since power will be provided to the pump station from the customer's residence or business.

C. Establishment of Additional Monthly Sewer Charge. An additional monthly charge of \$16.00 is hereby established for those customers who are served by individual pump stations.

D. Expenditures of Funds. Monies collected from additional monthly sewer charges shall be expended exclusively for costs associated with maintenance and operation of said systems. The city clerk/treasurer shall maintain an accurate accounting of said expenditures. (Ord. 1495 § 2, 2019)

13.16.100 Effluent testing.

Upon initial approval of the ordinance changing the sewer rate structure, each commercial utility account was designated as category A, B, C, schools and industrial. Definitions were provided for each category.

As an effort to encourage compliance with the city fats, oils, and grease program, the city will, upon request, perform BOD testing to determine the category into which a commercial establishment will be placed. Results from the testing will be conclusive. An additional round of testing may be requested after a 12-month period. An independent lab may be used as per subsection (G) of this section, if requested.

The testing will take place as per the following example: If a commercial establishment is determined by the city to be charged as a category C (which means generally discharging wastewater with a strength of 800 mg/1 BOD and 800 mg/1 TSS) and they would like to challenge that, the establishment may submit a request on forms provided by the city to be retested. If the results are less than that established in category C, their rates will be adjusted to reflect the applicable usage charges for the applicable category.

The city may perform or require periodic testing of effluent by businesses when the city has a reasonable belief that (A) a user is not meeting the discharge standards set forth in ZMC <u>13.16.060</u>; (B) FOG discharges in amounts that exceed the wastewater treatment standards cause a visible sheen on the discharge or in the public sewer system; or (C) the build-up of grease in any public sewer facility or which accumulations either alone or in combination with other discharges cause obstructions of the public sewer system. These determinations would be based on:

A. Downstream testing; or

B. Evidence of FOG build-up downstream; or

C. Discharger records that are incomplete, false, or not made available for inspection; or

D. Evidence of tampering with pretreatment equipment; or

E. Evidence of use by the business of degreasers, "enzymes" or other chemicals which keep grease in suspension past the grease trap or interceptor; or

F. Other reasons established by facts which warrant a belief that the discharge standards are violated.

G. All measurements, tests, and analyses of the characteristics of waters and wastes to which reference is made in this chapter shall be determined in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association. Sampling methods, locations, times, durations, and frequencies are to be determined on an individual basis subject to approval by the public works director.

City will use the city laboratory to determine the testing. An independent lab may be used by the applicant upon request at the applicant's own expense and as coordinated with the city. (Ord. 1495 § 2, 2019)

13.16.110 Annual review.

The city has used historical water data and other methods it deemed appropriate to determine the ERUs for establishment of the initial base rate for each nonresidential sewer utility account. The city shall review annually each nonresidential sewer utility account and any associated data to reevaluate and determine the number of ERUs used to establish the base rate for that year. (Ord. 1495 § 2, 2019)

13.16.120 Violation – Penalty.

A. Any person found to be violating any provision of this chapter shall be served by the city with written notice stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations.

B. Civil Penalties.

1. A user who has violated, or continues to violate, any provision of this chapter or order issued hereunder shall be liable for civil penalties imposed pursuant to Chapter 7.80 RCW and a maximum civil penalty of \$1,000 per violation, per day.

2. Enforcement shall be pursuant to Chapter 8.12 ZMC and Chapter 7.80 RCW.

3. To the extent that the provisions of Chapter 8.12 ZMC are inconsistent with this chapter, the provisions of this chapter govern.

4. The director may recover reasonable attorneys' fees, court costs, and other expenses associated with enforcement activities, including sampling and monitoring expenses, and the cost of any actual damages incurred by the city.

5. In determining the amount of civil liability, the court shall take into account all relevant circumstances, including, but not limited to, the extent of harm caused by the violation, the magnitude and duration of the violation, any economic benefit gained through the user's violation, corrective actions by the user, the compliance history of the user, and any other factor as justice requires.

C. Damages. In addition to any fines or court-related costs, the property/business owner found to be in violation of this chapter shall be responsible for system damages including but not limited to any repairs, additional maintenance costs, or other damages or expenses incurred by the city arising from or related to the violation. (Ord. 1495 § 2, 2019)

¹ Prior legislation: Ords. 1066 and 1161.

The Zillah Municipal Code is current through Ordinance 1511, passed October 19, 2020.

Disclaimer: The city clerk's office has the official version of the Zillah Municipal Code. Users should contact the city clerk's office for ordinances passed subsequent to the ordinance cited above.

City Website: <u>http://www.cityofzillah.us/</u> City Telephone: (509) 829-5151

Code Publishing Company



CITY OF ZILLAH SEWER CONSTRUCTION STANDARDS



CITY OF ZILLAH

DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS FOR PUBLIC WORKS IMPROVEMENTS

Approved:

John Simmons – Public Works Director

Date: 10 19 2020

AUGUST 2020

Adopted XXXXX Ordinance Number XXXXX Revised XXXXX

CITY OF ZILLAH



DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS FOR PUBLIC WORKS IMPROVEMENTS

City of Zillah 503 First Avenue Zillah, WA 98953

(509) 829-5151 FAX (509) 829-5457

AUGUST 2020

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CHAPTER 1 - GENERAL

1. ENACTING AUTHORITY

These Design and Construction Standards are enacted by the City of Zillah, in accordance with state law, to protect and preserve the public health, safety, and general welfare.

2. PURPOSE

The purpose of these Design and Construction Standards is to provide consistent requirements, standards, and specifications for the design and construction of public works infrastructure improvements by the City and by private developers. These standards shall apply to the City Limits as well as City-owned utility extensions into the Urban Growth Area (UGA).

3. STATE ENVIRONMENT POLICY ACT (SEPA)

These Design and Construction Standards will not affect any considerations involving issues under the State Environmental Policy Act (SEPA). The City's responsible official will continue to make all necessary SEPA decisions when individual proposals are submitted.

4. CONFLICTING PROVISIONS

The standards, procedures, and requirements of these Design and Construction Standards are the minimum necessary to promote the health, safety, and welfare of the residents of the City of Zillah. The City may adopt more or less rigorous, or different standards, procedures, and requirements whenever necessary. If the provisions of these Design and Construction Standards conflict with one another, or if a provision of these Design and Construction conflicts with the provision of the City Code or another Ordinance of the City, the most restrictive provision or the provision imposing the highest standard shall control.

5. SEVERANCE

If any provision of these Design and Construction Standards or its application to any person or circumstance is for any reason held to be invalid, the remainder of these Design and Construction Standards or the application of the provisions is not affected.

6. PROCESS

Design Phase

Any person, firm, or corporation (the "Developer") whom intends to plat land in accordance with the City of Zillah Municipal Code and construct a public works improvement shall apply to the City Public Works Director. The request by the Developer shall include a map showing the area to be served; the number and type of proposed units, or the type and size of the proposed facility, and a general layout of the development.

Upon receipt of the design requirements from the Public Works Director, the Developer shall employ a Consulting Engineer licensed by the State of Washington to prepare plans and specifications for the public works improvements in accordance with these Design and Construction Standards and the Zillah Municipal Code. The Developer or its Consulting Engineer shall submit three (3) paper sets of plans and specifications for review by the City and City Engineer.

The City shall review the initial submittal and indicate corrections or additions, or request additional information and return one "red-lined" set to the Developer. The Developer shall make the required corrections and resubmit two (2) paper sets of revised plans and specifications for review by the City and City Engineer.

When it has been determined the plans and specifications indicate compliance with City of Zillah Design and Construction Standards, the Developer shall submit to the City the original plan tracings and specifications for final approval. The cover sheet of the original plans shall contain an "APPROVED FOR CONSTRUCTION BY THE CITY OF ZILLAH" signature block as specified in CHAPTER 2, Section 2. The City's responsible official will sign the plans. Such approved plans and specifications shall not be changed, modified, or altered without written authorization from the City Public Works Director. The Developer shall provide the City with a minimum of three (3) copies of the approved plan set and specifications for use by City Inspectors and City Departments as required.

Upon payment of the plan review fee by the Developer to the City, the approved original plans and specifications will be returned to the Developer, as discussed in CHAPTER 1, Section 8.

Construction Phase

Before the Developer's Contractor commences any work, he shall be required to attend a Preconstruction Conference with the City Public Works Department, the City Engineer, and utility companies as determined by the City of Zillah. The Contractor will submit his insurance and construction schedule at this meeting.

All construction shall be inspected by the City of Zillah or its authorized agent. The Contractor shall give ten (10) days minimum notice to the Public Works Director prior to the start of any construction activities.

After cleanup by the Contractor and final inspection by the City, the City will calculate the inspection fees and submit them to the Developer. The Developer will pay the inspection fee to the Public Works Department in accordance with Section 8 of this Chapter.

7. ENGINEERING DESIGN PLAN REQUIREMENTS

All plans, specifications, engineering calculations, diagrams, details, and other relevant data shall be designed and prepared by a Civil Engineer licensed by the State of Washington (Consultant), in accordance with CHAPTER 2.

8. PLAN REVIEW AND INSPECTION FEE

Plan review and inspection fees are hereby established to defray the administrative expense of plan review and inspection costs incurred by the City of Zillah.

The plan review and inspection fee shall be the total actual costs incurred by the City of Zillah, its agents, employees, and elected or appointed officials, for review and approval of the plans and specifications and for inspection of construction of the public works improvements. The fee shall include, but not be limited to, initial plan review, subsequent meetings with the Developer, explanations to the Developer's engineering consultant, reviews of revised plans, construction inspection, re-inspections, and a final inspection prior to the expiration of the maintenance/warranty period.

The plan review fee shall be tabulated by the City and sent to the Developer once final plans and specifications are ready for approval. Payment shall be made in full by the Developer prior to the City releasing the approved original plans and specifications for construction, or the issuance of a Building Permit.

The construction inspection fee shall be tabulated by the City and sent to the Developer once construction is deemed complete as determined by the City. Payment shall be made in full by the Developer prior to the City issuing a Certificate of Occupancy or final acceptance of the public works improvements.

9. RECORD DRAWINGS

The Developer's Consulting Engineer shall prepare and maintain a neatly marked, full-sized print set of record drawings showing the final location and layout of all new construction of the public facilities. Prior to final acceptance by the City of Zillah, one (1) set of reproducible Record Drawings and two (2) copies prepared by the Developer's Engineer clearly marked "Record Drawings" shall be delivered to the Public Works Director for review and acceptance. In addition, the Record Drawings shall be scanned and a PDF file of the complete Record Drawings package shall be provided to the City via flash drive or through a file transfer database.

10. TRANSFER OF OWNERSHIP

The Public Works Director or his designee shall make final inspection of all constructed public improvements at construction completion. Upon final inspection and approval of all work, including the method of construction, workmanship, materials, and quality control testing of the improvements, the Developer shall complete a Transfer of Ownership Form for pending acceptance by the City. This form may be found in Appendix A.

11. EASEMENTS

Public utility easements shall be established for the location of existing, new, and future public improvements serving new land divisions and/or land developments. Easements shall also be granted across the front of new lots and existing lots to provide future utility access as required.

All easements required shall be prepared by the Developer on the proper form and format for recording at the Yakima County Auditor's Office. The easement legal description shall be prepared by a land surveyor licensed in the State of Washington. The executed and notarized easement document shall be submitted to the Planning & Community Development Director for review, approval, and recording.

Ten (10) foot wide utility easements shall be dedicated along the front of each lot in subdivisions and short subdivisions. Easements for existing, new, and future utility lines shall be a minimum of sixteen (16) feet wide, provided the width of the easements for buried utilities will be at least twice the depth of the planned excavation.

Utility easements shall be continuous and aligned from block to block within a subdivision and with easements in adjoining subdivisions to facilitate the extension and future extension of public utilities.

12. UTILITY OVERSIZING

In all cases, the Public Works Director shall have final determination of the size and depth of water, sewer, and irrigation mains connected to the City utility system. The determination shall be

consistent with the City's comprehensive plan and/or the long-range objectives for the associated utility.

For example, if a property owner/developer is required to install a water main with a diameter in excess of the size necessary to serve their development, and greater than the 8" minimum pipe size required for all utilities, and if the purpose of such oversizing is to provide for the future needs of the City, the City may, based upon the conditions established within this policy, reimburse the property owner/developer for the difference in pipe material costs incurred solely by reason of the oversizing requirement. No such reimbursement shall be made except upon the following:

- Complete installation of the utility main and approval of the same by the Public Works Director;
- Submittal to the Public Works Director of a bill of sale for the utility main including all applicable pipe diameters;
- Approval of the oversizing costs by the Public Works Director; and
- Approval of the reimbursement by the Public Works Director.

As an alternative to cash reimbursement, the City may choose to provide a credit, in the amount of the reimbursement that may otherwise be available, against the corresponding development charges. For example, if a water main is oversized, a credit may be granted against the water connection charge, but not the sewer connection charge. Said reimbursement or credit shall not be more than 100% of any and all connection charges.

An oversizing agreement must be executed by the Public Works Director and Developer prior to plan approval. A summary of all eligible reimbursable costs and backup itemization must be submitted to the Public Works Director, for review and acceptance, within 45 days of substantial completion of the project or phase. Following review of submission, a determination of the total reimbursement amount will be calculated by the Public Works Director and provided to the Developer within 45 days of submission receipt. Upon concurrence of the calculated amount by the Developer, the City will provide reimbursement payment within 30 days.

CHAPTER 2 - GENERAL PLAN REQUIREMENTS

All plans, details, specifications, engineering calculations, diagrams, and other relevant data shall be designed and prepared by a Civil Engineer licensed by the State of Washington.

GENERAL PLAN FORMAT

- 1. Plan sheets and profile sheets or combined plan and profile sheets and detail sheets shall be on a sheet size of 22" x 34" (ANSI D).
- 2. The Cover sheet shall contain the following:
 - a. Name, address, and phone number of the owner/developer;
 - b. Name, address, and phone number and stamp of the Civil Engineer preparing the plans (Consultant);
 - c. "APPROVED FOR CONSTRUCTION BY THE CITY OF ZILLAH" with signature block for City final approval of the plans;
 - d. "APPROVED FOR CONSTRUCTION BY THE CITY OF ZILLAH FIRE CHIEF" with signature block for final approval of the plans;
 - e. Signature block for outside utilities listed below with the statement "By signing, the indicated utility is acknowledging receipt of plans and notification of the project, including public improvements." The developer is responsible to coordinate with each utility, and their established system requirements and review/approval processes separate from the City plan submission requirements.
 - i. Cascade Natural Gas, (509) 961-7909
 - ii. Charter Communications, (509) 728-2865
 - iii. CenturyLink, (509) 839-6651
 - iv. Pacific Power, (509) 575-3158
 - v. Sunnyside Valley Irrigation District, (509) 837-6980
 - vi. Zillah Irrigation District, (509) 930-3448
 - vii. Buena Irrigation District, (509) 829-5481
 - viii. Konewock Ditch Company, (509) 969-0523

Please note, the approval from outside utilities must be received prior to final plan acceptance and plan approval consideration by the City.

- f. Vicinity map showing the project site location;
- g. Survey benchmark used for the project;
- h. An overall site plan with contours;
- i. Sheet Index;
- j. Legend;
- k. Applicable project information; and
- I. The utility locate call # 811.
- 3. Each sheet shall contain the following project information:
 - a. Project title and City project number, work order number, or LID number, if appropriate;
 - b. Quarter section, Section Township Range;
 - c. Sheet title;
 - d. Page (of page) numbering;
 - e. Revision block;

- f. Subdivision or short plat name; and
- g. Signed stamp by a Civil Engineer currently licensed by the State of Washington.
- 4. All plan sheets must have a NORTH arrow preferably pointing to the top of the sheet or to the left, and must indicate the drawing scale. All engineering plans must be drawn to an appropriate engineer's scale. For profiles, the vertical scale shall be 1"=2', 1"=5' or 1"=10'. The horizontal scale shall be the same for both plan and profile and shall normally be 1" = 20'. Plan and profile stationing shall generally read left to right.
- 5. Match lines are required at breaks between sheets.
- 6. The Horizontal Datum for all plan submittals must be based on the City of Zillah datum, NAD 83 (2011). The Vertical Datum for all plan submittals must be based on the City of Zillah datum, NAVD 88. The benchmark used shall be referenced on the plans. An assumed datum will not be accepted.
- 7. Existing features and topography within the project construction limits must be shown on the plans. This shall include existing road width and surfacing, utility poles, existing underground utilities and surface appurtenances, significant trees, landscaping, and other elements that may affect design/construction.
- 8. All existing and proposed underground utilities and pipes shall be shown in the profile. The location and depth of existing facilities should be verified if there is a potential conflict with proposed facilities.
- 9. All street, water, sewer and storm drainage work shall be drawn on standard plan and profile sheets. Street, water, sewer, storm drainage, irrigation, and electrical design information shall all be shown on the same plan and profile sheets.
- 10. Plan sheets shall indicate all existing and proposed property lines, right-of-way lines, and easements.
- 11. Plan sheets shall show all horizontal survey control as required to properly locate and tie the improvements in horizontal location.
- 12. An erosion/sedimentation control plan sheet shall be included in the plan set.
- 13. A traffic control plan shall be included in the plan set when a road closure is proposed.

WATER SYSTEM PLAN REQUIREMENTS

See CHAPTER 4 for specific design requirements.

- 1. Show all existing and proposed water system features if known, including but not limited to:
 - a. Water mains;
 - b. Water valves;
 - c. Water meters;
 - d. Water service lines;
 - e. Fire hydrants;
 - f. Blow offs;

- g. Air and vacuum release valve assemblies;
- h. Pressure reducing valves;
- i. Fire sprinkler system lines;
- j. Double check valves;
- k. Post indicator valves; and
- I. Thrust blocking/mechanical restraints.
- 2. Indicate all easements required for the water main extensions and future extensions.
- 3. Show the water system, irrigation system, and the sanitary sewer system on the same plan and profile view for verification of minimum separation requirements. The design information for each system may be on individual drawings for that system.
- 4. Show the length, size, and pipe type for all main extensions, fire sprinkler system services, and domestic services where applicable.
- 5. Identify all joint connections; provide detail of all non-standard joints.
- 6. Show by station or dimension the location of all fire hydrants, tees, crosses, and services relative to centerline or property lines.
- 7. A profile view shall be shown for all City water main extensions, aligned if practical with the plan view. Clearly indicate the horizontal and vertical scales.
- 8. Show the minimum cover and minimum separation on each sheet.
- 9. In the profile view, show all utilities crossing the proposed water main.

SANITARY SEWER SYSTEM PLAN REQUIREMENTS

See CHAPTER 5 for specific design requirements.

- 1. Show all existing and proposed sanitary sewer system features including, but not limited to, the following:
 - a. Sewer mains, gravity and force mains;
 - b. Side service, proposed locations;
 - c. Manholes;
 - d. Clean outs; and
 - e. Lift stations.
- 2. Indicate all easements required for the sanitary sewer main extensions and laterals.
- 3. Provide an overall site plan of development with contours, to show that all lots/parcels will be served by the proposed sewer system at design depth for all new development.
- 4. Show the sanitary sewer system and water system on the same plan and profile for verification of minimum separation requirements. The design information for each may be on individual drawings for that system.
- 5. Slope, length, size, and pipe type shall be indicated for all lines and side sewers. Pipe length shall be measured from centerline of manholes.

- 6. Provide a profile for each sanitary sewer main extension. Clearly indicate the vertical and horizontal scale. Show the profile on the same sheet with, and aligned underneath, the plan view as practical.
- 7. The plan and profile must show the location of all existing and proposed gas, water, irrigation, storm drain, and other utility lines and crossings.
- 8. Show all vertical data in the profile view and all horizontal data in the plan view. It is not desirable to repeat the vertical data in the plan view unless it does not show in a profile.
- 9. Each manhole shall be uniquely numbered and shall be stationed off of a referenced centerline. Indicate rim and invert elevations in and out at all manholes.
- 10. Indicate the length of each side sewer stub, the centerline stationing for each side sewer, and the size.

STORMWATER SYSTEM PLAN REQUIREMENTS

See CHAPTER 6 for specific design requirements.

- 1. Show all existing features if known and all proposed storm sewer (drain) system features, including but not limited to:
 - a. Storm drain mains and lines;
 - b. Catch basins;
 - c. Inlets;
 - d. Drywells;
 - e. Infiltration trenches;
 - f. Retention systems;
 - g. Biofiltration swales;
 - h. Culverts;
 - i. Streams;
 - j. Ditches;
 - k. Natural drainage swales;
 - I. Headwalls;
 - m. Oil/water separator assembly; and
 - n. Other requirements of the Department of Ecology's Stormwater Management Manual for Eastern Washington.
- 2. Indicate all easements required for the storm drainage system.
- 3. The plans shall clearly indicate the location of the storm drainage items stationed from a referenced centerline.
- 4. Show all horizontal measurements and control in the plan view.
- 5. Show slope, length, size, and pipe material for all storm drain mains and lines.
- 6. All catch basins and inlets shall be uniquely numbered and shall be clearly labeled. Stationing and offsets shall be indicated from referenced centerline. Show all proposed storm drain features within the right of way in a profile.

- 7. Indicate all grate, rim, and invert elevations in the profile view.
- 8. Provide a stormwater report consistent with Chapter 3 of the Stormwater Management Manual for Eastern Washington, with an emphasis on runoff and drainage facilities sizing calculations as described in CHAPTER 6. Additionally, the stormwater report shall include a maintenance plan for all drainage facilities, both public and private.

STREET PLAN REQUIREMENTS

See CHAPTER 7 for specific design requirements.

- 1. Show all existing and proposed roadway improvements, including but not limited to:
 - a. Pavement and edge of pavement;
 - b. Concrete curb and gutter;
 - c. Sidewalk(s);
 - d. Utilities (manholes, utility poles, pedestals, valves, water meters, etc.);
 - e. Sidewalk ramps;
 - f. Signs and Barricades;
 - g. Driveways;
 - h. Rockery or retaining walls;
 - i. Mailboxes;
 - j. Monuments;
 - k. Streetlights, conduits, junction boxes, and service cabinet; and
 - I. Compliance with ADA requirements.
- 2. Show all Right of Way (R/W) lines, centerlines, and roadway widths for all rights of way.
- 3. Clearly differentiate between areas of existing pavement, areas of new pavement, and areas to be overlaid.
- 4. Provide a cross section or typical section of all rights of way indicating right of way width, centerline, pavement width, super-elevation or crown, sidewalk, street lights, curb and gutter, pavement, and base thickness of proposed section.
- 5. Provide a Plan and Profile of all new public roadways or extensions of existing roadways. Provide topography within the R/W including utilities. Indicate all horizontal and vertical curve data, percent of grade, bearings, centerline stationing every 50 feet, finish grade elevations, and existing ground line. The profile of the existing centerline ground should extend a minimum of 100 feet before the beginning and at the end of the proposed improvements to show the gradient blend.
- 6. Align the profile view with the plan view, if practical. Clearly indicate the horizontal and the vertical scale.
- 7. Clearly label all profiles with respective street names and plan sheet reference numbers if drawn on separate sheets.
- 8. Provide survey monuments along the road centerline at all ends of curves, intersection points, angle points, and center of cul-de-sacs.

9. For developments where road work is required on an existing street, development plans are required to include cross section of the existing street and spot elevations at proposed intersections and appurtenances to the project.

CHAPTER 3 - GENERAL REQUIREMENTS FOR ALL PROJECTS

FORWARD

The City of Zillah has adopted the latest edition of the *Standard Specifications for Road, Bridge, and Municipal Construction* (Standard Specifications) prepared by the Washington State Department of Transportation (WSDOT), and the American Public Works Association (APWA) General Special Provisions (GSP's) for Division One General Requirements as the standard specifications governing all design and construction of public works improvements by the City and by private developers.

All references hereinafter made to the "Standard Specifications" shall refer to the latest edition of the Standard Specifications described above. Except as may be amended, modified, or supplemented hereinafter, each section of the Standard Specifications shall be considered as much a part of these requirements as if they were actually set forth herein.

The Standard Specifications, General and Project Special Provisions, and City Standard Details contained in these Design and Construction Standards shall apply in their entirety to all City of Zillah public works projects. These Design and Construction Standards have been prepared to form a compiled document intended to assist and inform developers, consultants, and contractors of the construction requirements to be used on proposed public works improvements.

The Standard Specifications, General and Project Special Provisions, and City Standard Details shall periodically be amended, revised, and updated. It shall be the responsibility of each user of this information to verify that he has the latest revisions prior to submitting any work covered by these specifications and details.

Copies of the Standard Specifications are available electronically at: <u>http://www.wsdot.wa.gov/Publications/Manuals/M41-10.htm</u>.

Copies of the APWA GSP's are available electronically at: <u>http://www.wsdot.wa.gov/Partners/APWA/Division_1_Page.htm.</u>

Also incorporated into the Construction Standards by reference are:

- *Manual on Uniform Traffic Control Devices for Streets and Highways*, currently adopted edition, with Washington State modifications, if any
- Standard Plans for Road, Bridge and Municipal Construction, WSDOT/APWA, current edition

Developers and contractors are encouraged to contact the City of Zillah Public Works Department to obtain a copy of these standards.

<u>GENERAL</u>

All work shall be done in accordance with the approved Plans, the latest edition of the *Standard Specifications for Road, Bridge, and Municipal Construction* prepared by the Washington State Department of Transportation, amendments to the Standard Specifications, referenced codes and organizations, and these Special Provisions.

The American Public Works Association (APWA) General Special Provisions (G.S.P.'s) to Division One of the WSDOT Standard Specifications shall amend Division One of the *Standard Specifications for Road, Bridge, and Municipal Construction*. These GSP's are available at www.wsdot.wa.gov/partners/apwa/.

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All materials incorporated into a proposed public works improvements project shall meet the requirements of Division 9 of the Standard Specifications or City of Zillah Design and Construction Standards as shown in the Standard Details and Special Provisions.

Any Public Works facility improvements or components that are not specifically addressed in these Design and Construction Standards shall be designed by a licensed professional engineer in the State of Washington, and provided to the City for review and approval consideration by the City and City Engineer.

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions

The terms defined in Section 1-01.3 of the Standard Specifications shall be further described by the following:

Consultant:	Means an engineer licensed in the State of Washington, employed by the Developer to design the improvement and prepare plans and specifications, perform construction staking, or similar services.
Construction Documents:	Means the project plans, specifications, and special provisions prepared by the Developer's Consultant for the public works improvements contemplated and approved by the City.
City:	Means the City of Zillah, a municipal corporation, as represented by its authorized officials, employees or agents.
Contractor:	Means the person or firm employed by the Developer or under Contract with the City to do the construction of the public works improvements.
Developer:	Means the person or firm constructing the new development and engaging the services of and employing consultants, and/or contractors and paying for the design and construction of the public works improvements to be transferred to the City.
Drawings:	Means the construction plans prepared by the Developer's Consultant for the public works improvements contemplated. The terms "Construction Documents," "Contract Documents," "Plans," "Engineer's Plans," "Engineer's Drawings," "Working Drawings," and "Project Manual" are synonymous.
Engineer:	Means the appointed City Engineer for the City of Zillah or his/her duly authorized agent or representative.
Owner:	Means the City of Zillah acting through its legally established officials, boards, commissions, etc., as represented by its authorized officers, employees, or agents.
Public Works Director:	Means the appointed official for the City, responsible for managing the Department of Public Works.

- Standard Plans and Details: Means specific drawings adopted by the City of Zillah and revised from time to time which show frequently recurring components of work which have been standardized for use.
- Standard Specifications: The latest edition of *Standard Specifications for Road, Bridge, and Municipal Construction* prepared by the Washington State Department of Transportation, and amendments, and the APWA GSP's for Division One that are, by this reference, made part of the Contract Documents. Except as may be amended, modified, or supplemented hereinafter, each section of the Standard Specifications shall be considered as much a part of these Construction Documents as if they were actually set forth herein.
- Special Provisions: The Special Provisions supplement or modify the Standard Specifications and supersede any conflicting provisions of the *Standard Specifications for Road, Bridge, and Municipal Construction* and the appended amendments to the Standard Specifications and are made a part of a Construction Document.

Should any conflicts be encountered, the following inter-relationships shall govern: The Special Provisions shall supersede the APWA GSP's, which shall supersede the WSDOT Amendments, which shall supersede the Standard Specifications.

Supplement this section with the following:

All references in the Standard Specifications, Amendments, or WSDOT General Special Provisions, to the terms "Department of Transportation", "Washington State Transportation Commission", "Commission", "Secretary of Transportation", "Secretary", "Headquarters", and "State Treasurer" shall be revised to read "Contracting Agency".

All references to the terms "State" or "state" shall be revised to read "Contracting Agency" unless the reference is to an administrative agency of the State of Washington, a State statute or regulation, or the context reasonably indicates otherwise.

All references to "State Materials Laboratory" shall be revised to read "Contracting Agency designated location".

All references to "certification of completed public improvements" shall be interpreted to mean the Contracting Agency form(s) by which final completion is granted.

1-04 SCOPE OF THE WORK

1-04.4 Changes

Supplement this section with the following:

No changes in the work covered by the approved Construction Documents shall be made without having prior written approval of the Developer and the City.
1-04.11 Final Cleanup

Delete this section and replace it with the following:

The Contractor shall perform final cleanup as provided in this section to the Developer's and City's satisfaction. The date of completion will not be established until this is done. The material sites and all ground the Contractor occupied to do the work shall be left neat and presentable. The Contractor shall:

- 1. Remove all rubbish, surplus materials, discarded materials, falsework, temporary structures, equipment, and debris, and
- 2. Deposit in embankments, or remove from the project, all unneeded, oversized rock left from grading, surfacing, or paving.

Partial cleanup shall be done by the Contractor when he feels it is necessary or when, in the opinion of the City or Developer, partial clean-up should be done prior to either major cleanup or final inspection. When directed by the City, the Contractor shall provide partial cleanup within 48 hours of such order. Should the Contractor fail to comply, the City may utilize its own staff and/or contracted staff at the prevailing wage rate plus equipment rental charges, which the Contractor shall be responsible for all applicable expenses. Subsequent building permits will not be processed until reimbursement is paid in total.

1-04.12 Waste Site (New Section)

The following new section shall be added to the Standard Specifications:

Where there is additional waste excavation in excess of that needed for the project and in excess of that needed for compliance with requests of the Developer or City, the Contractor shall secure and operate his own waste site at his own expense. The Contractor shall also be required to secure and operate his own waste site at his own expense for the disposal of all unsuitable material, asphalt, concrete, debris, waste material, and any other objectionable material which is directed to waste.

The Contractor shall comply with the State of Washington's regulations regarding disposal of waste material as outlined in WAC 173-304, Subchapter 461.

1-05 CONTROL OF WORK

1-05.1 Authority of the Engineer

Supplement this section with the following:

Unless otherwise expressly provided in the approved Construction Drawings, Specifications and Addenda, the means and methods of construction shall be such as the Contractor may choose; subject, however, to the Consultant and the City's right to reject the means and methods proposed by the Contractor which (1) will constitute or create a hazard to the work, or to persons or property; or (2) will not produce finished work in accordance with the terms of the approved Construction Documents. Approval of the Contractor's means and methods of construction or his failure to exercise his right to reject such means or methods shall not relieve the Contractor of the obligation to accomplish the result intended by the Construction Documents; nor shall the exercise of such right to reject create a cause for action for damages.

1-05.3(1) Project Record Drawings (New Section)

The following new section shall be added to the Standard Specifications:

The Contractor shall maintain a neatly marked, full-size set of record drawings showing the final location and layout of all new construction. Drawings shall be kept current weekly, with all field instruction, change orders, and construction adjustment.

The preparation and upkeep of the Record Drawings is to be the assigned responsibility of a single, experienced, and qualified individual. The quality of the Record Drawings, in terms of accuracy, clarity, and completeness, is to be adequate to allow the Contracting Agency to modify the computer-aided drafting (CAD) Contract Drawings to produce a complete set of Record Drawings for the Contracting Agency without further investigative effort by the Contracting Agency.

The Record Drawing markups shall document all changes in the Work, both concealed and visible. Items that must be shown on the markups include but are not limited to:

- Actual Dimensions, arrangement, and materials used when different than shown in the Plans.
- Changes made by Change Order or Field Order.
- Changes made by the Contractor.
- Accurate locations of storm sewer, sanitary sewer, water mains and other water appurtenances, structures, conduits, light standards, vaults, width of roadways, sidewalks, landscaping area, building footprints, channelization and pavement markings, etc. Include pipe invert elevations, top of castings (manholes, inlets, etc.).

Drawings shall be subject to the inspection of the Developer and the City at all times. Prior to acceptance of the work, the Contractor shall deliver to the Developer one set of neatly marked as-built drawings showing the information required above. The Developer shall prepare and deliver to the City of Zillah the reproducible Record Drawings and copies in accordance with Section 9 of CHAPTER 1.

1-05.5 Construction Staking (New Section)

The following new section shall be added to the Standard Specifications:

A land surveyor licensed in the State of Washington, retained by the Developer, shall establish the line and grade of proposed construction by offset stakes. Staking may be done by or at the direction of the licensed land surveyor. Said surveyor shall establish the centerline for minor structures and bench marks at convenient locations for use by the Contractor and City inspectors. GPS systems may be used by the Contractor, but physical reference points shall be available for City inspection.

The Contractor shall establish grades from the surveyor's stakes at suitable intervals in accordance with industry standards and acceptable to the City. Where new construction adjoins existing construction, the Contractor shall make such adjustments in grade as are necessary, and approved by the City.

1-05.6 Inspections of Work and Materials

Supplement this section with the following:

The Public Works Director or his representative may not be on the job site full-time. The Contractor shall follow the approved construction plans and specifications, schedule, and request inspections and testing at the appropriate times as required herein. The Public Works Director will try to provide inspections on short notice, but if unable to, the requirements for proper notice shall apply. The project schedule prepared by the Contractor and approved by the Public Works Director shall also be used as a guide for the Contractor to schedule inspections. The Contractor shall provide a minimum 48 hours notice to request inspections, but in no case shall there be more than 72 hours notice. The request shall state the date and approximate time the inspection is requested. If the Contractor has requested two (2) inspections and is not prepared for said inspection, the Contractor shall pay the costs for any additional improperly scheduled requests.

At the beginning of the project, or each applicable construction activity, the Contractor shall meet with the Public Works Director or his representative and establish a minimum standard for 100 feet of product (basis for acceptance), in the field, which meets the specifications. This work includes: Survey staking and control, pavement cuts, utility trenches, trench bedding, pipe installation, backfill, patches, curb and gutter alignment, grade and finish, sidewalk finish, paving finish, and any other activities determined by the Engineer to be important to the project. No major amount of work shall proceed until this minimum standard is established. This does not waive the Contractor's requirements in the specifications for quality control or materials used.

Inspections by the City of Zillah or its authorized agent are mandatory for acceptance of backfilling any utility trenches; placing base course and top course for streets; paving; placing sidewalks, curbs and gutters; storm, sewer and water line installation. All construction shall be inspected.

1-05.7 Removal of Defective and Unauthorized Work

(October 1, 2005 APWA GSP)

Supplement this section with the following:

If the Contractor fails to remedy defective or unauthorized work within the time specified in a written notice from the City or City Engineer, or fails to perform any part of the work required by the Contract Documents, the City or City Engineer may correct and remedy such work as may be identified in the written notice, with Contracting Agency forces or by such other means as the Contracting Agency may deem necessary.

If the Contractor fails to comply with a written order to remedy what the City or City Engineer determines to be an emergency situation, the City may have the defective and unauthorized work corrected immediately, the rejected work removed and replaced, or have work the Contractor refuses to perform completed by using Contracting Agency or other forces. An emergency situation is any situation when, in the opinion of the City, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

Direct or indirect costs incurred by the Contracting Agency attributable to correcting and remedying defective or unauthorized work, or work the Contractor failed or refused to perform, shall be paid by the Developer/Contractor. Such direct and indirect costs shall

include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

The rights exercised under the provisions of this section shall not diminish the Contracting Agency's right to pursue any other avenue for additional remedy or damages with respect to the Contractor's failure to perform the work as required.

Supplement this section with the following:

For new roadway/street construction and overlays, HMA work rejected shall require the replacement of the entire road or street width from block to block or as approved in writing from the City or City Engineer. For trench patching, HMA work rejected shall require the replacement of the entire patch width from block to block or as approved in writing from the City or City Engineer.

1-05.8 Means and Methods (New Section)

The following new section shall be added to the Standard Specifications:

Unless otherwise expressly provided in the Contract Drawings, Specifications and Addenda, the means and methods of construction shall be such as the Contractor may choose; subject, however, to the Consultant's or City's right to reject means and methods proposed by the Contractor which (1) will constitute or create a hazard to the work, or to persons or property; or (2) will not produce finished work in accordance with the terms of the Contract. The Consultant's or City's approval of the Contractor's means and methods of construction or his failure to exercise his right to reject such means or methods shall not relieve the Contractor of the obligation to accomplish the result intended by the Contract; nor shall the exercise of such right to reject create a cause for action for damages.

1-05.10 Guarantees

Delete this section and replace it with the following:

If, within two years (2) after the date of Final Acceptance of the Work, defective and unauthorized materials or work is discovered, the Developer/Contractor shall promptly, upon written request, return and in accordance with the instructions either correct such work, or if such work has been rejected, remove it from the Project Site and replace it with non-defective and authorized work, all without cost to the City. If the Contractor does not promptly comply with the written request to correct defective and unauthorized work, or if an emergency exists, the City reserves the right to have defective and unauthorized work corrected or rejected, removed, and replaced pursuant to the provisions of Section 1-05.7 of the Standard Specifications.

The Contractor agrees the above two-year limitation shall not exclude nor diminish any rights under any law to obtain damages and recover costs resulting from defective and unauthorized work discovered after two years.

1-05.14 Cooperation With Other Contractors

Supplement this section with the following:

No additional compensation will be given to the Contractor for any coordination or delays caused by other nearby construction projects.

1-05.16 Water and Power (New Section)

The following new section shall be added to the Standard Specifications:

<u>Water Supply</u>: Water for use on the projects may be obtained/purchased from the City of Zillah and the Contractor shall arrange for and convey the water from the nearest convenient hydrant or other source at his own expense, including hydrant meter rental fee and metered water usage. The hydrants shall be used in accordance with the City of Zillah Water Department regulations.

The City reserves the right to deny the use of fire hydrants where deemed inappropriate by the City.

<u>Power Supply</u>: The Developer shall make necessary arrangements, and shall bear the costs for power necessary for the performance of the work.

1-05.17 Oral Agreements (New Section)

The following new section shall be added to the Standard Specifications:

No oral agreement or conversation with any officer, agent, or employee of the Contracting Agency, either before or after construction, shall affect or modify any of the terms or obligations contained in any of the City-approved documents. Such oral agreement or conversation shall be considered as unofficial information and in no way binding upon the Contracting Agency, unless subsequently put in writing and signed by the Contracting Agency.

1-06 CONTROL OF MATERIAL

1-06.2(1) Samples and Tests for Acceptance

Supplement this section with the following:

The Contractor/Developer shall be responsible for scheduling and paying for all material and compaction testing required by these Design and Construction Standards for new public works Improvements. All testing services shall be performed by an independent, certified testing firm and/or laboratory meeting the approval of the City and/or City Engineer. The Contractor shall submit information relating to the qualifications of the proposed testing firm to the City for review and approval prior to the preconstruction conference. The Contractor shall provide copies of all test result reports to the City within 24 hours after completion of any test. Test reports shall become the property of the City. Testing frequencies listed below may be modified to assure compliance with the Specifications.

Trench Backfill

Copies of moisture-density curves for each type of material encountered and copies of all test results shall be provided to the City as construction progresses.

Compaction tests shall be taken at a frequency and at depths sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for each 100 linear feet of mainline pipeline trench and one (1) test for each street crossing. At alternating 100-foot locations along the main trench line, tests shall be taken at 1-foot, 2-foot, and 3-foot depths below finish grade.

The City or City Engineer may request additional tests be performed at the Contractor's/Developer's expense, if test results do not meet the required trench backfill densities.

All trenches shall be backfilled and compacted to at least 95 percent of maximum density as determined by ASTM D 698 (Standard Proctor).

Roadway Subgrade (Embankment and Excavation Sections)

Copies of the moisture density curves for each type of material encountered and copies of all test results shall be provided to the City or City Engineer as construction progresses.

Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 5,000 square feet of subgrade.

The City or City Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities. Subgrade compaction shall be as specified for Roadway Embankment in Section 2-03.3(14)C, Method C, compacted to at least 95 percent of maximum density as determined by ASTM D 698 (Standard Proctor).

Ballast and Crushed Surfacing

Copies of the moisture density curves and gradation for each type of material incorporated into the project and copies of all test results shall be provided to the City or City Engineer as construction progresses.

Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 5,000 square feet of surface area for each lift of ballast or crushed surfacing.

The City or City Engineer may request additional tests be performed at the Contractor's/Developer's expense, if test results do not meet the required subgrade densities.

Compaction of ballast and crushed surfacing shall be as specified in Section 4-04.3(5).

Asphalt Pavement

Copies of the reference maximum density test for each class of Hot Mix Asphalt pavement and copies of all test results shall be provided to the City or City Engineer as construction progresses.

Density tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 5,000 square feet of surface area for each lift of asphalt concrete pavement.

The City or City Engineer may request additional tests be performed at the Contractor's/Developer's expense, if test results do not meet the required subgrade densities.

Compaction of Hot Mix Asphalt pavement shall be as specified in Section 5-04.3(10)A.

Portland Cement Concrete for Curb, Gutter, and Sidewalk

A copy of the cement concrete design mix or certification from the concrete supplier that the concrete provided has been prepared to the strength requirement as specified elsewhere in these specifications.

Sample the first truck and each load until two successive loads meet specifications, and then randomly test one load for every 100 cubic yards. If at any time one load fails to meet specifications, continue testing every load until two successive loads meet specifications, and then randomly test one load for every 100 cubic yards.

All testing procedures shall be conducted in accordance with applicable Sections of Division 6-02 of the Standard Specifications.

Copies of all test results shall be provided to the City or City Engineer as construction progresses.

1-06.2(2) Statistical Evaluations of Materials for Acceptance

Delete Section 1-06.2(2).

1-07 LEGAL RELATION AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 Laws to be Observed

(October 1, 2005 APWA GSP)

Supplement Section 1-07.1 with the following:

In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

The Contractor shall maintain at the project site office, or other well-known place at the project site, all articles necessary for providing first aid to the injured. The Contractor shall

establish, publish, and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor's care, persons, including employees, who may have been injured on the project site. Employees should not be permitted to work on the project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

The Contractor shall have sole responsibility for the safety, efficiency, and adequacy of the Contractor's plant, appliances, and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation. The Contractor shall be solely and completely responsible for the conditions of the project site, including safety for all persons and property in the performance of the work. This requirement shall apply continuously, and not be limited to normal working hours. The required or implied duty of the Engineer to conduct construction review of the Contractor's performance does not, and shall not, be intended to include review and adequacy of the Contractor's safety measures in, on, or near the project site.

Amend the second sentence of the first paragraph to read:

The Contractor/Developer shall indemnify and save harmless the City of Zillah (including any agents, officers, employees, and representatives) against any claims that may arise because the Contractor (or any employee of the Contractor or subcontractor or materialman) violated a legal requirement.

1-07.5(3) State Department of Ecology

Add the following:

9. Comply with the requirements and special general conditions of the *Construction Stormwater General Permit* issued by the Washington State Department of Ecology to the Developer/Contractor for this project.

1-07.5(4) Air Quality

Supplement this section with the following:

The Contractor shall comply with the environmental provisions of local air pollution authorities, Yakima County Clean Air Authority.

A method of dust control during construction shall be submitted to, and approved by, the Yakima County Clean Air Authority. A written copy of their approval shall be submitted to the Public Works Director prior to commencement of construction. The Contractor/Developer shall designate a project coordinator for contact during construction regarding alleged air quality violations and other complaints.

1-07.13 Contractor's Responsibility for Work

1-07.13(1) General

Supplement this section with the following:

The Contractor is responsible for constructing and completing all work included in the approved Construction Documents and any other work directed by the Developer in a professional manner with first-class workmanship.

The Contractor shall keep the City of Zillah, the Developer, and the Consultant informed in writing of the address to which official correspondence is to be directed, the address and phone number of the person in charge of his field personnel, and the address and telephone number of the Contractor's representative who will be responsible and available outside of normal working hours for emergency repairs and the maintenance of traffic control and safety devices.

The Developer shall be responsible for the satisfactory operation and condition of all public improvements for a period of two (2) years following final inspection and City acceptance in accordance with the Zillah Municipal Code.

1-07.17 Utilities and Similar Facilities

Supplement this section with the following:

It shall be the Contractor's responsibility to investigate and verify the presence and location of all utilities prior to construction.

The Contractor/Developer shall call for field location, not less than two nor more than ten business days before the scheduled date for commencement of excavation which may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, state, or federal holiday. The phone number for the Northwest Utility Notification Center for Zillah is 1-800-424-5555 (or 811). If no one-number locator service is available, notice shall be provided individually by the Contractor to those owners known to or suspected of having underground facilities within the area of proposed excavation.

The Contractor/Developer is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor/Developer incurred as a result of this law shall be at the Contractor's/Developer's expense.

No excavation shall begin until all known facilities, in the vicinity of the excavation area, have been located and marked.

In addition to the requirements of RCW 19.122, the Contractor shall use surface features and other evidence in determining the approximate utility location prior to excavation. The Contractor shall hand dig to expose known utilities.

Where the location of the work is in proximity to overhead wires and power lines, the Contractor shall coordinate all work with the utility and shall provide for such measures as may be necessary for the protection of workmen.

Only City personnel shall operate water system valves.

1-07.18 Public Liability and Property Damage Insurance

Supplement this section with the following:

The Contractor shall obtain and maintain in full force and effect during the duration of this Contract public liability and property damage insurance in accordance with this section and as modified herein.

Prior to start of construction, the Contractor/Developer shall furnish the City of Zillah a Certificate of Insurance and the additional insured endorsements as evidence of compliance with these requirements. This certificate shall name the City of Zillah, its employees, agents, elected and appointed officials, engineering consultant, and all subcontractors as "additional insureds" and shall stipulate that the policies named thereon cannot be canceled unless at least forty-five (45) days written notice has been given to the City of Zillah. The certificate shall not contain the following or similar wording regarding cancellation notification: "Failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents, or representatives."

1-07.23 Public Convenience and Safety

Supplement this section with the following:

All signs, barricades, traffic control devices, and labor for traffic control required by construction activities for the control of traffic shall be supplied, placed, and maintained by the Contractor. This shall apply to detours and traffic control both within and outside the limits of the project.

All work shall be done under a plan which shall have the approval of the City of Zillah and create a minimum of interruption or inconvenience to pedestrian and vehicular traffic. All arrangements to care for such traffic will be the Contractor's responsibility and shall be made at his expense. All work shall be carried out with due regard for public safety. Open trenches shall be provided with proper barricades and at night they shall be distinctly indicated by adequately placed lights. At entrances to business properties and other private roads, driveways, bridges, or other such means as to provide access shall be provided by the Contractor. The Contractor shall maintain vehicular and pedestrian access to businesses at all times that businesses are open for business.

Upon failure of the Contractor to immediately provide and maintain adequate suitable barricades, lights and detour signs, when ordered to do so, the City shall be at liberty, without further notice to the Contractor or the Surety, to provide the same and request payment for providing proper barricades, lights, and signs, and the City assumes no liability connected therewith.

Any traffic restriction must have prior approval of the City of Zillah. Appropriate traffic control measures and signing are required during such temporary road closures.

It shall be the responsibility of the Contractor to secure the City's approval for any desired road closure and associated traffic control plan including detours. Following approval, the Contractor shall notify the Developer, City of Zillah, and the Police and Fire Departments at least 24 hours prior to closing any street. When the street is re-opened, it shall again be the responsibility of the Contractor to notify the above named departments and persons.

1-07.28 Safety Standards (New Section)

The following new section shall be added to the Standard Specifications:

All work shall be performed in accordance with all applicable local, state, and federal health and safety codes, standards, regulations, and/or accepted industry standards. It shall be the responsibility of the Contractor to ensure that his work force and the public are adequately protected against any hazards.

The City of Zillah or Developer shall have the authority at all times to issue a stop work order at no penalty if, in their opinion, working conditions present an undue hazard to the public, property, or the work force. Such authority shall not, however, relieve the Contractor of responsibility for the maintenance of safe working conditions or assess any responsibility to the City or Developer for the identification of any or all unsafe conditions.

1-07.29 Notifying Property Owners (New Section)

The following new section shall be added to the Standard Specifications:

When construction activities will affect ingress and egress to a property along the project alignment, the Contractor shall be responsible for notifying the occupant/occupants of the property 72 hours prior to the construction activity beginning. If personal contact with the occupant is not possible, the Contractor shall leave written notification. A copy of all notifications shall be provided to the City.

1-08 PROSECUTION AND PROGRESS

1-08.3 Progress Schedule

Supplement this section with the following:

Prior to the commencement of any work, a preconstruction conference shall be held. The Contractor or Developer shall contact the City of Zillah and set a date and time for the meeting. It shall be the responsibility of the Contractor/Developer to notify and invite all parties having an interest in the project to the meeting, including the major subcontractors, Fire Department, Irrigation Districts, and private utilities.

At this conference, all points of the approved Plans and Specifications will be open to discussion including scope, order and coordination of work, equipment lead time required, means and methods of construction, inspection and reporting procedures, etc. The Contractor should satisfy himself that all provisions and intentions of the work are fully understood.

The Contractor shall prepare and submit to the City and Developer at the Preconstruction Conference a Construction Progress and Completion Schedule using a bar graph format. Items in the Schedule shall be arranged in the order and sequence in which they will be performed. The schedule shall be drawn to a time scale, shown along the base of the diagram, using an appropriate measurement per day with weekends and holidays indicated. The Construction Progress Schedule shall be continuously updated and, if necessary, redrawn upon the first working day of each month or upon issuance of any Change Order which substantially affects the scheduling. Copies (2 prints or 1 reproducible) of newly updated Schedules shall be forwarded to the City, as directed, immediately upon preparation.

Any proposed road or sidewalk closures including duration of closure must be approved by City Council prior to consideration. If approved, closures shall not extend beyond permitted duration.

At the discretion of the City, a weekly meeting between representatives of the City (inspector and/or engineer) and contractor (foreman, supervisor, and/or project manager) shall be held at the project site or at City Hall at a pre-determined time. The contractor

shall present an update on project status, project schedule, and any problems that have arisen.

1-08.3(2) Contractor Responsibility (New Section)

The following new section shall be added to the Standard Specifications:

The Contractor is responsible for constructing and completing all work included in the Contract Documents and any other work directed by the Developer in a professional manner with first-class workmanship.

The Contractor shall keep the City of Zillah, the Developer, and the Consultant informed in writing of the address to which official correspondence is to be directed, the address and phone number of the person in charge of his field personnel, and the address and telephone number of the Contractor's representative who will be responsible and available outside of normal working hours for emergency repairs and the maintenance of traffic control and safety devices.

1-10 TEMPORARY TRAFFIC CONTROL

Supplement this section with the following:

The provisions of the latest edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) for Streets and Highways and amendments thereto published by the U.S. Department of Transportation, Federal Highway Administration, and WSDOT by this reference are made a part of these Documents.

1-10.2(2) Traffic Control Plans

Delete the entire section and replace with the following:

The Contractor shall prepare a signing plan showing the necessary Class A and B construction signing, barricades, and traffic control devices required for the project and submit it to the City, no later than the preconstruction conference date, unless a road closure is proposed which requires City Council approval. When the Class B signing for a particular area will be provided as detailed on one or more of the figures included in the MUTCD without modification, the Contractor may reference the applicable MUTCD figure at the appropriate location on the Plan. When this procedure is used, variable distances such as minimum length of taper must be specified by the Contractor.

The signing plan prepared by the Contractor shall provide for adequate warning within the limits of the project and on all streets, alleys, and driveways entering the project so that approaching traffic may turn left or right onto existing undisturbed streets before reaching the project. The Plan shall be prepared to create a minimum of inconvenience for pedestrian and vehicle traffic.

All modifications to the accepted signing plans shall be reviewed by the City.

1-10.3(3)A Construction Signs

The first sentence of the first paragraph is revised to read:

All signs, barricades, flashers, cones, traffic safety drums, barricades, and other traffic control devices required by the approved traffic control plan(s), as well as any other appropriate signs prescribed by the City or County, shall be furnished and maintained by the Contractor.

Open trenches shall be provided with proper barricades and at night they shall be distinctly indicated by adequately spaced lights.

7-08 GENERAL PIPE INSTALLATION REQUIREMENTS

7-08.1 General

Add the following:

All construction work shall be inspected by the City of Zillah prior to backfilling. At least 48 hours notice shall be given to the City Public Works Department prior to backfilling.

The Contractor shall notify the Utility Notification Center (One Call Center) at least 48 hours prior to start of excavation so that underground utilities may be marked. Telephone number is 1-800-424-5555.

7-08.3 Construction Requirements

7-08.3(1)A Trenches

Supplement this section with the following:

Existing pavement shall be neatly saw-cut on both sides of the trench parallel consistent with the dimensions presented on the Trench Surfacing Repair standard detail, including a saw-cutting prior to surface repair.

7-08.3(1)C Bedding the Pipe

Add the following:

<u>Gravel Backfill for Pipe Zone (including Bedding)</u>: Pipe zone material shall be Crushed Surfacing Top Course meeting the requirements of section 9-03.9(3), and shall be placed and compacted in layers as designated by the City.

7-08.3(2)B Pipe Laying – General

Supplement this section with the following:

Potable domestic water mains shall maintain a 10-foot horizontal and 18-inch vertical separation above non-potable pipelines (sewer, irrigation, and storm) consistent with the Department of Health Water System Design Manual.

When parallel to existing utilities, new domestic water mains shall be installed a minimum of 10 feet horizontally (outside pipe wall to outside pipe wall, typical) and 18 inches

vertically above other non-potable pipelines. Where this is not possible at the discretion of the Engineer, a water main may be installed a minimum of five feet horizontally and 18 inches vertically above other non-potable pipelines, as long as the water main is placed in a separate trench and on a bench of undisturbed earth.

When crossing existing utilities, new domestic water mains shall be installed a minimum of 18 inches vertically above non-potable pipelines. Where this is not possible, or the water main passes under a non-potable pipeline, the water main shall be installed in a pressure rated pipe casing extending 10 feet each side of the crossing. In addition, where the water main passes under an existing non-potable pipeline, support shall be provided for the non-potable pipeline by backfilling the non-potable pipeline trench with controlled density backfill or other approved methods. A minimum of 6 inches of separation between the crossing pipelines must be maintained in all cases.

When parallel to existing potable water mains, new non-potable pipelines shall be installed a minimum of 10 feet horizontally and 18 inches vertically below existing water mains. Where this is not possible at the discretion of the Engineer, a non-potable pipeline may be installed a minimum of five feet horizontally from an existing water main, as long as the non-potable pipeline is installed a minimum of 18 inches vertically below the water main and the non-potable pipeline is placed in a separate trench. If the vertical separation cannot be met, then the non-potable pipeline shall be constructed of or encased in materials equal to water main standards with a minimum pressure rating of 165psi (C900 PVC DR 25, ductile iron, etc.).

When crossing existing potable water mains, new non-potable pipelines shall be installed a minimum of 18 inches vertically below existing water mains. Due to difficulties in compacting under existing utilities, controlled density backfill or other City-approved materials shall be placed as backfill at the crossing locations, to a depth of the water main spring line. Where the minimum clearance is not possible, or the non-potable pipeline passes above a water main, a full length of non-potable pipeline shall be centered at the crossing. In addition, the non-potable pipeline shall either be installed in a pressure rated pipe casing extending 10 feet each side of the crossing, or be constructed of one standard length of pipe material equal to waterline standards with a minimum pressure rating of 165psi (C900 PVC DR 25, ductile iron, etc.). A minimum of 6 inches of separation between the crossing pipelines must be maintained in all cases.

Magnetic detectable marking tape shall be installed above all pipes including service lines. The tape shall be placed approximately two feet above the top of the pipe and shall extend its full length. The horizontal location of the tape shall vary no more than one foot from the centerline alignment of the pipe. Detectable marking tape shall meet the requirements of Section 9-15.18 of the Standard Specifications. Tape width shall be a minimum of 3 inches wide, or wider as recommended by the manufacturer for the installation depth. Care must be taken to ensure that the marking tape shall be continuous and unbroken during the backfill process.

Tracer wire shall be installed on all water mains and appurtenances, water services, side sewers, and sanitary sewer force mains.

7-08.3(3) Backfilling

Supplement this section with the following:

Street crossing trenches and other locations, where directed, shall be backfilled for the full depth of the trench with Imported Select Backfill conforming to Section 9-03.9(3) Crushed Surfacing Base Course. The Public Works Director may require the use of Controlled Density Fill (CDF) for trench backfill in certain circumstances. The requirements for CDF are set forth in CHAPTER 7, Section 8-30 of these Special Provisions.

Mechanical compaction shall be required for all trenches. The density of the compacted materials shall be at least 95% of the maximum density as determined by ASTM D 698 Test (Standard Proctor). The Contractor shall be responsible for scheduling, conducting, and paying for all testing required.

7-08.3(5) Marker Posts (New Section)

The following new section shall be added to the Standard Specifications:

Stub-outs for future connections at property lines, including utility mains, services, conduit, etc., shall be marked with an 8' treated 2x4 inside of an 8' steel stud, painted the color consistent with those tape colors identified in Section 9-15.18 of the Standard Specifications, extending 24"-36" above finished ground surface.

8-01 EROSION CONTROL AND WATER POLLUTION CONTROL

8-01.3(1) Construction Requirements

Supplement this section with the following:

Exposed and unworked soils shall be temporarily or permanently stabilized as soon as practicable, unless otherwise approved by the City of Zillah. Contractor shall follow the requirements in the most current publication of the Stormwater Management Manual for Eastern Washington.

CHAPTER 4 - WATER SYSTEM IMPROVEMENTS

GENERAL REQUIREMENTS FOR WATER SYSTEM IMPROVEMENTS

All extensions and additions to the City of Zillah's domestic water system shall conform to the Design and Construction Standards of the City of Zillah and the Washington State Department of Health (DOH), American Water Works Association, and designed by a Civil Engineer currently licensed by the State of Washington.

All new lots and developments shall be served by a public domestic water supply line to be maintained by the City of Zillah and located adjacent to the lot or development site. The water supply line shall be capable of providing sufficient flow and pressure to satisfy the fire flow and domestic service requirements of the proposed lots and development requirements. If determined necessary by the City Engineer, hydraulic analysis including modeling shall be performed by the City or its agents, and all costs shall be borne by the Developer.

Water lines shall be extended by the Developer to the point where the adjoining property owner's responsibility for further extension begins. This typically requires an extension across the entire frontage of the property to the property line of the adjoining owner. In some cases, it will require dedication of an easement and a line extension across the property or extension across two or more sides of the developing property. Extensions will be consistent with and implement the City's adopted Water System Plan.

All new public domestic water mains shall be a minimum diameter of 8 inches, or larger diameters as specified in the City's Water System Plan, or larger as required to meet the fire flow demand of the development. Fire hydrants located within 50 feet of the water main shall be a minimum diameter of 6 inches. Hydrants beyond 50 feet of the water main shall be a minimum diameter of 8 inches, or larger as necessary to achieve required fire flows. Cover over new watermains shall be a minimum depth of 48 inches and a maximum of 72 inches.

New water mains shall be located in existing or proposed streets within City right-of-way and shall be offset from the street centerline, not located within a vehicle wheel path.

Larger public water mains may be required depending upon fire flow requirements as determined by the City and City Engineer.

All domestic water mains shall be looped, where possible. Temporary dead-end mains over 500 feet in length will only be allowed where future water main looping via public right of way will be assured. No permanent dead-end water mains over 300 feet in length will be allowed to be part of the City of Zillah's public water system.

Permanent dead-end water mains may become private water mains owned and maintained by the Developer. All dead-end water mains shall be isolated from the public water main with a reduced pressure double check valve assembly and vault furnished and installed by the Developer to City of Zillah standards for cross-connection control. All services must extend from a water main owned and operated by the City.

Maximum valve spacing in public water mains will be 750 linear feet. Valves will be furnished and installed on all legs of new water main intersections. Valve operating nut extensions approved by the City will be required on valves where the operating nut is deeper than 36 inches below finished grade.

All new water main installations shall be satisfactorily tested per Section 7-09 prior to being placed into service including hydrostatic pressure and bacteriological testing, all at the expense of the Developer.

All new water service lines shall be a minimum 1-inch, for 3/4- and 1-inch meters, and shall be a minimum of 2-inch, for 1 1/2- and 2-inch meters. Commercial properties shall be served by a minimum 1 1/2-inch meter. All 1-inch and smaller meters shall be furnished and installed by the City of Zillah and paid for by the Developer. All meters larger than 1-inch shall be furnished and installed by the Developer, but must be pre-approved for operation with the City's automatic meter reading system, prior to installation. The Developer/Contractor shall furnish and install all water service components (except water meter) from the water main to the property line including service saddle, corporation stop, service tap, service pipe, meter stop, meter check valve, and meter box, all at the Developer's expense. Only one meter shall be served from each main tap. All service hot taps shall be made under the supervision of the Public Works Director or his designee, and the coupon shall be delivered to the Public Works Director for all taps.

All live taps of water mains shall be performed by a contractor approved by the Public Works Director (or City's representative with Public Works Director's approval) using a full circle stainless steel tapping sleeve with gate valve and paid for by the Developer. No cut-in tees will be allowed.

Minimum 2-inch air and vacuum release valves shall be furnished and installed at high points in the water system.

Maximum spacing of fire hydrants shall be 300 feet. Additional hydrants may be required to protect structures as determined by the Fire Chief and Public Works Director. Additional fire hydrants required on a site may require a looped, on-site water main. Easements shall be provided for all on-site, public, looped water mains, in accordance with CHAPTER 1, Section 11. Fire hydrants shall be located at the ends of curb returns or at property lines between lots, and not be located within driveways, driveway ramps, or curb ramps.

Water mains shall maintain a 10-foot horizontal and 18-inch vertical separation above non-potable pipelines (sanitary sewers, reclaimed water, irrigation pipelines, stormwater pipes, and other uses) in accordance with Section 6.3.4 of the *Water System Design Manual*, *October 2019*, by the Washington State Department of Health. Additionally, water and sewer mains shall be separated in accordance with Section C1-9.1 of the *Criteria for Sewage Works Design, August 2008,* by the Washington State Department of Ecology. Gas, power, telephone, and other dry utilities shall maintain a minimum 3-foot horizontal clearance from water mains.

The design of water mains and appurtenances is subject to review and approval consideration by the Public Works Director and City Engineer. The Public Works Director may, at his discretion, adjust these Design and Construction Standards as necessary to facilitate installation of water lines and appurtenances for the health, safety, and protection of the general public.

All double detector check valve assemblies shall conform to City of Zillah standards. Initial <u>and</u> <u>annual</u> testing will be required.

Irrigation Systems

Where applicable and as determined by the Public Works Director, subdivisions and developments shall be served by a separate irrigation water distribution system with an individual service for each lot. If an irrigation assessment is in place for the subject parcel, an irrigation system must be installed. The irrigation system shall be designed by a professional engineer and constructed in accordance with applicable Sunnyside Valley Irrigation District, Zillah Irrigation

District, Buena Irrigation District, Konewock Ditch Company, and City of Zillah Construction Standards. All turnout modifications with irrigation districts shall be coordinated and constructed by the Developer. Construction of all irrigation system components shall be the responsibility of the Developer. All irrigation pipe shall be installed with a minimum cover of 30 inches, pipe zone bedding and backfill per Standard Detail SS-1, and with a 3-inch wide detectable magnetic marking tape nine (9) inches above the pipe. In the event irrigation water is not available in the vicinity of the subdivision and an irrigation system is not required, the Developer may elect to install a "dry" irrigation system, tested, sealed, and buried with ends clearly marked to facilitate a future connection when irrigation water is available. Refer to Section 8-03 for material requirements.

Domestic water and non-potable irrigation services should be extended to opposite lot corners in new construction. Where it is impossible to install them in that manner, 10-feet of separation needs to be supplied between the service points (meter boxes).

SPECIAL PROVISIONS FOR WATER SYSTEMS

The following sections of the WSDOT Standard Specifications have been amended or supplemented as described below and apply to the construction of public works water system improvements within the City of Zillah.

7-09 WATER MAINS

7-09.2 Materials

Pipe for main line approved for use shall be as follows:

Pipe for Main Line:

Ductile Iron Pipe Polyvinyl Chloride (PVC) Pressure Pipe

Supplement this section with the following:

<u>Ductile Iron Pipe</u>: Ductile iron pipe shall conform to the requirements of Section 9-30.1(1) of the Standard Specifications. Joints shall be rubber gasket, push-on type (Tyton Joint). Fittings shall be mechanical joint or flanged, as shown on the Plans, and shall conform to Section 9-30.2(1) of the Standard Specifications.

<u>Polyvinyl Chloride (PVC) Pressure Pipe</u>: PVC pipe shall conform to the requirements of Section 9-30.1(5)A. Fittings shall be the same as specified for Ductile Iron pipe.

<u>Detectable Marker Tape</u>: Marker tape shall be a detectable type and shall be marked "WATER," and shall conform to Section 9-15.18 of the Standard Specifications.

<u>Tracer Wire</u>: Tracer wire shall be 12-gauge heavy insulated (60 mil) copper wire with UF insulation colored for the utility being installed in accordance with Section 9-15.18.

Fittings for Main Lines:

<u>Connection Couplings</u>: Couplings for Ductile Iron or PVC pipe, either transition or straight couplings, shall be compression type flexible couplings conforming to Section 9-30.2(7) of the Standard Specifications.

Aggregates:

See Section 7-08.3 of these Specifications.

7-09.3 Construction Requirements

7-09.3(5) Grade and Alignment

Replace the first sentence of the third paragraph with the following:

The depth of trenching for water mains shall be such to provide a minimum cover of 4 feet and a maximum cover of 6 feet, unless otherwise approved by the Public Works Director.

7-09.3(7) Trench Excavation

Supplement this section with the following:

The Contractor shall neatly sawcut all areas of existing pavement within the trench excavation area, then remove and haul all waste materials from the project and dispose of at an approved site provided by the Contractor. Should any undermining occur on adjacent pavement, the Contractor shall neatly cut the pavement six (6) inches beyond the undermined area.

All trench excavations shall have adequate safety systems for the trench excavation that meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW. The Contractor shall be fully responsible for providing the necessary back sloping, cribbing, trench boxes, etc., as required to meet the specified safety requirements for the trench.

7-09.3(9) Bedding the Pipe

Supplement this section with the following:

All construction work shall be inspected by the City or its representative before pipe installation and backfilling.

7-09.3(11) Compaction of Backfill

Delete the first paragraph and supplement this section with the following:

Mechanical compaction shall be required for all trenches. The Developer/Contractor shall be responsible for scheduling and paying for all testing required.

The density of the compacted material shall be at least 95% of the maximum density as determined by ASTM D 698 Tests (Standard Proctor). Density tests shall be taken at various depths in the trench. All costs associated with testing shall be the responsibility of the Contractor. Placement of courses of aggregate shall not proceed until density requirements have been met.

The first 500 feet of trench backfill operations shall be considered a test section for the Contractor to demonstrate his backfilling and compaction techniques. The Contractor shall notify the City at least 3 working days prior to beginning trench excavation and backfill

operations. The Contractor shall arrange for in-place density tests to be taken on the completed test section in accordance with the above requirements. No further trenching will be allowed until the specified density is achieved in the test section. Passing in-place density tests in the test section will not relieve the Contractor from achieving the specified densities throughout the project.

7-09.3(12)A Locating Wire (New Section)

The following new section shall be added to the Standard Specifications:

A continuous solid copper locating wire shall be placed along the top of all water pipe. This wire shall be secured to the top of the pipe at maximum 10-foot intervals using 6-inch strips of 2-inch wide duct tape. All splices shall be tied, electrically continuous, and made waterproof. Access to terminal ends of the locating wire shall be made at locating wire boxes, per the details shown on the Drawings. The result of this installation shall be a continuous wire circuit electrically isolated from ground. The Contractor shall be responsible for testing continuity and for testing isolation from ground in the wire after all work has been completed on the test section. The Contractor is advised to do intermediate testing on his own after backfilling operations and prior to surface restoration work to be sure continuity is maintained. If there is a break or defect in the wire, it shall be the Contractor's responsibility to locate and repair the defect. The continuity of the location wire shall be tested from one test load point to the next by use of a temporary wire laid between test points in-line with an ohmmeter. Resistance shall be measured with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms per 500 feet of location wire being tested. Isolation from ground shall be measured with a megohmmeter and shall be a minimum of 20 megohms for any section of location wire tested. The City shall witness the acceptance test.

7-09.3(19)A Connections to Existing Mains

Supplement this section with the following:

New water mains shall be tested, flushed, and disinfected per Section 7-09.3(23) and 7-09.3(24) with passing results, prior to making connection to existing main and being placed into operation.

No existing line valves shall be closed without permission by the Public Works Director. In no case shall any existing water main valve be closed for a period of greater than eight (8) hours. Only City personnel or those authorized by the City may operate City valves.

The anticipated schedule for the connections shall be discussed and scheduled at the preconstruction conference, and indicated on the weekly schedule. The City reserves the right to adjust the schedule of the connections, as required, subject to a minimum of 24-hour notice of schedule change to the Contractor.

7-09.3(21) Concrete Thrust Blocking

Supplement this section with the following:

Thrust blocks shall be formed and placed in conformance with the Standard Details for the appropriate pipe size and fitting type.

Mechanically restrained pipe and fittings may be used in lieu of thrust blocking. The Engineer shall provide appropriate restraint calculations, indicating the length of pipe and fittings to be restrained for each particular diameter and type of fitting to be installed. Thrust restraint calculators such as those provided by Ductile Iron Pipe Research Association, EBAA Iron, or similar may be used to determine required restraint lengths.

7-09.3(22) Blow-off Assemblies

Supplement this section with the following:

All permanent dead-end lines must end with a blow-off, unless there is a hydrant connection within the last 30 feet of the water main.

7-09.3(23) Hydrostatic Pressure Test

Replace the first sentence with the following:

Prior to any hydrostatic pressure testing, the Developer/Contractor shall verify requirements with the Public Works Director. All water mains and appurtenances shall be tested under the following hydrostatic pressure settings based on watermain location in relation to the bluff bisecting the City of Zillah:

Above bluff: 150 psi for fifteen (15) minute period Below bluff: 200 psi for a fifteen (15) minute period

7-09.3(24) Disinfection of Water Mains

Supplement this section with the following:

AWWA Standard C651 shall be used as a guideline for disinfecting water mains.

7-12 VALVES FOR WATER MAINS

7-12.2 Materials

Supplement this section with the following:

<u>Gate Valves</u>: All valves sizes 2-inch through 10-inch shall be gate valves manufactured in the U.S. and shall conform to the latest revision of AWWA Resilient Seated Gate Valves Standard C515 or AWWA C509.

All gate valves shall have non-rising stems, open counterclockwise, and shall be provided with a 2-inch square AWWA operating nut. Gate valves 4-inch and larger shall have mechanical joint connections. Stuffing box shall be O-ring type.

<u>Butterfly Valves</u>: All valves sizes 12 inches and larger shall be butterfly valves manufactured in the U.S. and suitable for direct burial and shall be rubber seated and conform to the latest revision of AWWA Standard C504 Class 150B. Valve operators shall be sealed, gasketed, and lubricated for underground service. All valves shall open counterclockwise and shall be provided with a 2-inch square AWWA operating nut.

Valves shall have mechanical joint connections and shall be of the same size as the line on which they are located. Valve shafts shall be a one-piece unit extending full size through the valve disc and valve bearings, with minimum shaft diameter as specified in AWWA C504 Class 150B.

<u>Tapping Sleeve and Valve Assemblies:</u> Tapping sleeves shall be full circle, Romac Stainless Steel Tapping Sleeve (SST) with ductile iron flanged outlet, or approved equal, conforming to the latest AWWA Standard C223. Tapping gate valves shall meet the requirements for Gate Valves in Section 7-12.2.

<u>Valve Boxes:</u> Valve boxes shall be two-piece adjustable. The top section shall be Olympic Foundry Model 940-B, or equal, 18-inches high. The bottom section shall be Olympic Foundry Model R-36, or equal, 36-inches high. Extension sections shall be Olympic Foundry Model 044, or equal, 12-inches high.

<u>Combination Air Release/Air Vacuum Valves:</u> Valves shall meet the requirements of C512 and shall be APCO 140 Series or Val-Matic VM-200 Series.

7-12.3 Construction Requirements

Supplement this section with the following:

<u>Tapping Sleeve and Valve Assemblies</u>: The Contractor or Subcontractor completing the work shall have at least five (5) years' experience with a minimum of ten (10) water main taps of pipes with diameters equal to or larger than specified in this project. Contractor shall notify City at least 72 hours prior to all proposed taps and provide work experience references if requested. Work to complete the tap shall not commence without City's written approval. If the Contractor or Subcontractor does not have sufficient experience in the sole opinion of the City, a qualified Subcontractor as approved by the City, shall be used to complete the tap at no additional cost.

<u>Valves</u>: Upon completion of all work in connection with this Contract, the Developer/Contractor shall contact the City of Zillah Public Works for opening water valves. Valves shall only be operated by City Public Works staff.

<u>Valve Boxes</u>: Valve boxes should be set to position during backfilling operations so they will be in a vertically centered alignment to the valve operating stem. The top of the box will be at final grade.

The Contractor shall adjust all water valve boxes to the final grade of the surrounding area including new concrete sidewalk, asphalt paving, gravel surfacing, or topsoil surfacing, in accordance with the details shown on the Drawings. Valve box cover shall be rotated such that lugs are in-line with pipe alignment.

The Contractor shall keep the valve boxes free from debris caused by the construction activities. All valve boxes will be inspected during final walk-thru to verify that the valve box is plumb and that the valve wrench can be placed on the operating nut. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the Contractor's expense.

7-14 HYDRANTS

7-14.2 Materials

Supplement this section with the following:

The City of Zillah accepts fire hydrants of the following manufacturers, providing the hydrants conform to the City's technical specifications for fire hydrants:

Mueller Super Centurion M&H 929 Reliant

All hydrants shall have a Main Valve Opening (MVO) of 5-1/4" and one port with a 5" Storz Quick Coupling and two (2) 2-1/2" diameter ports. Threads on all ports shall be National Standard Thread.

Fire hydrants shall be painted with two coats of high visibility yellow paint.

7-14.3(1) Setting Hydrants

Delete the first and second paragraphs and replace with the following:

The hydrant shoe shall be set to the correct elevation on a concrete block base 12" x 12" x 6" thick, which has been placed on undisturbed earth. Around the base of the hydrant and weep hole, the Contractor shall place 0.5 cubic yards of washed drain rock ranging in size from 3/4" to 1-1/2", to allow free drainage of the hydrant. The drain rock shall be completely surrounded with construction geotextile filter fabric.

The contractor shall set all hydrants plumb and nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb. Hydrants shall be set so that the flange is 2"-8" above the back of curb, sidewalk, or finished grade to clear nuts and bolts. Hydrants shall be ordered with the bury depth required to meet the flange elevation requirements. The Contractor shall be responsible for verifying the hydrant flange elevations and no extensions will be allowed.

Fire hydrants shall be painted with two coats of high visibility yellow paint.

7-14.3(2) Hydrant Connections

Replace this section with the following:

Fire hydrants located within 50 feet of the water main shall be a minimum diameter of 6 inches. Hydrants beyond 50 feet of the water main shall be a minimum diameter of 8 inches, or larger as necessary to achieve required fire flows. Each hydrant lateral shall include an isolation valve at the water main connection point. The valve size shall equal the hydrant lateral diameter and shall be of the type specified in Section 7-12.2. Where hydrant runs are in excess of 6 inches in diameter, an additional 6-inch auxiliary gate valve shall be installed just prior to the hydrant installation.

7-14.3(2)A Hydrant Restraints

Replace this section with the following:

All hydrants shall be securely connected to the water main as shown on the City's Standard Detail.

7-14.3(2)C Hydrant Guard Posts

Replace this section with the following:

The Public Works Director may determine that four (4) 6-inch diameter Sch. 40 steel guard posts shall be installed at a hydrant location. Hydrant guard posts shall be painted the same color as the hydrants.

7-15 SERVICE CONNECTIONS

7-15.1 Description

Replace this section with the following:

This work consists of the relocation of existing water meters and water meter boxes, where necessary, and the installation of new saddles, corporation stops, service pipe, water meter boxes, and meter stops as shown on the Plans. The Developer/Contractor shall furnish and install all water service components (except water meter) from the water main to the property line including service saddle, corporation stop, service tap, service pipe, meter stop, and meter box, all at the Developer's expense.

7-15.2 Materials

Supplement this section with the following:

All fittings shall be lead free.

Saddles: New service saddles shall be Romac Style 202NS.

<u>Corporation Stops</u>: New 1" corporation stops shall be Ford type 1001, and new 2" corporation stops shall be Ford FB400.

<u>Service Pipe</u>: New service pipe shall be CTS Cross-linked Polyethylene (PEX-a) tubing meeting the requirements of Section 9-30.6(3)C.

<u>Meter (3/4" to 2"):</u> New water meters shall be Badger Meter with automatic meter reading (AMR) capabilities.

<u>Meter (3" to 8"):</u> New water meters shall be stainless steel Octave Ultrasonic with automatic meter reading AMR capabilities.

<u>Meter Setter:</u> New 12" height meter setter shall have inlet key valve and outlet single check valve, Ford type VH70 series for 1" service and 2" service.

<u>Meter Check Valve</u>: New meter check valve shall be Ford type HA34 for 1" service, and Ford HFA31 for 2" service.

<u>Meter Boxes</u>: New meter boxes shall be Carson HDPE 1220 with L Bolt (for $\frac{3}{4}$ " and 1" meters) and MSBCF-1730-18 (for 1 $\frac{1}{2}$ " and 2" meters), ductile iron cover (for vehicular traffic areas) and heavy duty plastic covers (for non-vehicular areas) with reader doors. Meter box extensions shall be used as necessary.

<u>Meter Vault (3" to 8" meters)</u>: New precast cement concrete vault shall be Oldcastle Precast or H2 Precast meeting inside dimension tolerances specified on Details and shall have diamond plate spring assisted cover with locking latch inside (332P for 3", 2-322P for 4" to 6", and 3-322P for 8" to 12", or H2 Precast equivalent). Contractor/Developer shall provide to the City any factory tools, keys, or wrenches required to open vault lid.

<u>Pipe Bedding and Backfill</u>: Pipe bedding and select backfill shall be utilized for trench backfill as directed by the City in accordance with Section 7-08.2 of the Special Provisions.

<u>Backflow Preventer (Double Check Valve)</u>: New backflow preventer shall be Zurn 950XL, Zurn 975XL, Watts 007 or approved equal, and shall be provided and installed by the Contractor/Developer for all irrigation system connections to domestic water mains.

7-15.3 Construction Requirements

Supplement this section with the following:

The Contractor shall set the water meter box to the finished grade of the area, typically flush with the top back of sidewalk. The Contractor will be required to reset the meter box if it is not at finished grade at the completion of the project. The completed water service shall be tested at system operating pressure by the Contractor and must show no signs of leakage.

No joints are allowed between the corporation stop and the meter stop.

8-03 IRRIGATION SYSTEMS

Supplement this section with the City of Zillah Irrigation Standards.

8-03.2 Materials

Supplement this section with the following:

Pipe for main line approved for use shall be as follows:

Pipe for Main Line:

All new irrigation mains under roadways shall meet the requirements of Section 9-30.1(5)A (AWWA C900 or C905), and be purple in color. Irrigation mains outside of the roadway limits shall meet the requirements of Section 9-05.12 (PVC solid wall ASTM D3034 SDR 35) for <u>gravity systems</u> and Section 9-15.1(2) (ASTM D2241, 200 psi, SDR 21) for <u>pressurized systems</u>. Fittings shall be cast or ductile iron. Pipe zone bedding and backfill shall be installed per Section 7-08.2.

CHAPTER 5 - SANITARY SEWER SYSTEM IMPROVEMENTS

GENERAL REQUIREMENTS FOR SANITARY SEWER SYSTEM IMPROVEMENTS

All extensions and additions to the City's sanitary sewer system shall conform to the Design and Construction Standards of the City of Zillah, the Washington State Department of Ecology, and designed by a Civil Engineer currently licensed by the State of Washington.

All sanitary sewer improvements shall be designed in accordance with the Washington state Department of Ecology's Criteria for Sewage Works Design (Orange Book).

All new lots and developments shall be served by a public sanitary sewer line adjacent to the lot or development site.

Sewer lines shall be extended by the Developer to the point where the adjoining property owner's responsibility for further extension begins. This typically requires an extension across the entire frontage of the property to the property line of the adjoining owner. In some cases, it will require dedication of an easement and a line extension across the property or extension across two or more sides of the developing property. Extensions will be consistent with and implement the City's adopted General Sewer Plan, including alignments, sizes, and depths necessary to serve future areas within the Urban Growth Area (UGA) boundary.

Sewer lines shall be located in streets to serve abutting properties. Lines located in streets will be offset from the street centerline and not located within a vehicle wheel path. When necessary, sewer lines may be located within public easements, see CHAPTER 1, Section 11. Sewer lines located in easements shall typically be located in the center of the easement, but may, with the approval of the Public Works Director, be offset to accommodate the installation of other utilities or to satisfy special circumstances.

The minimum size for public sewer lines is eight (8) inches in diameter. The developer's sewer system must provide capacity for the proposed development, but must also provide capacity for future extensions consistent with the General Sewer Plan.

Sewer lines shall be terminated with a manhole. In special circumstances, a flush-end (cleanout) may be installed on the end of a sewer main extension, provided the end is no further than 150 feet from the last manhole and the sewer main line and grade will permit further extension.

Manholes shall be installed at intervals of no greater than 350 feet and at all vertical and horizontal angle points in the sewer main. Curved or deflected pipelines will not be permitted.

All new sewer line installations shall be satisfactorily tested and inspected per Section 7-17 prior to being placed into service including low pressure air and deflection testing, and television inspection, all at the expense of the Developer.

Each building containing sanitary sewer facilities shall be served by a separate private side sewer line. Branched side sewers serving multiple buildings and properties shall not be permitted. A single side sewer serving multi-unit buildings is permitted.

Sewer services to residential single-family lots shall be 4-inch diameter, and commercial properties shall be a minimum of 6-inch diameter.

Side sewers shall be installed in accordance with these Construction Standards and as shown on the City Standard Details. Water service and side sewer lines shall not be laid in the same trench, G:\PROJECTS\2020\20045E\2020 Zillah Construction Standards.docx Page 5-1

except if approved materials (those listed in Section 7-17.2 of the *Standard Specifications for Road, Bridge, and Municipal Construction*) are used and the following requirements are met:

- 1. The bottom of the water pipe shall not be less than 12 inches above the top of the sewer or drain line.
- 2. The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a clear horizontal distance of not less than 12 inches from the sewer or drain line.

Side sewer stubs shall extend beyond the right-of-way as shown on the standard detail and the pipe end shall be capped and marked for future connection. Services shall be located a minimum of 10-feet from water services and on the low side of the lot.

Sewer lines shall be designed for gravity flow operation and in accordance with the General Sewer Plan.

Sewer force mains may be necessary in specific City locations as determined by the City Engineer. Lift stations and force mains shall be limited to those locations and circumstances where they are consistent with the General Sewer Plan and are the only viable solution to serve the proposed development and other properties in the vicinity. Lift stations and force mains shall be designed by a Professional Civil Engineer licensed in the State of Washington in accordance with the direction and requirements given by the City Engineer, for review and approval by the Public Works Director and City Engineer. Hydraulic analysis including modeling shall be performed by the Developer's Civil Engineer as determined necessary by the City Engineer.

Grinder pump stations for individual properties shall contain a semi-positive displacement grinder pump controlled by sump levels. The basis of design for the Zillah Lakes low pressure sewer system is the Model 2010 grinder pump station, as manufactured by the Environmental One (E/One) Corporation. Grinder pumps shall be installed per manufacturer's recommendations and electrical controls by a licensed electrician. Grinder pumps and sewer laterals will remain private up to the sewer main or force main, where City ownership begins.

The design of sewer lines and appurtenances is subject to review and approval by the Public Works Director and City Engineer. The Public Works Director may, at his discretion, adjust these Design and Construction Standards as necessary to facilitate installation of sewer lines and appurtenances for the health, safety, and protection of the general public.

SPECIAL PROVISIONS FOR SANITARY SEWER SYSTEM IMPROVEMENTS

The following sections of the WSDOT Standard Specifications have been amended or supplemented as described below and apply to the construction of public works sewer system improvements within the City of Zillah.

7-05 MANHOLES, INLETS, CATCH BASINS, AND DRYWELLS

7-05.2 Materials

Supplement this section with the following:

Sanitary sewer manholes shall be gasketed and constructed of 48-inch or larger diameter reinforced precast concrete manhole sections in conformance with the requirements of this Section. The base and first barrel section shall be precast monolithically with preformed channels.

A-Lok boot connectors or approved equal shall be provided for all inlets and outlets, and the channel diameter shall match the outlet pipe diameter.

Joints in the manhole sections shall be watertight complying with ASTM C443 (confined groove joint) or ASTM C990 (tongue and groove joint).

Manhole frames and covers shall be manufactured in the United States and be cast iron with a combined weight of not less than 400 pounds and have a clear opening of 24 inches. The frames and covers shall be the manufacturer's stock pattern capable of withstanding, with appropriate margin of safety, an H20 loading. Covers shall have a 1-inch hole only, unless otherwise noted, and the top shall be flat with a non-skid pattern and marked "SEWER." The contact surfaces of the frames and covers shall be machine finished to a common plane or have other adequate provision to prevent rocking.

7-05.3 Construction Requirements

Supplement this section with the following:

The design and construction of all manholes shall provide for a 0.10-foot vertical drop through the manhole.

7-05.3(1) Adjusting Manholes and Catch Basins to Grade

Delete and replace with the following:

Manholes, valve boxes, catch basins, and similar utility appurtenances and structures shall not be adjusted until the pavement is completed, at which time the center of each structure shall be relocated from references previously established by the Contractor. All existing manhole castings shall be replaced with new castings at time of adjustment.

The asphalt concrete pavement shall be cut and removed to a neat circle, the diameter as specified on the Standard Details. The frame shall be placed on cement concrete blocks or adjustment rings and brought up to the desired grade. The base materials shall be removed and Class 3000 cement concrete shall be placed to the depth specified on the Standard Detail.

On the following day, a tack coat of asphalt shall be applied to the concrete, the edges of the asphalt concrete pavement, and the outer edge of the casting. HMA CI. 3/8-Inch asphalt concrete shall then be placed and compacted with hand tampers and a patching roller.

The completed patch shall match the existing paved surface for texture, density, and uniformity of grade. The joint between the patch and the existing pavement shall then be sealed with emulsified asphalt and shall be immediately covered with dry paving sand before the tack has broken.

Utility appurtenances outside paved areas shall be adjusted to match the finish grade of the area surrounding the structure. The utility cover shall be cleaned of all concrete prior to acceptance.

7-05.3(2) Abandon Existing Manholes

Replace the entire section with the following:

Where shown on the Plans, existing sanitary sewer manholes shall be abandoned in place after the new sanitary sewer collection system is in place and all side sewers have been transferred to the new sanitary sewer pipeline.

At least the top 3 feet of each manhole, or the top conical section in precast concrete manholes, shall be removed, including the cast iron ring and cover and concrete pad, if any. Debris resulting from breaking of the upper portion of the manhole may be mixed with backfill subject to the approval of the Public Works Director. Ring and cover shall become the property of the City and all other surplus material shall be disposed of by the Contractor.

The existing pipe openings shall be plugged watertight with Class 3000 concrete and the manhole bottom slabs shall be broken to promote drainage. The remaining manhole structure shall be backfilled with granular material conforming to Section 9-03.9(3) Crushed Surfacing Base Course. Place backfill in uniform layers and compact to 95% maximum dry density, as determined by ASTM D 698 (Standard Proctor).

Excavations resulting from manhole abandonment shall be backfilled with suitable, jobexcavated material to top of subgrade. Compact to 95% maximum dry density as determined by ASTM D 698 (Standard Proctor). Restore surface to the condition existing prior to excavation with native material, gravel surfacing, or asphalt concrete pavement, as shown for trench repair on the Plans.

7-17 SANITARY SEWERS

7-17.1 Description

Supplement this section with the following:

The term "sewer(s)" and "sanitary sewer(s)" shall mean the same.

7-17.2 Materials

Pipe approved for use shall be as follows:

<u>PVC Sanitary Sewer Pipe (Gravity)</u>: Polyvinyl Chloride Pipe with flexible gasketed joints shall conform to the requirements of Section 9-05.12(1) of the Standard Specifications (ASTM D3034, DR 35 for pipe sizes up to 15 inches in diameter). When restrained pipe is required (inside casing), Certa-Lok or Ford 1300 mechanical pipe restraints shall be used.

PVC fittings for PVC sewer pipe such as tees, wyes, elbows, plugs, caps, etc., shall be flexible gasket joint fittings acceptable for use and connection to PVC sewer pipe.

<u>Transition Coupling</u>: Couplings shall be longitudinally bolted with gasketed joints. Approved manufacturers include Romac, Dresser, Rockwell, Ford, and Smith-Blair.

<u>Detectable Marker Tape</u>: Marker tape shall be a detectable type and shall be marked "SEWER," and shall conform to Section 9-15.18 of the Standard Specifications.

7-17.3 Construction Requirements

7-17.3(1) Protection of Existing Sewerage Facilities

Supplement this section with the following:

When connecting to an existing sewer, the downstream system shall be protected from construction debris by placing a 90 degree, SRECO, UEMSI or equal "stove pipe" sand trap, the same size as the sewer main line, in the first existing manhole downstream of the connection. It shall be the Contractor's responsibility to maintain this trap until the new system is placed in service and then to remove it. Any construction debris, excavation or backfill material which enters the existing downstream system shall be removed. When the first manhole is set, the outlet shall be plugged until the entire system is accepted by the Engineer.

7-17.3(2)A General

Delete the first paragraph and replace it with the following:

All sewer pipes and appurtenances shall be cleaned and tested after backfilling. Both infiltration (if applicable) and exfiltration testing of the gravity sewer pipeline will be required. Deflection testing of the pipeline may be required should video inspection review identify any irregularities or concerns at the discretion of the Public Works Director. All testing shall be witnessed by the City.

7-17.3(2)H Television Inspection

Delete the first paragraph and replace it with the following:

All new sewer lines shall be inspected by the Contractor by use of television (TV) camera before final acceptance.

TV inspection shall begin at the downstream manhole and end at the next upstream manhole. The camera speed shall not exceed one-half (1/2) foot per second. A pivot head camera shall be used with detailed inspection of all laterals showing the entire lateral with a 360-degree pan around the opening. Panning of each lateral shall be a minimum of 15 seconds.

All recordings shall show on the screen the correct time and date of the inspection, the name of the camera operator, the manhole numbers being inspected, an accurate footage count, and all lateral locations using a 12-hour clock position.

The television inspection shall be recorded on a DVD or comparable video file on a flash drive, and include logs and a verbal narrative indicating construction deficiencies, side sewer locations and other notable items. Each DVD/video file shall be permanently labeled with the Project Title, Contractor/Developer name, date of inspection, location and size of pipe, and video number. A written log shall also be provided for each segment of pipe that correlates to the respective video.

The Contractor shall submit one copy of the television inspection DVD or video file, and written logs to the City for review and approval within one week of completing the inspection.

7-18 SIDE SEWERS

7-18.2 Materials

Supplement this section with the following:

<u>Saddles</u>: Side sewer saddles shall be Romac CB with a 3-1/2" stainless steel single strap. Saddles are limited to side sewer connections on existing sewer mains and shall have prior approval by the Public Works Director. CDF encasement shall be installed around tapping saddle and existing sewer main, such that all exposed sections of the sewer main are bedded full depth with CDF to minimize settling.

<u>Tracer Wire</u>: Tracer wire shall be 12-gauge heavy insulated (60 mil) copper wire with UF insulation colored for the utility being installed in accordance with Section 9-15.18.

7-18.3 Construction Requirements

7-18.3(1) General

Supplement this section with the following:

Side sewers shall be constructed with a minimum of 30 inches of cover. This provision may be waived by the Public Works Director under special circumstances; however, under no circumstances shall the side sewer be laid with less than 18 inches of cover.

Side sewers shall be a minimum of four (4) inches in diameter. Larger sizes, if required, will be approved by the Public Works Director on a case-by-case basis.

7-25 SEWER FORCE MAINS (NEW SECTION)

The following new section shall be added to the Standard Specifications:

7-25.1 Description

This work shall consist of constructing sewer force mains in accordance with the Plans and Standard Specifications.

7-25.2 Materials

Materials shall meet the requirements of section 7-09 Water Mains of the Standard Specifications except as follows:

Pipe for Main Line:

<u>High Density Polyethylene Pipe (HDPE)</u> shall be extra high molecular weight, high density ethylene/hexane copolymer, PE 4710 polyethylene resin. The Standard Dimension Ratio (SDR) shall be SDR 13.5 for pipe sizes 12-inch diameter and smaller. Pipe material shall be provided in straight segments and no coiled pipe will be allowed. Pipe material shall be provided such that the pipe cross-section is uniformly round. No out-of-round pipe shall be used on the project.

The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties throughout.

Polyethylene fittings shall comply with all appropriate requirements of AWWA C901, AWWA C906, or CSA B137.1. Socket type fittings shall comply with ASTM D2683. Butt fusion fittings shall comply with ASTM D3261. Electrofusion fittings shall comply with ASTM F1055. Fabricated fittings shall be designed and manufactured to be as strong as or stronger than the pipe to which the fittings will be joined. Mechanical fittings shall be approved only after submission of appropriate test data and service histories indicating their acceptability for the intended service. In all cases, the specifications and requirements for the fittings supplied shall comply with the appropriate sections of AWWA C901, AWWA C906, or CSA B137.1.

Pipe stiffeners shall be used in conjunction with mechanical restrained fittings. Pipe stiffeners shall be designed to support the interior wall of the HDPE and maintain pipe cross-section shape. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed for 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE.

Detectable marker tape shall be a detectable type and shall be marked "SEWER," and shall conform to Section 9-15.18 of the Standard Specifications.

Fittings for Main Lines:

<u>Connection Couplings</u>: Couplings for Ductile Iron or PVC pipe, either transition or straight couplings, shall be compression type flexible couplings conforming to Section 9-30.2(7) of the Standard Specifications.

Hardware: All bolts, nuts, and washers shall be of stainless-steel material.

Aggregates:

See Section 7-08.3 of these Specifications.

7-25.3 Construction Requirements

7-25.3(2) Pipe Installation

Sewer force main installation shall conform to the requirements of Section 7-08 General Pipe Installation Requirements of the Standard Specifications or as modified by these Special Provisions.

All sewer force mains shall be tested under a hydrostatic pressure of 150 psi for a fifteen (15) minute period. The Developer shall make all provisions for transporting water and filling the force main and shall be responsible for all costs. No leakage will be allowed during the test.

7-25.3(6)B Joining HDPE Pipe

All fused joints shall be watertight and shall have a tensile strength equal to that of the pipe.

CHAPTER 6 - STORMWATER IMPROVEMENTS

GENERAL REQUIREMENTS FOR STORMWATER IMPROVEMENTS

All extensions and improvements to the City of Zillah's storm sewer (storm drain) system shall conform to the Design and Construction Standards of the City of Zillah and the Washington State Department of Ecology. Private systems, where required by applicable provisions of the Zillah Municipal Code, shall also comply with these requirements.

All storm drainage improvements shall be planned, designed, permitted, constructed and maintained in accordance with the requirements of the latest edition of the Washington Department of Ecology (Ecology) *Stormwater Management Manual for Eastern Washington* (SWMMEW).

All storm drainage facilities, public or private, shall be designed by a Civil Engineer currently licensed in the State of Washington. Complete stormwater runoff and drainage facilities sizing calculations shall be submitted to the Public Works Director and City Engineer for review and comment. Storm sewer facilities and pipelines shall be designed to meet a minimum 25-year storm criteria, and both the long-duration and short-duration storms shall be considered in the design.

All storm runoff occurring on all new lots and developments (private property) shall be retained and disposed of on-site. Storm runoff will not be permitted to enter public property or the public storm drainage system. The property owner shall maintain all stormwater Best Management Practices (BMPs) that are installed on private property.

Where existing stormwater from adjacent properties enters the proposed site, the Developer shall be responsible for including the additional stormwater in the proposed system including retention and treatment as applicable.

Storm runoff for new public streets shall be designed and constructed as required to the point where the adjoining property owner's responsibility for further extension begins. This typically requires an extension across the entire frontage of the property to the property line of the adjoining owner.

All storm sewer designs for new public streets shall be based upon an engineering analysis by the Developer's Consultant that considers total drainage areas, runoff rates, pipe and inlet capacities, treatment capacity, and any other factors pertinent to the design.

All subsurface infiltration facilities used for the treatment and disposal of stormwater shall meet the requirements of and be registered with the Ecology Underground Injection Control (UIC) program. Developer/Applicant must register UIC wells with Ecology in the applicant's name, 60 days prior to construction as required by Ecology. Following construction completion and at the time of public improvements acceptance, the developer/applicant shall process an ownership transfer request with Ecology, to transition UIC ownership of public improvements to the City of Zillah.

Inlet spacing shall be designed in accordance with the WSDOT Hydraulics Manual, Chapter 5. Generally, inlet spacing shall not exceed 300 feet. There shall be a manhole or Type 2 catch basin installed at the intersection of two collector storm sewers. A collector storm sewer is a sewer servicing more than one catch basin.

All public stormwater pipes or culverts shall be a minimum of 12 inches in diameter. Pipes shall have a minimum slope of 0.5% and be designed with a minimum velocity of 2-feet per second. Pipes shall be sized so that they do not surcharge under design storm conditions.

The applicant's project may require coverage under the Washington State General NPDES Permit for construction projects. The Developer shall be responsible for compliance with the State stormwater permit conditions and shall provide the City with a copy of the Ecology approved Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), or Erosivity Waiver Certification as applicable.

A temporary erosion and sedimentation control (TESC) plan shall be included with all plan submittals and should show how existing storm systems and adjacent properties will be protected from storm runoff.

All critical areas within the site limits shall be identified in the stormwater report and shown on the plans. Improvements impacting critical areas shall be noted and mitigation measures shall be presented for City review and approval consideration.

DESIGN CRITERIA

The SWMMEW allows different methodologies to apply design storms to stormwater facility design. For purposes of consistency, specific design storm amounts of precipitation are provided below and summarized in Table 6-1. Precipitation amounts are taken from the figures and calculation methods provided in the SWMMEW. Once the rainfall amount is known, hydrographic methods are used to determine the rate and volume of runoff from the selected design storm, and to mathematically route a storm through proposed facilities. Hydrographic methods are discussed below along with their application to different design conditions in Zillah.

DESIGN STORMS

Design storms are used to establish the amount of precipitation to be used in calculating the runoff from a parcel or basin. Based on rainfall records and methods outlined in the SWMMEW, the storm events described below are applicable to Zillah. Note that all 24-hour storm precipitation amounts have been adjusted by a factor of 1.0 for use in the long-duration storm for Eastern Washington Region 2.

Water Quality 3-Hour Storm – 0.26 inches of precipitation. This short-duration water quality storm event is intended to provide treatment for the "first flush" events and is representative of a summer thundershower. The "first flush" can be thought of as the first amount of water that enters the system during a storm, which typically contains the highest concentration of pollutants such as roadway grit, dust and oils.

Water Quality 24-Hour Storm – 0.53 inches of precipitation. This 24-hour water quality storm event is intended to provide treatment for the "first flush" events.

25-Year, 3-Hour Storm (Regional Short-Duration Storm) – 0.92 inches of precipitation. This shortduration storm has a 25-year return frequency, or a 4 percent chance of occurring in any one year. This unique storm is representative of the summer thunderstorm where a significant amount of rainfall occurs over a 3-hour period, and <u>should be used for design of flow-based stormwater</u> <u>BMPs</u>. 25-year, 72-Hour Storm (Regional Long-Duration Storm) – 1.6 inches of precipitation (uses 25year, 24-hour storm intensity). This long-duration storm has a 25-year return frequency, or a 4 percent chance of occurring in any one year. <u>Volume-based BMPs should be designed for this</u> <u>72-hour, long-duration storm</u>. The intensity of this storm is lower since the rainfall occurs more slowly over an extended time within the 72-hour period. Therefore, the runoff rate is lower, but the volume is greater than the 3-hour storm.

The 25-year design storm warranting the largest storm sewer facility size shall be the controlling storm.

TABLE 6-1 PRECIPITATION EVENT INFORMATION	
Storm Event	Precipitation (Inches)
6-Month, 3-Hour Storm Event	0.26
6-Month, 24-Hour Storm Event	0.53
2-Year, 24-Hour Storm Event	0.8
10-Year, 24-hour Storm Event	1.3
25-Year, 3-Hour Storm Event	0.92
25-Year, 24-Hour Storm Event	1.6
50-Year, 24-Hour Storm Event	1.8
100-Year, 24-Hour Storm Event	2.0
Source: Stormwater Management Manual for Eastern Washington, Ecology, Aug. 2019 Note: 24-hour precipitation amounts have been adjusted for use in the long-duration regional storm distribution	

HYDROLOGIC ANALYSIS

Hydrologic analysis determines the amount of runoff from a given storm for a given drainage area. Available methods range from simple calculations such as the Rational Method to complex computer models, requiring significant data input and knowledge of hydrologic effects.

The following hydrographic methods are considered acceptable for the watersheds within Zillah and its urban growth area.

- The Santa Barbara Urban Hydrograph (SBUH) method may be used for all analyses regardless of the size of the drainage area. Input parameters shall be as described by Ecology or WSDOT for the design storms described above. Other computer models may also be used with prior approval by the City.
- For drainage areas less than or equal to 20 acres, the rational formula and modified rational method, as described in older WSDOT and Soil Conservation Service publications, may be used for flow-rate-based applications. Inputs shall be as described in those publications, or other engineering texts. The SCS Unit Hydrograph Method may also be used.
- For drainage areas greater than 20 acres, and when it is necessary to route flows through detention facilities, the SCS Unit Hydrograph Method may be used. Inputs shall be as G:\PROJECTS\2020\20045E\2020 Zillah Construction Standards.docx Page 6-3
described in WSDOT and Soil Conservation Service publications, or other engineering texts.

The SBUH method uses a hyetograph to depict the intensity (amount) of rainfall versus time. A hyetograph may also be required for routing design storms through some BMPs. Design storm hyetographs applicable to Zillah stormwater facilities are as follows:

- Water Quality Volume-Based Treatment BMPs 24-hour SCS Type 1A storm with a 6month return frequency.
- Water Quality Flow-Rate-Based Treatment BMPs 3-hour short-duration storm with a 6month return frequency.
- Volume-Based BMPs 72-hour Regional Long-Duration Storm with a 25-year return frequency. Storm intensity is based on the 25-year, 24-hour storm event.
- Flow-Rate-Based BMPs 3-hour short-duration storm with a 25-year return frequency as described in the SWMMEW.
- Critical facilities required to carry 50- and 100-year storms 24-hour SCS Type II storm.

TREATMENT BMP SIZING

The City of Zillah is located in Ecology's Region 2 of Eastern Washington. Therefore, all calculations shall be based on Region 2 methods recommended in the Ecology's SWMMEW for the sizing of stormwater BMPs. The following are design guidelines for volume-based treatment BMPs and flow-rate-based treatment BMPs.

Volume-based treatment BMPs are sized the same whether they are located upstream or downstream of a detention facility. The volume of runoff predicted for the proposed developed condition of a site will be calculated using the 24-hour SCS Type 1A storm with a 6-month return frequency (the 0.53-inch water quality design storm). The BMP will be sized to treat this amount of water, and will also be sized to pass the 25-year short-duration storm, either through or around the BMP, without damaging the BMP or dislodging pollutants from within it.

Flow-rate-based treatment BMPs are sized differently depending on whether they are located upstream or downstream from a detention facility. If the BMP is located upstream of a detention facility, or if there is no detention facility, the runoff flow rate predicted for the proposed developed condition of a site will be calculated using the 3-hour short-duration storm with a 6-month return frequency (the 0.26-inch water quality design storm). See Chapter 7 of the SWMMEW for design parameters. If the BMP is located downstream of a detention facility, it must be sized for the full 2-year release rate of the detention facility.

FLOW CONTROL

The criteria listed below shall apply to control of stormwater runoff flow and the designated design storms shall apply:

 Flow-rate-based stormwater BMPs such as storm sewer facilities and pipelines shall be designed to carry at a minimum the 25-year, 3-hour short-duration design storm described in the SWMMEW (0.92 inches of precipitation). Depending on the size of the basin, time of concentration and infiltration rates, some infiltration facilities shall be designed using the 25-year, 24-hour storm (1.6 inches of precipitation, SCS Type 1A). The 25-year design storm warranting the largest storm sewer facility size shall be the controlling storm. At the City's discretion, if the facilities are critical to public health and safety, or significant property damage could occur, they shall be designed to successfully pass the 50-year or 100-year storm. Storm runoff from any new construction will not be permitted to enter the City's existing storm sewer pipelines.

 Volume-based stormwater BMPs such as retention and detention basins shall be designed based on the 25-year, 72-hour long-duration storm (1.6 inches of precipitation, Regional Long-Duration). A secondary outlet or emergency spillway shall be provided to pass the 100-year storm (2.0 inches of precipitation, SCS Type II) without damage to the facility.

SPECIAL PROVISIONS FOR STORM SEWERS AND DRAINAGE

The following sections of the WSDOT Standard Specifications have been amended or supplemented as described below and apply to the construction of public works storm sewer or drainage improvements within the City of Zillah.

7-02 CULVERTS

7-02.2 Materials

Add the following:

Culvert pipe approved for use on a City project shall be as follows:

<u>Aluminum Culvert Pipe:</u> Aluminum Culvert Pipe shall meet the requirements of Section 9-05.5 of the Standard Specifications.

<u>Steel Culvert Pipe:</u> Steel Culvert Pipe shall meet the requirements of Section 9-05.4 of the Standard Specifications.

<u>Corrugated Polyethylene Culvert Pipe:</u> Corrugated Polyethylene (CPE) pipe, couplings, and fittings shall meet the requirements of Section 9-05.19 of the Standard Specifications.

7-04 STORM SEWERS

7-04.1 Description

Supplement this section with the following:

The term "storm drain(s)" shall mean the same as storm sewer(s).

7-04.2 Materials

Supplement this section with the following:

The storm sewer (drain) pipe approved for use shall be as follows:

15-INCH THROUGH 36-INCH PIPE

<u>Aluminum Storm Sewer Pipe:</u> All Aluminum Storm Sewer pipe shall meet the requirements specified in Section 9-05.11 of the Standard Specifications and shall be 16 gauge with helical corrugations. A protective coating shall not be required. All corrugated metal pipe joints shall be flexible using rubber gasket joints. Gaskets shall be made of 3/8-inch thick by 12-inch minimum width closed cell synthetic sponge rubber, per ASTM D 1056, Grade SCE-43, fabricated in the form of a cylinder with a diameter of approximately 10 percent less than the nominal pipe size. The gasket shall be centered under the band and lapped an equal distance on the ends of the adjoining pipe sections. Coupling bands shall be used and shall conform to the provisions of Section 9-05.11(1) of the Standard Specifications. Coupling bands shall be made by the same manufacturer as the pipe and shall be made of the same base material as the pipe which it connects.

<u>Corrugated Polyethylene Storm Sewer Pipe:</u> Corrugated Polyethylene (CPE) pipe, couplings, and fittings shall meet the requirements of Section 9-05.20 of the Standard Specifications.

8/10/12-INCH STORM DRAIN PIPE

Solid Wall PVC Storm Sewer Pipe Corrugated Polyethylene Storm Sewer Pipe High-Density Polyethylene (HDPE) Pipe Polypropylene Storm Sewer Pipe

Where specified on the Plans, storm drain pipe shall be PVC pressure pipe conforming to the requirements of Section 9-30.1(5)A and Ductile Iron conforming to the requirements of Section 9-30.1(1).

UNDERDRAIN INFILTRATION SYSTEM MATERIALS

<u>Pipe</u>: Perforated Corrugated Polyethylene Underdrain pipe, couplings, and fittings shall comply with all the requirements of Section 9-05.2(8) of the Standard Specifications.

<u>Drain Rock</u>: Drain rock for use as backfill for the perforated underdrain pipe in the infiltration trench system shall be clean coarse aggregate conforming to the requirements of Gravel Backfill for Drywells, as specified in Section 9-03.12(5) of the Standard Specifications.

<u>Construction Geotextile:</u> Geotextile fabric for underground infiltration systems shall be moderate survivability, non-woven, Class A as specified in Section 9-33.2(1).

7-04.3(1) Cleaning and Testing

7-04.3(1)A General

Supplement this section with the following:

No infiltration or exfiltration test will be required for storm drain pipe.

7-05 MANHOLES, INLETS, CATCH BASINS, AND DRYWELLS

7-05.2 Materials

Section 7-05.2 of the Standard Specifications shall be revised as follows:

<u>Drain Rock</u>: Backfill for drywells shall be Gravel Backfill for Drywells as specified in Section 9-03.12(5) of the Standard Specifications.

<u>Manhole Metal Castings</u>: All cast iron frames and covers shall be as specified in Section 9-05.15(1) of the Standard Specifications and manufactured in the United States. All cast iron frames and covers to be used on this project shall be of the type, weight, and size approved by the City of Zillah, and shall be furnished by the Contractor. Covers for storm drain shall be stamped "STORM" or "DRAIN."

<u>Precast Concrete Catch Basin</u>: Catch basins shall be WSDOT Type 1, 1L, or 2 and constructed as shown on the City Standard Details.

<u>Catch Basin Metal Castings</u>: All frames and grates shall be capable of withstanding, with a reasonable margin of safety, a concentrated load of 20,000 pounds and shall be as specified in Section 9-05.15(2) of the Standard Specifications and WSDOT Standard Plan B-30.30-01 or B-30.40-01. The grate shall be ductile iron and "bicycle safe." The contact surfaces of the frame and grate shall be machine finished to a common plane and shall be so cast as to prevent rocking.

<u>Type 2 Catch Basin Frames and Covers</u>: Frames and covers shall be class 30 cast iron meeting the requirements of ASTM A48. 24" round covers shall read "STORM" embossed in top (2" raised letters), cover weight 150 lbs, frame weight 185 lbs. Approved manufacturers include East Jordan Iron Works, D&L Foundry, and Olympic Foundry.

<u>Precast Concrete Pretreatment Manhole</u>: Stormwater pretreatment manholes shall be approved by the Washington State Department of Ecology (Ecology) with a General Use Level Designation (GULD), capable of 50% removal of fine (50 micron mean size) and 80% removal of coarse (125 micron mean size) total suspended solids (TSS) for influent concentrations greater than 100 mg/L, but less than 200 mg/L, as required by Ecology.

Pretreatment manholes shall be constructed of pre-cast concrete manhole sections, flat top slab, and adjustment sections (similar to WSDOT Catch Basin Type 2, Standard Plan B-10.20-01), with cast iron covers as described above. The pretreatment insert shall be constructed of fiberglass and/or steel materials that are corrosion resistant. Manhole safety steps shall be provided as shown on the Plans and the pretreatment insert shall act as a platform for maintenance purposes.

The pretreatment manhole shall be capable of handling the specified water quality flows and shall incorporate a bypass within the unit to handle the specified peak flows. The pretreatment manhole shall be capable of incorporating multiple inlets/outlets, with the inlet and outlet pipes at 90 degrees to each other. Access to pretreatment insert ports and openings for maintenance shall be achieved through the cast iron cover(s).

7-05.3(1) Adjusting Manholes and Catch Basins to Grade

Delete and replace with the following:

Manholes, valve boxes, catch basins, and similar utility appurtenances and structures shall not be adjusted until the pavement is completed, at which time the center of each structure shall be relocated from references previously established by the Contractor.

The asphalt concrete pavement shall be cut and removed to a neat circle, the diameter as specified on the Standard Details. The frame shall be placed on cement concrete blocks or adjustment rings and brought up to the desired grade. The base materials shall be removed, and Class 3000 cement concrete shall be placed to the depth specified on the Standard Detail.

On the following day, a tack coat of asphalt shall be applied to the concrete, the edges of the asphalt concrete pavement, and the outer edge of the casting. HMA CI. 3/8-Inch asphalt concrete shall then be placed and compacted with hand tampers and a patching roller.

The completed patch shall match the existing paved surface for texture, density, and uniformity of grade. The joint between the patch and the existing pavement shall then be sealed with emulsified asphalt and shall be immediately covered with dry paving sand before the tack has broken.

Utility appurtenances outside paved areas shall be adjusted to match the finish grade of the area surrounding the structure. The utility cover shall be cleaned of all concrete prior to acceptance.

7-05.3(3) Connection to Existing Manholes

Supplement this section with the following:

The Contractor shall be required to core drill into the structure, shape the channel to accommodate the new pipe, and grout the opening.

CHAPTER 7 - STREET IMPROVEMENTS

GENERAL REQUIREMENTS FOR STREET IMPROVEMENTS

All new street design and construction must conform to these Design and Construction Standards of the City of Zillah, and the latest edition of the Manual on Uniform Traffic Control Devices, the Zillah Municipal Code, the International Fire Code (including Section 503.1), and the WSDOT Standard Specifications.

STREET REQUIREMENTS

Arterials and Major Collector streets serve as the high volume corridors that connect the major traffic generators and shall be designed to meet the minimum right-of-way and roadway dimensions as shown on the City Standard Details. Face of curb radius at intersection shall be a minimum of fifty (50) feet, or as approved by the Public Works Director and City Engineer. Both Arterial and Collector streets shall be designed for a WB-50 vehicle and HS-25 loadings.

Minor Collector streets shall be designed to meet the minimum right-of-way and roadway dimensions as shown on the City Standard Details. Face of curb radius at intersection shall be a minimum of thirty-five (35) feet, or as approved by the Public Works Director and City Engineer.

Local Access (Residential) streets shall be designed to meet the minimum right-of-way and roadway dimensions as shown on the City Standard Details. If on-street parking <u>is</u> desired by the Developer and required by the City, Local Access (Residential) streets shall be designed to meet the minimum right-of-way and roadway dimensions as shown on the on-street roadway City Standard Detail. Face of curb radius at intersection shall be a minimum of twenty-five (25) feet, or as approved by the Public Works Director and City Engineer.

Boulevard streets shall be designed to meet the minimum right-of-way and roadway dimensions as shown on the City Standard Details. Face of curb radius at intersection shall be a minimum of thirty-five (35) feet, or as approved by the Public Works Director and City Engineer.

The street centerline radius shall be designed to meet minimum standards for applicable design speeds as presented in the Policy on Geometric Design of Highways and Streets (Green Book) published by the American Association of State Highway and Transportation Officials, or as approved by the City Engineer.

The maximum length of a cul-de-sac street shall be 500 feet measured along the street centerline from the nearest street intersection to the throat of the cul-de-sac. Where it is not feasible to construct a cul-de-sac turnaround, the City may allow the use of an "L" or "Hammerhead" turnaround upon approval by the Public Works Director and City Engineer. The minimum cul-de-sac right-of-way is a radius of 60 feet and a curb radius of 50 feet.

A subdivision of 25 or more lots shall have two or more access points. Street intersection angles shall not be less than 80 degrees. Offset street intersections shall not be less than 200 feet for Collector streets and 100 feet for Local Access streets. A tangent at least 200 feet long shall be introduced between reverse curves on collectors and arterials, unless otherwise approved by the City of Zillah and City Engineer.

Street grades shall be kept to a maximum of six (6) percent for Major Collectors, eight (8) percent for Minor Collectors, and twelve (12) percent for Local Access streets. The minimum grade for all streets shall be five-tenths (0.5) percent. Vertical curves shall be designed when the grade difference is greater than two (2) percent. AASHTO requirements for sight-distance shall apply.

Cement concrete barrier curb and gutter and sidewalks shall be installed along both sides of all new streets unless otherwise approved by the City of Zillah and City Engineer. Cement concrete rolled curb is allowable for local access streets in subdivisions, except for the curb return and 20 feet beyond at an intersection radius where the curb shall be full height (barrier). There shall be a 10-foot long transition from the full height curb to the rolled curb.

Pedestrian ramps shall be designed to City Standard Details (WSDOT Standard Plans) and shall meet ADA requirements. Crosswalks between pedestrian ramps shall be designed meet ADA requirements with cross slopes less than 2%.

Driveways shall be located on the lowest classification of roadway abutting the development. Driveways accessing onto arterial streets are discouraged and shall be limited. Driveway widths and locations are limited to one per lot as approved by the Public Works Director. A "Corner" lot driveway shall be located as far as possible from the street intersection (50 feet minimum).

A street light shall be installed at each street intersection, at mid-block, no more than two hundred (200) feet apart, and at cul-de-sac ends. Street lights shall meet the design and placement requirements of these Design and Construction Standards. Power service placement shall be proposed for review and approval consideration by the Public Works Director, City Engineer, and local electric utility.

In all new developments, monuments with cover caps and cases shall be installed at the centerline of street intersections, angle point and points of curves, and at other locations as determined by the Public Works Director.

Traffic signs, posts, sleeves, pavement markings, and channelization devices shall be provided and installed by the developer in accordance with the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD) and City Design and Construction Standards. Center line markings shall be installed on all paved arterials and collectors, and any lower classified roadways having an ADT of 2,000 vehicles per day or greater, or as required by the Public Works Director and City Engineer.

Fencing, transformers, pedestals, and other above ground utilities shall not inhibit intersection sight triangles or access to any City utility.

The City Fire Chief may require an emergency vehicle access in addition to other access points. If required, the access shall be designed to meet the standards as approved by the Fire Chief.

TRAFFIC STUDIES

In order to provide sufficient information to assess a development's impact on the transportation system and level of service, the Public Works Director or City Engineer may require a traffic study to be completed by the Developer at the Developer's expense. This decision will be based upon the size of the proposed development, existing roadway condition, existing and expected traffic volumes, accident history, expressed community concern, and other factors relating to transportation. Typically, a traffic study is required when the development includes new trips totaling 90 ADT, and/or 45 parking stalls. Traffic studies shall be conducted under the direction of a Traffic Engineer or Civil Engineer licensed in the State of Washington and possessing special training and experience in traffic engineering. The level of detail and scope of the traffic study may vary with the size, complexity, and location of the proposed development. A traffic study shall, at a minimum, be a thorough review of the immediate and long-range effects of the proposed

development on the City's transportation system. At a minimum, a traffic study shall include the following:

- Description of development (location, current and proposed land use and zoning) AM, PM, and Daily trip generation
- Site plan review
 - Access locations
 - Bike/ped/vehicle circulation
 - Parking evaluation

Traffic study elements that could also be requested by the City include:

- Inventory of existing transportation network
 - Pedestrian, bicyclist, and vehicular
- Trip distribution
- Surrounding area land uses and zoning
- Existing Conditions (traffic counts collected within previous 12 months)
- No Build Conditions
 - Using background growth and background project trips
- Build Conditions
- Mitigation Conditions (if necessary)
 - o Off-site, such as proportionate share of infrastructure improvements
 - On-site, such as traffic management plan (TMP) or parking management plan (PMP)
- Safety analysis
 - Crash data for all study intersections from last 5 years
 - o Discussion on crash trends, if any
 - o Recommendations for safety improvements, if any

Guidelines for the traffic study shall be reviewed by the Public Works Director and City Engineer on a project basis. ADT and peak hour volumes for the development shall be estimated using the trip generators found in the latest edition of the Trip Generation Manual published by ITE.

SPECIAL PROVISIONS FOR STREET IMPROVEMENTS

The following sections of the Standard Specifications have been amended or supplemented as described below.

2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP

2-01.1 Description

Supplement this section with the following:

All work beyond the right-of-way line shall be coordinated with affected property owner(s) per Section 1-07.24 Rights of Way.

The Contractor shall temporarily remove and later replace to its original condition or relocate nearby as directed, all mail boxes, small trees, shrubs, street signs and posts, culverts, irrigation facilities, concrete or rock walls, or other similar obstructions which lie in or near the line of work and are not intended for removal. Should any damage be incurred, the cost of replacement or repair shall be borne by the Contractor.

2-01.3(5) Fencing (New Section)

Add the following new section:

The Contractor shall carefully remove existing fencing located within or near the proposed alignments. All fencing materials to be removed and replaced shall be temporarily placed on the adjacent properties or stored as directed by the City. The removal and replacement of all fencing shall be done at the Contractor's expense. Any fencing that is to be reset shall be relocated and reset by the Contractor along the property lines or as directed by the City.

2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

2-02.3 Construction Requirements

2-02.3(2) Removal of Bridges, Box Culverts, and Other Drainage Structures

Supplement this section with the following:

Where structures or installations of concrete, brick, blocks, etc., interfere with the construction, they shall be removed and any pipe openings shall be properly plugged watertight with Class 3000 concrete, or with mortar and masonry, blocks, or brick. The removal and plugging of pipes shall be considered as incidental to the construction.

Where the structures are removed, the voids shall be backfilled with suitable, jobexcavated material and compacted, and such work shall be considered as incidental to the removal work. If the City determines the job-excavated material to be unsuitable for backfill, the Contractor shall place ballast or crushed surfacing material as directed by the City.

2-02.3(3) Removal of Pavement, Sidewalks, Curbs, and Gutters

Supplement this section with the following:

Where shown on the Plans or as directed by the City, the Contractor shall be required to remove existing pavement, sidewalks, curbs, etc., which are outside the right-of-way line and are required to be removed for construction of the improvements.

In those areas where asphalt pavement removal is required, the Contractor shall, prior to excavation, score the edge of the asphalt concrete pavement with an approved pavement cutter such as a concrete saw. During the course of the work, the Contractor shall take precautions to preserve the integrity of this neat, clean pavement edge. Should the pavement edge be damaged prior to asphalt concrete paving activities, the Contractor shall be required to trim the edge with an approved pavement cutter as directed by the City immediately prior to paving.

2-03 ROADWAY EXCAVATION AND EMBANKMENT

2-03.1 Description

Supplement this section with the following:

Street excavation shall consist of removing the existing material of whatever nature encountered to the subgrade elevation and shaping the subgrade to conform to the cross-section shown on the Plans or as staked in the field.

Where directed by the Consultant, the Contractor shall excavate beyond the right-of-way in order to adequately slope adjacent properties.

The Contractor shall use caution while performing roadway excavation. Heavy, rubbertired equipment, particularly front end loaders, shall limit their travel over a single area as much as possible. Trucks shall observe a 10 mph speed limit when traveling over exposed subgrade areas.

The Contracting Agency will reference all known existing monuments or markers relating to subdivisions, plats, roads, street centerline intersections, etc. The Contractor shall take special care to protect these monuments or markers and also the reference points. In the event the Contractor is negligent in preserving such monuments and markers, the points will be reset by a licensed surveyor at the Contractor's expense.

2-03.3 Construction Requirements

2-03.3(3) Excavation Below Subgrade

Supplement this section with the following:

At the direction of the Consultant, areas within the street subgrade which exhibit instability due to high moisture content shall be:

- 1. Aerated and allowed to dry,
- 2. Over-excavated and backfilled with ballast, or crushed surfacing base course. The contractor may be instructed to install construction geotextile for soil stabilization in the excavation,
- 3. Or a combination of any of the above.

2-03.3(14)D Compaction and Moisture Control Tests

Delete this section and replace it with the following:

Compaction shall be 95% of maximum density as determined by ASTM D 698 (Standard Proctor). The Contractor shall notify the City when ready for in-place subgrade density tests. Placement of courses of aggregate shall not proceed until density requirements are met. The Developer/Contractor shall be responsible for scheduling and paying for all testing. All costs associated with failed tests/testing shall be the responsibility of the Contractor.

If any tests are failed, the Public Works Director will require additional testing to determine the extent of the failure and more frequent tests may be required on additional work.

2-07 WATERING

2-07.1 Description

Supplement this section with the following:

The Contractor shall be solely responsible for dust control on the Developer's project and shall protect motoring public, adjacent homes and businesses, orchards, crops, and school yards from damage due to dust, by whatever means necessary. The Contractor shall be responsible for any claims for damages and shall protect the City, Yakima County, and Consultant from any and all such claims.

When directed by the City, the Contractor shall provide water for dust control within two hours of such order and have equipment and manpower available at all times including weekends and holidays to respond to orders for dust control measures. Should the Contractor fail to comply within two hours, the City may utilize its own staff at the prevailing staff wage rate plus equipment rental charges, and/or contracted watering services. The Contractor will be responsible for reimbursement of all dust control costs including labor, equipment, water, and contractor costs. Subsequent building permits will not be processed until reimbursement is paid in total.

2-11 TRIMMING AND CLEANUP

2-11.3 Construction Requirements

Add the following to the first paragraph:

- 7. Restore all grass area affected by construction with sod and in accordance with the City of Zillah Construction Standards.
- 8. Restore all landscaping rock, mulch, and bark with the same materials as existed prior to construction.
- 9. Restore all shoulders, from edge of pavement to right of way line, with the same material as existed prior to construction, except that earth shoulders shall be restored with 2 inches of compacted crushed surfacing top course.
- 10. Restore the site and offsite areas damaged by the Work to their original condition or better and to the satisfaction of the Public Works Director and the adjoining homeowners.

4-04 BALLAST AND CRUSHED SURFACING

4-04.3 Construction Requirements

4-04.3(5) Shaping and Compaction

Supplement this section with the following:

The Contractor shall notify the City when he is ready for in-place ballast, base course, or top course density tests. Placement of successive courses of aggregate or asphalt concrete shall not proceed until density requirements are met. The Developer/Contractor

shall be responsible for scheduling and paying for all testing. All costs associated with failed tests/testing shall be the responsibility of the Contractor.

5-04 HOT MIX ASPHALT

(July 18, 2018 APWA GSP)

Delete Section 5-04 and amendments, Hot Mix Asphalt and replace it with the following:

5-04.1 Description

This Work shall consist of providing and placing one or more layers of plant-mixed hot mix asphalt (HMA) on a prepared foundation or base in accordance with these Specifications and the lines, grades, thicknesses, and typical cross-sections shown in the Plans. The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these Specifications. WMA processes include organic additives, chemical additives, and foaming.

HMA shall be composed of asphalt binder and mineral materials as may be required, mixed in the proportions specified to provide a homogeneous, stable, and workable mixture.

5-04.2 Materials

Materials shall meet the requirements of the following sections:

Asphalt Binder	9-02.1(4)
Cationic Emulsified Asphalt	9-02.1(6)
Anti-Stripping Additive	9-02.4
HMA Additive	9-02.5
Aggregates	9-03.8
Recycled Asphalt Pavement	9-03.8(3)B
Mineral Filler	9-03.8(5)
Recycled Material	9-03.21
Portland Cement	9-01
Sand	9-03.1(2)
(As noted in 5-04.3(5)C for crack	sealing)
Joint Sealant	9-04.2
Foam Backer Rod	9-04.2(3)A

The Contractor may choose to utilize recycled asphalt pavement (RAP) in the production of HMA. The RAP may be from pavements removed under the Contract, if any, or pavement material from an existing stockpile.

The Contractor may use up to 20 percent RAP by total weight of HMA with no additional sampling or testing of the RAP. The RAP shall be sampled and tested at a frequency of one sample for every 1,000 tons produced and not less than ten samples per project. The asphalt content and gradation test data shall be reported to the Contracting Agency when submitting the mix design for approval on the QPL. The Contractor shall include the RAP as part of the mix design as defined in these Specifications.

The grade of asphalt binder shall be PG 64S-28 or PG 64H-28. A combination of binders will not be acceptable. Blending of asphalt binder from different sources is not permitted.

The Contractor may only use warm mix asphalt (WMA) processes in the production of HMA with 20 percent or less RAP by total weight of HMA. The Contractor shall submit to the Engineer for approval the process that is proposed and how it will be used in the manufacture of HMA.

Production of aggregates shall comply with the requirements of Section 3-01. Class 1/2" is the standard as shown on the standard details, but Class 3/8" is an acceptable alternate.

Preparation of stockpile site, the stockpiling of aggregates, and the removal of aggregates from stockpiles shall comply with the requirements of Section 3-02.

5-04.2(1) How to Get an HMA Mix Design on the QPL

If the contractor wishes to submit a mix design for inclusion in the Qualified Products List (QPL), please follow the WSDOT process outlined in Standard Specification 5-04.2(1).

5-04.2(1)A Vacant

5-04.2(2) Mix Design – Obtaining Project Approval

No paving shall begin prior to the approval of the mix design by the Engineer.

Nonstatistical evaluation will be used for all HMA not designated as Commercial HMA in the contract documents.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, pre-level, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Project Engineer. Sampling and testing of HMA accepted by commercial evaluation will be at the option of the Project Engineer. The Proposal quantity of HMA that is accepted by commercial evaluation will be excluded from the quantities used in the determination of nonstatistical evaluation.

Nonstatistical Mix Design. Fifteen days prior to the first day of paving the contractor shall provide one of the following mix design verification certifications for Contracting Agency review;

- The WSDOT Mix Design Evaluation Report from the current WSDOT QPL, or one of the mix design verification certifications listed below.
- The proposed HMA mix design on WSDOT Form 350-042 with the seal and certification (stamp & signature) of a valid licensed Washington State Professional Engineer.
- The Mix Design Report for the proposed HMA mix design developed by a qualified City or County laboratory that is within one year of the approval date.

The mix design shall be performed by a lab accredited by a national authority such as Laboratory Accreditation Bureau, L-A-B for Construction Materials Testing, The Construction Materials Engineering Council (CMEC's) ISO 17025 or AASHTO Accreditation Program (AAP) and shall supply evidence of participation in the AASHTO: resource proficiency sample program.

Mix designs for HMA accepted by Nonstatistical evaluation shall:

• Have the aggregate structure and asphalt binder content determined in accordance with WSDOT Standard Operating Procedure 732 and meet the requirements of Sections 9-03.8(2), except that Hamburg testing for ruts and stripping are at the discretion of the Engineer, and 9-03.8(6).

• Have anti-strip requirements, if any, for the proposed mix design determined in accordance with AASHTO T 283 or T 324 or based on historic anti-strip and aggregate source compatibility from previous WSDOT lab testing.

At the discretion of the Engineer, agencies may accept verified mix designs older than 12 months from the original verification date with a certification from the Contractor that the materials and sources are the same as those shown on the original mix design.

Commercial Evaluation. Approval of a mix design for "Commercial Evaluation" will be based on a review of the Contractor's submittal of WSDOT Form 350-042 (For commercial mixes, AASHTO T 324 evaluation is not required) or a Mix Design from the current WSDOT QPL or from one of the processes allowed by this section. Testing of the HMA by the Contracting Agency for mix design approval is not required.

For Commercial HMA, the Contractor shall select a class of HMA and design level of Equivalent Single Axle Loads (ESAL's) appropriate for the required use.

5-04.2(2)B Using Warm Mix Asphalt Processes

The Contractor may elect to use additives that reduce the optimum mixing temperature or serve as a compaction aid for producing HMA. Additives include organic additives, chemical additives and foaming processes. The use of Additives is subject to the following:

- Do not use additives that reduce the mixing temperature more than allowed in Section 5-04.3(6) in the production of mixtures.
- Before using additives, obtain the Engineer's approval using WSDOT Form 350-076 to describe the proposed additive and process.

5-04.3 Construction Requirements

5-04.3(1) Weather Limitations

HMA shall not be placed on any traveled way beginning October 1st through March 31st of the following year without written approval from the Public Works Director and City Engineer.

Asphalt for prime coat shall not be applied when the ground temperature is lower than 50°F without written approval of the Public Works Director.

HMA shall not be placed on any wet surface, or when the average surface temperatures are less than those specified in the following table, or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures. Any exceptions to the above and following limitations will not be allowed without the written approval of the Public Works Director.

Compacted Thickness (Feet)	Wearing Course	Other Courses
Less than 0.10	55°F	45°F
0.10 to .20	45°F	35°F
More than 0.20	35°F	35°F

Minimum Surface Temperature for Paving

- 1. If the weather criteria are met, the paving contractor shall complete the entire panel or lane with no transverse joints.
- 2. If meteorological conditions change after starting, construction shall be monitored by the Engineer and require their approval.
- 3. HMA shall not be placed on ground that is frozen.

The weather guide shall be the "National Weather Service" forecast for Zillah, WA at <u>https://www.weather.gov/wrh/</u>.

5-04.3(2) Paving Under Traffic

When the Roadway being paved is open to traffic, the requirements of this Section shall apply.

The Contractor shall keep intersections open to traffic at all times except when paving the intersection or paving across the intersection. During such time, and provided that there has been an advance warning to the public, the intersection may be closed for the minimum time required to place and compact the mixture. In hot weather, the Engineer may require the application of water to the pavement to accelerate the finish rolling of the pavement and to shorten the time required before reopening to traffic.

Before closing an intersection, advance warning signs shall be placed, and signs shall also be placed marking the detour or alternate route.

During paving operations, temporary pavement markings shall be maintained throughout the project. Temporary pavement markings shall be installed on the Roadway prior to opening to traffic. Temporary pavement markings shall be in accordance with Section 8-23.

5-04.3(3) Equipment

5-04.3(3)B Hauling Equipment

Trucks used for hauling HMA shall have tight, clean, smooth metal beds and shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from adverse weather. Whenever the weather conditions during the work shift include, or are forecast to include, precipitation or an air temperature less than 45°F or when time from loading to unloading exceeds 30 minutes, the cover shall be securely attached to protect the HMA.

The contractor shall provide an environmentally benign means to prevent the HMA mixture from adhering to the hauling equipment. Excess release agent shall be drained prior to filling hauling equipment with HMA. Petroleum derivatives or other coating material that contaminate or alter the characteristics of the HMA shall not be used. For live bed trucks, the conveyer shall be in operation during the process of applying the release agent.

Sufficient numbers of trucks shall be provided by the Contractor to assure a continuous paving operation at proper HMA mix temperatures. Paving operations shall not proceed until hauling equipment sufficient to assure continuous operations is provided.

5-04.3(3)C Pavers

HMA pavers shall be self-contained, power-propelled units, provided with an internally heated vibratory screed and shall be capable of spreading and finishing courses of HMA plant mix material in lane widths required by the paving section shown in the Plans.

The screed shall be operated in accordance with the manufacturer's recommendations and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture. A copy of the manufacturer's recommendations shall be provided upon request by the Contracting Agency. Extensions will be allowed provided they produce the same results, including ride, density, and surface texture as obtained by the primary screed. Extensions without augers and an internally heated vibratory screed shall not be used in the Traveled Way.

If the paving machine in use is not providing the required finish, the Engineer may suspend Work as allowed by Section 1-08.6. Any cleaning or solvent type liquids spilled on the pavement shall be thoroughly removed before paving proceeds.

5-04.3(3)E Rollers

Rollers shall be of the steel wheel, vibratory, oscillatory, or pneumatic tire type, in good condition and capable of reversing without backlash. Operation of the roller shall be in accordance with the manufacturer's recommendations. When ordered by the Engineer for any roller planned for use on the project, the Contractor shall provide a copy of the manufacturer's recommendation for the use of that roller for compaction of HMA. The number and weight of rollers shall be sufficient to compact the mixture in compliance with the requirements of Section 5-04.3(10). The use of equipment that results in crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of the surface, displacement of the mixture or other undesirable results shall not be used.

5-04.3(4) Preparation of Existing Paved Surfaces

When the surface of the existing pavement or old base is irregular, the Contractor shall bring it to a uniform grade and cross-section as shown on the Plans or approved by the Engineer.

Pre-leveling of uneven or broken surfaces over which HMA is to be placed may be accomplished by using an asphalt paver, a motor patrol grader, or by hand raking, as approved by the Engineer.

Compaction of pre-leveling HMA shall be to the satisfaction of the Engineer and may require the use of small steel wheel rollers, plate compactors, or pneumatic rollers to avoid bridging across pre-leveled areas by the compaction equipment. Equipment used for the compaction of pre-leveling HMA shall be approved by the Engineer.

Before construction of HMA on an existing paved surface, the entire surface of the pavement shall be clean. All fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement. All pavements or bituminous surfaces shall be thoroughly cleaned of dust, soil, pavement grindings, and other foreign matter. All holes and small depressions shall be filled with an appropriate class of HMA. The surface of the patched area shall be leveled and compacted thoroughly. Prior to the application of tack coat, or paving, the condition of the surface shall be approved by the Engineer.

A tack coat of asphalt shall be applied to all paved surfaces on which any course of HMA is to be placed or abutted; except that tack coat may be omitted from clean, newly paved surfaces at the discretion of the Engineer. Tack coat shall be uniformly applied to cover the existing pavement with a thin film of residual asphalt free of streaks and bare spots at a rate between 0.02 and 0.10 gallons per square yard of retained asphalt. The rate of application shall be approved by the Engineer. A heavy application of tack coat shall be limited to surfaces that will be paved during the same

working shift. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.

Equipment shall not operate on tacked surfaces until the tack has broken and cured. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the HMA.

The tack coat shall be CSS-1, or CSS-1h emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be diluted once with water at a rate not to exceed one part water to one part emulsified asphalt. The tack coat shall have sufficient temperature such that it may be applied uniformly at the specified rate of application and shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

Overlays and Utility Patches

Edges of asphalt and curb edge shall be tack coated.

Prior to paving utility trenches, the edges of the trenches shall be saw-cut parallel to the center of the street leaving long straight edges. Should any undermining occur on existing adjacent pavement, the contractor shall neatly cut the pavement 6 inches beyond the undermined area. The Public Works Director may waive all or a portion of the saw cutting requirement if the original street cut is straight and not damaged.

All utility patching and/or pre-leveling of damaged areas must be completed prior to overlay. A minimum depth of 2 inches is required for overlays.

5-04.3(4)B Soil Residual Herbicide

Where shown on the Plans, the Contractor shall apply one application of an approved soil residual herbicide on areas where hot mix asphalt is applied. The requirements of Section 8-02.3(3)B shall apply to this application. The application of herbicide shall precede paving by no more than 48 hours.

5-04.3(4)C Pavement Repair

The Contractor shall sawcut and excavate pavement repair areas and shall backfill these with HMA in accordance with the details shown in the Plans and as marked in the field. The Contractor shall conduct the excavation operations in a manner that will protect the pavement that is to remain. Pavement not designated to be removed that is damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer at no cost to the Contracting Agency. The Contractor shall excavate only within one lane at a time unless approved otherwise by the Engineer. The Contractor shall not excavate more area than can be completely finished during the same shift, unless approved by the Engineer.

Excavated materials will become the property of the Contractor and shall be disposed of in a Contractor-provided site off the Right of Way or used in accordance with Sections 2-02.3(3) or 9-03.21.

Asphalt for tack coat shall be required as specified in Section 5-04.3(4). A heavy application of tack coat shall be applied to all surfaces of existing pavement in the pavement repair area.

After the completion of trench and patch repairs, the Contractor shall seal all joints with CSS-1 and dry paving sand.

5-04.3(7) Spreading and Finishing

The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. HMA pavers complying with Section 5-04.3(3) shall be used to distribute the mixture. Unless otherwise directed by the Engineer, the nominal compacted depth of any layer of any course shall not exceed 0.30 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other equipment or by hand.

5-04.3(8) Aggregate Acceptance Prior to Incorporation in HMA

For HMA accepted by nonstatistical evaluation the aggregate properties of sand equivalent, uncompacted void content and fracture will be evaluated in accordance with Section 3-04. Sampling and testing of aggregates for HMA accepted by commercial evaluation will be at the option of the Engineer.

5-04.3(9) HMA Mixture Acceptance

Acceptance of HMA shall be as provided under nonstatistical, or commercial evaluation.

Nonstatistical evaluation will be used for the acceptance of HMA unless Commercial Evaluation is specified.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, pre-level, temporary pavement, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Engineer. Sampling and testing of HMA accepted by commercial evaluation will be at the option of the Engineer.

Commercial HMA can be used for patching utility or conduit trenches less than 24 inches in width.

5-04.3(9)C2 Mixture Nonstatistical Evaluation Sampling

Samples for acceptance testing shall be obtained by the Contractor when ordered by the Engineer. The Contractor shall sample the HMA mixture in the presence of the Engineer and in accordance with AASH-TO T 168. A minimum of three samples should be taken for each class of HMA placed on a project.

5-04.3(9)C3 Mixture Nonstatistical Evaluation – Acceptance Testing

Testing of HMA for compliance of V_a will at the option of the Contracting Agency. If tested, compliance of V_a will use WSDOT SOP 731.

Testing for compliance of asphalt binder content will be by WSDOT FOP for AASHTO T 308.

Testing for compliance of gradation will be by FOP for WAQTC T 27/T 11.

Testing costs shall be the responsibility of the Contractor.

5-04.3(10) HMA Compaction Acceptance

HMA mixture accepted by nonstatistical evaluation that is used in traffic lanes, including lanes for intersections, ramps, truck climbing, weaving, and speed change, and having a specified compacted course thickness greater than 0.10-foot, shall be compacted to a specified level of relative density. The specified level of relative density shall be a minimum of 91.0% of the reference maximum density as determined by WSDOT for AASHTO T 209. The reference maximum density shall be determined as the moving average of the most recent five determined by five nuclear gauge tests taken in accordance with WAQTC FOP TM8 and WSDOT SOPT 729 on the day the mix is placed (after completion of the finish rolling) at locations determined by the stratified random sampling procedure conforming to WSDOT Test Method 716 within each density lot.

Tests for the determination of the pavement density will be taken in accordance with the required procedures for measurement by a nuclear density gauge after completion of the finish rolling. The test procedures FOP for WAQTC TM 8 and WSDOT SOP T 729 will be used on the day the mix is placed and prior to opening to traffic.

Two (2) density tests shall be taken within the first one hundred (100) tons of asphalt delivered to the site each day and one (1) every 100 tons thereafter for the remainder of the day. If the asphalt fails any test, the Engineer will require additional testing to determine the extent of the failure and more frequent tests may be required on additional asphalt. Testing and samples shall be in accordance with Section 1-06.2(1).

In addition to randomly selected density test locations, the City may also isolate any area that is suspected of being defective in relative density and may require additional testing at the Contractor's expense.

HMA for pre-leveling shall be thoroughly compacted. HMA that is used for pre-leveling wheel rutting shall be compacted with a pneumatic tire roller unless otherwise approved by the Engineer.

Test Results

HMA testing shall be pre-arranged and oil content results reported within two (2) hours of sampling. Initial reports may be by phone, subsequent written documents shall be submitted to the City prior to the next day's paving shift.

5-04.3(10)A HMA Compaction – General Compaction Requirements

Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. Areas inaccessible to large compaction equipment shall be compacted by other mechanical means. Any HMA that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced with new hot mix that shall be immediately compacted to conform to the surrounding area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided the specified densities are attained. Unless the Engineer has approved otherwise, rollers shall only be operated in the static mode when the internal temperature of the mix is less than 175°F. Regardless of mix temperature, a roller shall not be operated in a mode that results in checking or cracking of the mat. Rollers shall only be operated in static mode on bridge decks.

5-04.3(11) Reject Work

5-04.3(11)A Reject Work General

Work that is defective or does not conform to requirements shall be rejected. The Contractor may propose, in writing, alternatives to removal and replacement of rejected material. Acceptability of such alternative proposals will be determined at the sole discretion of the Engineer. HMA that has been rejected is subject to the requirements in Section 1-06.2(2) and this specification, and the Contractor shall submit a corrective action proposal to the Engineer for approval.

5-04.3(11)B Rejection by Contractor

The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material. Any such new material will be sampled, tested, and evaluated for acceptance. Supplement this section with the following:

5-04.3(12) Joints

5-04.3(12)A1 Transverse Joints

The Contractor shall conduct operations such that the placing of the top or wearing course is a continuous operation or as close to continuous as possible. Unscheduled transverse joints will be allowed, and the roller may pass over the unprotected end of the freshly laid mixture only when the placement of the course must be discontinued for such a length of time that the mixture will cool below compaction temperature. When the Work is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

A temporary wedge of HMA constructed on a 20H:1V shall be constructed where a transverse joint as a result of paving or planing is open to traffic. The HMA in the temporary wedge shall be separated from the permanent HMA by strips of heavy wrapping paper or other methods approved by the Engineer. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The material that is cut away shall be wasted and new mix shall be laid against the cut. Rollers or tamping irons shall be used to seal the joint.

5-04.3(12)A2 Longitudinal Joints

The longitudinal joint in any one course shall be offset from the course immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the wearing course shall be located at a lane line or an edge line of the Traveled Way. A notched wedge joint shall be constructed along all longitudinal joints in the wearing surface of new HMA unless otherwise approved by the Engineer. The notched wedge joint shall have a vertical edge of not less than the maximum aggregate size or more than ½ of the compacted lift thickness and then taper down on a slope not steeper than 4H:1V. The sloped portion of the HMA notched wedge joint shall be uniformly compacted.

All joints shall be hand raked prior to rolling. The final joint shall be straight, level with the abutting edge, free of coarse material at the surface, and neat in appearance. The Contractor shall use panel widths that minimize longitudinal pavement joints.

5-04.3(13) Surface Smoothness

The completed surface of all courses shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface of the wearing course shall not vary more than $\frac{1}{8}$ inch from the lower edge of a 10-foot straightedge placed on the surface parallel to the centerline. The transverse slope of the completed surface of the wearing course shall vary not more than $\frac{1}{4}$ inch in 10 feet from the rate of transverse slope shown in the Plans.

When deviations in excess of the above tolerances are found that result from a high place in the HMA, the pavement surface shall be corrected by one of the following methods:

- 1. Removal of material from high places by grinding with an approved grinding machine, or
- 2. Removal and replacement of the wearing course of HMA, or
- 3. By other method approved by the Engineer.

Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

Where directed by the Public Works Director, the Contractor shall feather the HMA pavement in a manner to produce a smooth-riding connection to the existing pavement.

5-04.3(14) Planing (Milling) Bituminous Pavement

The planing plan must be approved by the Public Works Director and a pre-planing meeting must be held prior to the start of any planing. See Section 5-04.3(14)B2 for information on planing submittals.

Locations of existing surfacing to be planed are as shown in the Drawings.

Where planing an existing pavement is specified in the Contract, the Contractor must remove existing surfacing material and reshape the surface to remove irregularities. The finished product must be a prepared surface acceptable for receiving an HMA overlay.

Use the cold milling method for planing unless otherwise specified in the Contract. Do not use the planer on the final wearing course of new HMA.

Conduct planing operations in a manner that does not tear, break, burn, or otherwise damage the surface which is to remain. The finished planed surface must be slightly grooved or roughened and must be free from gouges, deep grooves, ridges, or other imperfections. The Contractor must repair any damage to the surface by the Contractor's planing equipment.

Repair or replace any metal castings and other surface improvements damaged by planing, as determined by the Engineer.

A tapered wedge cut must be made at transitions to adjoining pavement surfaces (meet lines) where butt joints are shown on the Drawings. Cut butt joints in a straight line with vertical faces 2 inches or more in height, producing a smooth transition to the existing adjoining pavement.

After planing is complete, planed surfaces must be swept, cleaned, and if required by the Contract, patched and preleveled.

The Public Works Director may direct additional planing depth.

All debris resulting from the planing operation shall become the property of the Contractor and be disposed of in accordance with Section 2-03.3(7)C.

5-04.3(14)A Pre-Planing Metal Detection Check

Before starting planing of pavements, and before any additional depth planing, the Contractor is encouraged to conduct a physical survey of existing pavement to be planed with equipment that can identify hidden metal objects.

Should such metal be identified, promptly notify the Engineer.

See Section 1-07.16(1) regarding the protection of survey monumentation that may be hidden in pavement.

The Contractor is solely responsible for any damage to equipment resulting from the Contractor's failure to conduct a pre-planing metal detection survey, or from the Contractor's failure to notify the Engineer of any hidden metal that is detected.

5-04.3(14)B Paving and Planing Under Traffic

5-04.3(14)B1 General

In addition, the requirements of Section 1-07.23 and the traffic controls required in Section 1-10, and unless the Engineer approves, the Contractor must comply with the following:

- 1. Intersections:
 - a. Keep intersections open to traffic at all times, except when paving or planing operations through an intersection requires closure. Such closure must be kept to the minimum time required to place and compact the HMA mixture, or plane as appropriate. For paving, schedule such closure to individual lanes or portions thereof that allows the traffic volumes and schedule of traffic volumes required in the approved traffic control plan. Schedule work so that adjacent intersections are not impacted at the same time and comply with the traffic control restrictions required by the Public Works Director. Each individual intersection closure or partial closure must be addressed in the traffic control plan, which must be submitted to and accepted by the City Council, see Section 1-10.2(2).
 - b. When planing or paving and related construction must occur in an intersection, consider scheduling and sequencing such work into quarters of the intersection, or half or more of an intersection with side street detours. Be prepared to sequence the work to individual lanes or portions thereof.
 - c. Should closure of the intersection in its entirety be necessary, keep such closure to the minimum time required to place and compact the HMA mixture, plane, remove asphalt, tack coat, and as needed.
 - d. Any work in an intersection requires advance warning in both signage and a number of Working Days advance notice as determined by the Public Works Director, to alert traffic and emergency services of the intersection closure or partial closure.
 - e. Allow new compacted HMA asphalt to cool to ambient temperature before any traffic is allowed on it. Traffic is not allowed on newly placed asphalt until approval has been obtained from the Public Works Director.
- 2. Temporary centerline marking, post-paving temporary marking, temporary stop bars, and maintaining temporary pavement marking must comply with Section 8-23.
- 3. Permanent pavement marking must comply with Section 8-22.

6-02 CONCRETE STRUCTURES

6-02.3(14) Finishing Concrete Surfaces

Supplement this section with the following:

The completed surface shall be of uniform texture, smooth, uniform as to grade, and free from defects of all kinds. The completed surface shall not vary more than 1/8-inch from the lower edge of a 10-foot straightedge placed on the surface parallel to the centerline.

The finish shall be a light broom finish, or as noted in the City of Zillah Standard Plans, or as approved by the Public Works Director. A non-uniform finish, an overworked finish, a finish where a cement layer has formed, discolored, is spalling, or a finish damaged by the weather, will not be accepted, and shall be replaced at the Contractor's expense.

8-04 CURBS, GUTTERS, AND SPILLWAYS

8-04.3 Construction Requirements

Supplement this section with the following:

Testing requirements shall be as follows:

Project Quantity	Test Requirement
Less than 5 CY	None
5 CY – 10 CY	1 Slump, 4 Cylinders
10+ CY	2 Slump, 4 Cylinders per 25 CY

For project quantities above five (5) cubic yards, test requirements shall be based on concrete placed during one (1) working day. If the concrete fails any test, the Public Works Director will require additional testing to determine the extent of the failure and more frequent tests may be required on additional concrete being placed. Testing and samples shall be in accordance with Section 1-06.2(1).

Regardless of quantity, a Certification of Compliance shall be provided for all concrete delivered to the site in accordance with Section 6-02.3(5)B.

8-04.3(1) Cement Concrete Curbs, Gutters, and Spillways

Supplement this section with the following:

Cement concrete traffic curb and gutter shall be as shown on the City's Standard Plans. Full Height or "Barrier" cement concrete traffic curb and gutter as shown shall be used on the roadway as shown on the Plans. Depressed or "Driveway" cement concrete traffic curb and gutter as shown shall be used at all driveway entrances and sidewalk ramp locations as shown on the Plans and as directed in the field by the City. Mountable or "Rolled" curb may be used on the Local Access roadway as shown on the Plans. Cement concrete curb and gutter which does not comply with the City's details shall be removed and replaced at the Contractor's expense.

A template shall be required to be placed at the back of curb for construction of driveway transitions from Barrier to Driveway or Rolled curb and gutter. The template shall extend

from the bottom of curb to the top of the curb and shall have a minimum length to provide a maximum slope of 8.3%. The transition shall be no less than six (6) feet long. When the transition is on a street with a steep grade making the 8.3% maximum slope unachievable, the transition length shall be 15 feet. The Contractor shall also be required to use a template at the back of Driveway/Depressed curb and gutter to ensure a straight and uniform back of curb in conformance with the Standard Plan.

The new concrete curb and gutter shall be cured in accordance with Section 5-05.3(13)A of the Standard Specifications. Application of the curing compound shall be in accordance with the manufacturer's recommendations.

First-class workmanship and finish will be required on all portions of concrete curb and gutter work. Quality of workmanship and finish will be evaluated continuously and will be based solely upon the judgment of the City. The Contractor shall be required to construct a minimum 20 linear foot section of curb and gutter which demonstrates quality which is acceptable by the City. This "model" section will be referenced during construction for comparison to newly poured curb. If at any time it is found that quality is unacceptable, work shall be immediately stopped, and no additional curb and gutter shall be placed. Cement concrete curb and gutter which does not comply with the section details on the Plans, or in the City's opinion does not demonstrate first-class workmanship and finish, shall be removed and replaced at the Contractor's expense. Should the Contractor's equipment or methods be unable to produce curb and gutter meeting the requirements of the Details and Specifications, no further curb and gutter construction will be allowed until corrections have been made to said equipment or methods.

8-06 CEMENT CONCRETE DRIVEWAY ENTRANCES

8-06.3 Construction Requirements

Supplement this section with the following:

The concrete driveway entrance/sidewalk shall be six (6) inches in thickness. Both the curb and gutter as well as the sidewalk portion must comply the requirement of 8-04.3(1). Class 4000 air entrained concrete conforming to the Section 6-02 shall be required.

8-14 CEMENT CONCRETE SIDEWALKS

8-14.3 Construction Requirements

Supplement this section with the following:

Testing requirements shall be as follows:

Project Quantity	Test Requirement
Less than 5 CY	None
5 CY – 10 CY	1 Slump, 4 Cylinders
10+ CY	2 Slump, 4 Cylinders per 25 CY

For project quantities above five (5) cubic yards, test requirements shall be based on concrete placed during one (1) working day. If the concrete fails any test, the Public Works Director will require additional testing to determine the extent of the failure and more frequent tests may be required on additional concrete being placed. Testing and samples shall be in accordance with Section 1-06.2(1).

Regardless of quantity, a Certification of Compliance shall be provided for all concrete delivered to the site in accordance with Section 6-02.3(5)B.

8-14.3(3) Placing and Finishing Concrete

Supplement this section with the following:

All sidewalks not located in driveway entrance areas shall be four (4) inches in thickness. All concrete approaches located behind a depressed curb and gutter section or at any driveway location shall be six (6) inches in thickness.

Sidewalks shall be marked across the entire width every five (5) feet and with preformed asphalt impregnated joint fillers 3/8-inch thick every twenty (20) feet. See WSDOT Standard Plans F-40 for joints at pedestrian ramps. All work shall be perpendicular to the curb and straight. Joint material shall be set flush or trimmed flush with the finished concrete surface.

Concrete sidewalk shall be cured in accordance with Section 5-05.3(13)A of the Standard Specifications. Application of the curing compound shall be in accordance with the manufacturer's recommendations. Failure to properly secure or seal the cement concrete sidewalk will require the Contractor to remove and replace the sidewalk section at his expense.

Sidewalk ramps shall be constructed as shown on the Plans in accordance with the Standard Plans or as shown otherwise in the Details.

First-class workmanship and finish will be required on all portions of cement concrete sidewalk work. Quality of workmanship and finish will be evaluated continuously and will be based solely upon the judgment of the City. If at any time it is found that quality is unacceptable, work shall be immediately stopped, and no additional sidewalk shall be placed. Cement concrete sidewalk which does not comply with the section details on the Plans, or in the City's opinion does not demonstrate first-class workmanship and finish, shall be removed and replaced at the Contractor's expense. Should the Contractor's equipment or methods be unable to produce sidewalk meeting the requirements of the Plans and Specifications, no further sidewalk construction will be allowed until corrections have been made to said equipment or methods.

8-20 ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

8-20.2 Materials

Supplement this section with the following:

The provisions of Section 9-29 shall apply, except for the following modifications or additions:

<u>Conduit</u>: Below grade conduit shall be Schedule 40 PVC, conforming to NEMA TC 2. Rigid Steel Conduit and Fittings shall be used for all bends, entrances, and exits of pull boxes and where required by code. Conduit bends shall have no less than 12-Inch radius. "Push-Penny" plugs shall be used at all terminations to keep conduits clean. A 1/8-Inch braided nylon rope, 450 pounds minimum breaking strength, shall be installed in each conduit run with two (2) feet doubled back at each termination. When the conductors are pulled, a rope shall be re-pulled with the conductor and left for future use. Pull rope shall be installed in all spare conduits.

<u>Light Standards</u>: Poles shall be round powder coated with tapered arms. Light standards shall be aligned vertically on their foundations. All standards shall be grounded through the use of a 3/4-inch x 10-foot copper weld ground rod connected to the standard by means of a #8 bare copper wire fastened to the standard with a grounding stud provided by the standard manufacturer.

Light standards shall be designed to a minimum of AASHTO 90 MPH wind velocity. The lighting standard shall be as manufactured by Philips Lumec, SAM8V-23-FS2, DR8-1A-BKTX (1 fixture), DR8-2A-BKTX (2 fixture), or by Sternberg, DA8-17" split base-23.5' ARTS7-4-BK (1 fixture and 2 fixture), or pre-approved equal.

Street lighting standards shall be equipped as follows:

- 4.5"x10" handhole with removable cover turned toward the street
- Removable pole cap
- Weather-resistant arm attachment
- Grounding lug
- Pole base fusing

All poles, arms and accessories shall be furnished by the same manufacturer. Accessories shall include anchor bolts (each with heavy hex nuts and washers) as sized by the manufacturer, bolt templates, full base covers, and removable pole end caps. On arterials and collectors, two (2) clamp-on adjustable banner arms by the pole manufacturer shall be furnished and installed for each pole. When banner arms are included, a GFCI duplex receptacle with painted weatherproof cover matching the pole shall also be installed for each pole.

Luminaires: Luminaires shall be as manufactured by Philips Lumec, RN20-ACDR-LE2R-SMA, 90W80LED4K, DR8-1A (1 fixture), DR8-2A (2 fixture), BKTX or by Sternberg 1A-1914LED-1L 40 T2-MDL16-A-HSHS (1 fixture), 2A-1914LED-1L 40 T2-MDL16-A-HSHS (2 fixture), or pre-approved equal. All fixtures shall be 240V.

<u>Service Cabinets</u>: A 240V single phase, 200 AMP, pad-mounted service cabinet type EUSERC 308 with photocell in window, as approved by Pacific Power.

The Developer may submit alternative decorative illumination materials for consideration by the City of Zillah. Specifications shall be provided to the Public Works Director and City Engineer for review and approval consideration.

8-20.3 Construction Requirements

8-20.3(1) General

Supplement this section with the following:

Prior to installation, the Contractor shall inform the City when the luminaire equipment has arrived on-site. The City will compare the supplied luminaire equipment to these Design

and Construction Standards prior to installation and must be present during installation to check for socket settings and luminaire head orientation.

The Contractor is responsible for coordinating with the Department of Labor and Industries, the Engineer, and Pacific Power for all required inspections and service.

8-20.3(2) Excavating and Backfill

Delete the first paragraph and replace it with the following:

The excavation required for the installation of conduit, cement concrete anchor bases, and pullboxes shall be performed in such a manner as to cause the least possible injury to streets, sidewalks, and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of the conduit and pullboxes. Anchor base excavation shall be augered or dug by hand with proper care to avoid damage to other utilities. Excavation shall not be performed until immediately prior to installation of conduit and/or structures. The material from the excavation shall be placed so as to cause the least interference to vehicular and pedestrian traffic and to surface drainage. All surplus excavated material shall be removed and disposed of by the Contractor. Backfilling shall be as shown on the Plans and shall conform to the provisions specified herein. Compaction of conduit trenches and structure backfill shall be accomplished by a method which will result in backfill compacted to at least 95 percent of maximum density.

8-20.3(4) Foundations

Supplement this section with the following:

The top six inches (anchor base) of the concrete foundation shall be formed and finished 24-inches square with 3/4-Inch chamfer edges, and the top shall be at finish sidewalk grade. The anchor base shall be separated from adjacent concrete surfaces by means of expansion joints. Forms for the anchor bases shall be true to line and grade and the conduit ends and anchor bolts shall be held in proper position and height by means of a temporary template. After standards are plumbed, the Contractor shall grout between the base plate and anchor base as shown on the Plans.

Precast bases meeting contract requirements are acceptable for use. If the Contractor elects to use precast bases, the Contractor shall furnish, install, and compact six (6) inches of crushed surfacing top course below the base, and backfill/compact around the sides with clean native material or crushed surfacing as directed. The precast base top shall be set six inches below finish sidewalk grade and a six-inch depth concrete pad with 3/4-inch chamfer edges shall be formed and finished at the ground surface as shown on the Plans. The concrete pad shall be separated from adjacent concrete surfaces my means of expansion joints. All requirements pertaining to use of precast bases shall be considered as incidental work to the various bid items and no separate payment will be made.

8-20.3(5) Conduit

Supplement this section with the following:

The ends of conduits for future connection shall be marked with an 8' treated 2x4 inside of an 8' steel stud, painted red, extending 24"-36" above finished ground surface.

8-20.3(6) Junction Boxes, Cable Vaults, and Pull boxes

Replace the first paragraph with the following:

The terms "pullbox" and "junction box" are considered interchangeable.

Pullboxes shall be constructed as shown on the Plans and in accordance with Standard Plan J-40.10-03 Type 1. The pullboxes shall be installed true to line and grade. The pullboxes shall be placed where shown on Plans and shall be separated from other concrete surfaces by an expansion joint.

8-20.3(10) Electrical Service

Supplement this section with the following:

A 120/240 V single phase electrical service shall be provided as determined by the City. The Contractor shall coordinate the final location of the service with the local electrical utility company and City. A State electrical permit will be required for the service. All wiring and equipment shall be in conformance with the appropriate electrical codes.

All of the work shall meet the requirements of Pacific Power and the National Electric Code. The Contractor shall provide conduits to the proposed service locations shown on the Plans and shall coordinate the location of the service(s) with Pacific Power.

8-20.3(13)A Light Standards

Supplement this section with the following:

Light standards shall have base flanges requiring four (4) anchor bolts for connection to foundation. Anchor bolt covers shall be provided on all light standards.

8-21 PERMANENT SIGNING

8-21.2 Materials

Supplement this section with the following:

Reflective background sheeting material shall be Type III for regulatory signs and Type I for all other signs.

Sign posts for permanent traffic control signing shall be 2"x2" 12-gauge perforated steel tubing. Socket sleeves for the sign post shall be 2-1/4"x 2-1/4"x30" 12-gauge perforated steel tubing.

8-21.3 Construction Requirements

Supplement this section with the following:

Socket sleeves for sign posts shall be set in 12" diameter x 18" deep base of class 3000 cement concrete at finish grade so that erected signs will be plumb with roadway/sidewalk. The Contractor shall correct any misaligned socket sleeves at his own expense.

8-22 PAVEMENT MARKING

8-22.1 Description

Supplement this section with the following:

This work includes temporary pavement markings as described in the Plans.

8-22.2 Materials

Supplement this section with the following:

All arrows, letters, symbols, stop lines, and crosswalks shall be Type B – Pre-formed Fused Thermoplastic (125 mil. thickness). Centerline(s), lane line(s), and parking markings shall be painted, two (2) coats.

8-22.3(3)E Installation

Supplement this section with the following:

All pavement lines over 50 feet long shall be applied using a truck mounted striping machine.

8-30 CONTROLLED DENSITY FILL (NEW SECTION)

The following new section shall be added to the Standard Specifications:

8-30.1 General

Controlled Density Fill (CDF) may be required for street crossings by the Public Works Director. It shall be a mixture of Portland Cement, fly ash, aggregate, water, and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing material which will result in a hardened, dense, non-settling fill.

8-30.2 Materials

Materials shall meet the requirements of the following Sections of the Standard Specifications:

Portland Cement	9-01 Type II
Fly Ash	Class F or C
Aggregates	9-03.1
Water	9-25
Admixtures	9-23.6

8-30.3 Construction Requirements

8-30.3(1) Construction Materials

The CDF shall be a mixture of Portland Cement, fly ash, aggregate, water, and admixtures which has been batched and mixed in accordance with Section 6-02.3 of the Standard Specifications.

The following table provides a guideline for proportioning the Controlled Density Fill for this project. The final mix provided by the Contractor shall result in a material which is excavatable by machine with a maximum unconfined compressive strength of 300 psi.

Water	50 gals per cubic yard
Cement	50 lbs per cubic yard
Fly Ash	250 lbs per cubic yard
Aggregate	3,200 lbs per cubic yard

The above table provides a guideline for the CDF mixture. The weights shown are only an estimate of the amount to be used per cubic yard of CDF. Actual amounts may vary from those shown as approved by the City or approved mix data from similar projects which provided proper strength, workability, consistency, and density.

8-30.3(7) Placing Controlled Density Fill

The floatable CDF shall be placed in the trench area where directed by the City and brought up uniformly to the top of the pipe zone backfill as shown on the Plans. In the cases where existing concrete slabs have been undermined by excavation, the Contractor shall ensure that the CDF is flowed completely under the slab.

Mixing and placing may be started if weather conditions are favorable, when the temperature is at least 34°F and rising. At the time of placement, CDF must have a temperature of at least 40°F. Mixing and placing shall stop when the temperature is 38°F and falling. Each filling stage shall be as continuous an operation as practicable. CDF shall not be placed on frozen ground.

The trench section to be filled with CDF shall be contained at either end of trench section by bulkhead or earth fill.

APPENDIX A

TRANSFER OF OWNERSHIP FORMS

TRANSFER OF OWNERSHIP OF PUBLIC WORKS IMPROVEMENTS

(Individual)

, the Developer or Owner(s), do(es) hereby transfer(s), deliver(s) and relinquish(es) to the City of Zillah, Washington, all right, title and interest in, and ownership of, the following described Public Works Improvement located at:_____

{ Water	{ Sewer	{ Stormwater	{ Streets	

The undersigned owner(s) agree(s) and understand(s) that this transfer of ownership of the above described Public Improvement to the City of Zillah is subject to the conditions of the third paragraph of **Section 1-05.12 Final Acceptance** of the latest edition of the Standard Specifications for Road, Bridge, and Municipal Construction, Washington State Department of Transportation modified as follows:

"Final acceptance shall not constitute acceptance of any unauthorized or defective work or material. The City shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or material or from recovering damages for any such work or material for a period of two (2) years."

This Transfer of Ownership shall be effective only upon the City's final approval and acceptance of the Constructed Improvements and the acceptance of the Project Record Drawings.

PROPERTY OWNER/DEVELOPER

DATE

ACCEPTED BY THE CITY OF ZILLAH

AUTHORIZED OFFICIAL

DATE

STATE OF WASHINGTON)	
Yakima County))	SS.

I certify that I know of and have satisfactory evidence that ______ and (is/are) the person(s) who personally appeared before me and that said person(s) acknowledged that (he/she/they) signed this instrument, and acknowledged it to be (his/her/their) free and voluntary act and for the uses and purposes mentioned in the instrument.

Dated: _____

Given under my hand and official seal the day and year last written.

Notary Public in and for the State of Washington residing at _____

My Commission expires _____

TRANSFER OF OWNERSHIP OF PUBLIC WORKS IMPROVEMENT

(Corporate)

, the Developer or Owner(s), do(es) hereby transfer(s), deliver(s) and relinquish(es) to the City of Zillah, Washington, all right, title and interest in, and ownership of, the following described Public Works Improvement located at:_____

{ Water	{ Sewer	{ Stormwater	{ Streets	

The undersigned owner(s) agree (s) and understand(s) that this transfer of ownership of the above described Public Improvement to the City of Zillah is subject to the conditions of the third paragraph of **Section 1-05.12 Final Acceptance** of the latest edition of the Standard Specifications for Road, Bridge, and Municipal Construction, Washington State Department of Transportation modified as follows:

"Final acceptance shall not constitute acceptance of any unauthorized or defective work or material. The City shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or material or from recovering damages for any such work or material for a period of two (2) years."

This Transfer of Ownership shall be effective only upon the City's final approval and acceptance of the Constructed Improvements and the acceptance of the Project Record Drawings.

PROPERTY OWNER/DEVELOPER

DATE

ACCEPTED BY THE CITY OF ZILLAH

AUTHORIZED OFFICIAL

DATE

STATE OF WASHINGTON)) ss. Yakima County)

I certify that I know or have satisfactory evidence that ______ Is the person who appeared before me, and said person acknowledged that he signed this instrument, on oath stated that he was authorized to execute the instrument, and acknowledged it as the ______ of _____ a _____ to be the free voluntary act of such party for the uses and purposes mentioned in the instrument. Dated: ______

Given under my hand and official seal the day and year last written.

Notary Public in and for the State of Washington residing at _____

My Commission expires

APPENDIX B

STANDARD DETAILS
ZILLAH STANDARD DETAILS INDEX

- D-1 Catch Basin Type 1/1L
- D-2 Catch Basin Type 1/1L with Combination Inlet
- D-3 Infiltration System
- D-4 Oil/Water Separator
- E-1 Conduit Trench
- E-2 Conduit Entrance at Junction Box
- E-3 Street Light
- SS-1 Storm/Sewer Pipe Trench Section
- SS-2 Manhole Type 1
- SS-3 Manhole Safety Step
- SS-4 Drop Connection
- SS-5 Manhole Adjustment
- SS-6 Sanitary Sewer Cleanout
- SS-7 Side Sewer Connection
- SS-8 Shallow Manhole Type 3
- SS-9 Doghouse Manhole
- SS-10 Force Main Junction Manhole
- SS-11 Force Main Cleanout Manhole
- ST-1 Roadway Section Major Collector
- ST-2 Roadway Section Minor Collector
- ST-3 Roadway Section Local Access (Residential) No Parking Allowed
- ST-4 Roadway Section Local Access (Residential) On Street Parking Allowed
- ST-5 Roadway Section Boulevard
- ST-6 Concrete Curb and Gutter
- ST-7 Concrete Sidewalk Sections
- ST-8 Concrete Sidewalk Ramp
- ST-9 Sidewalk Jointing
- ST-10 Asphalt Sidewalk Ramp
- ST-11 Residential Driveway Approach
- ST-12 Commercial Driveway Approach
- ST-12A Commercial Driveway Approach Alternate
- ST-13 Trench Surfacing Repair
- ST-14 Monument
- ST-15 Cul-de-Sac Layout
- ST-16 Permanent Bollard
- ST-17 Corner Lot Vision Clearance
- W-1 Water Main Trench Section
- W-2 Fire Hydrant Assembly
- W-3 Water Valve Box
- W-4 Air Release / Vacuum Valve Assembly
- W-5 Blow-Off Assembly
- W-6 Concrete Thrust Blocking
- W-7 New Water Service (1" or Smaller)
- W-8 New Water Service $(1 \ 1/2" 2")$
- W-9 New Water Service $(3^{\circ} 8^{\circ})$
- W-10 Irrigation Backflow Preventer
- W-11 Hydrant Guard Posts and Concrete Pad
- W-12 Double Detector Check Valve Assembly



































KEY NOTES




































SAWCUT TRENCH EDGE AT ASPHALT LOCATIONS SEE TRENCH SURFACING REPAIR DETAIL FOR SURFACING REQUIREMENTS YNY) ** R 4'-0" FOR S DIRECTED DIRECTOR X EXCAVATION LIMITS NATIVE **ALTERNATE** MATERIAL BACKSLOPE AT SHALL BE NORKS D USED FOR CONTRACTOR'S OVER 24"I.[BACKFILL OPTION <u>1</u>8" 18" I.D **UNLESS** OTHERWISE MINIMUM PIPE (WATER MAIN (BY PUBLIC W UP TO DIRECTED 12" 24" 12" I.D DETECTABLE BY THE MARKING TAPE PER PUBLIC SECTION 9-15.18 WORKS DIRECTOR. STREET CROSSING TRENCHES 6" SHALL BE BACKFILLED FULL DEPTH WITH IMPORTED RRE SELECT BACKFILL, AS DIRECTED BY THE PUBLIC WATER WORKS DIRECTOR. MAIN COMPACTION 12 AWG UF SOLID COPPER ALL TRENCH BACKFILL WIRE W/ BLUE INSULATION. INCLUDING BEDDING MATERIAL Š SECURE WIRE TO TOP OF PIPE SHALL BE COMPACTED IN 4" WITH 2" WIDE x MIN 6" LONG ACCORDANCE WITH THE STRIPS OF DUCT TAPE AT 10 SPECIFICATIONS EXCEPT HAND TAMP ONLY DIRECTLY FT O.C. ONLY REQUIRED FOR OVER PIPE FOR 6 INCHES. NON-D.I. WATER MAIN. UNDISTURBED EARTH MECHANICAL COMPACTION IS REQUIRED UNLESS WATER LOCATING WIRE NOTES: 1. AT SPLICES, THE CONNECTING PIPE ZONE BEDDING SETTLING IS ALLOWED BY BEDDING MATERIAL SHALL THE SPECIFICATIONS. ENDS OF THE WIRES SHALL BE MEET THE REQUIREMENTS OF OVERLAPPED AND TIED. THE ENDS SECTION 9-03.9(3), CRUSHED SHALL BE STRIPPED AND SURFACING TOP COURSE. CONNECTED WITH A WIRE NUT. WATERPROOF CONNECTION WITH SILICONE SPLICE KIT. 2. ACCESS TO LOCATING WIRE NOTE: TERMINAL ENDS SHALL BE MADE CONTRACTOR SHALL COMPLY AT ALL VALVE BOXES AND FIRE WITH ALL APPLICABLE O.S.H.A. HYDRANTS, SECURE TO EXTERIOR AND W.I.S.H.A. SAFETY AND OF VALVE BOXES AND HYDRANTS HEALTH REGULATIONS. WITH STAINLESS STEEL PIPE STRAPS. WATER MAIN TRENCH SECTION NOT TO SCALE NOTE: ONLY THE LATEST DETAIL. AS APPROVED BY THE DIRECTOR OF ORIG. 8/20 PUBLIC WORKS, SHALL BE USED. AΗ Revision Date Description Appr

CITY OF ZILLAH-STANDARD DETAIL

WATER MAIN TRENCH SECTION

W-1

























HYDRAULIC ANALYSIS RESULTS



City of Zillah Existing Peak with Stadelman Point Load (50,000 gpd) Forcemain Report

Headloss	(ft)	3.727	16.686
Velocity	(ft/s)	3.402	3.402
Storm Flow	(mgd)	0	0
Infiltration	Flow (mgd)	0	0
Coverage	Flow (mgd)	0	0
Peakable	Flow (mgd)	0.006	0.02
Unpeakable	Flow (mgd)	0	0
Total Flow	(pgu)	0.025	0.069
	Length (ft)	467.78	2,093.99
Diameter	(in)	9	9
	To ID	31	22
	From ID	33	28
	Q	433	435

City of Zillah Existing Peak with Stadelman Point Load (50,000 gpd) Gravity Main Report

ů		Dian	neter	(#)	T	otal Flow	Peakable	Velocity	2/7	0/2	Water	Critical	Froude F	ull Flow B:	ackwater	Adjusted	Adjusted
F,	0 1 0 mo	1) (I)	in) Lé	ingth (ft)	Slope	(mgd)	Flow (mgd) Flow Type	(π/s)	a/D	9/U	Deptn (Tt) 1	Deptn (Tt)	Number	(mga) Ac	glustment	Deptn (Tt)	velocity (π/s)
	7 0		11	31/12 700 0C1	0.004	0./34	0.269 Free Surface	2.821	15.U 000 0	0.51/	0.51	0.449	0./83	T 742 No		12.0	178.7
7 0	γ,	7	71	128.027	0.112	0./34	0.269 Free Surface	109.6	0.208	CEU.U	802.0	0.449	4.433	7.743 NO		0.202	109.6
τ) <	4 ⊔	505	11	131.943	0.114	0./34	0.269 Free Surface	9.059 005 C	0.207	0.094	U.2U/	0.449	4.4/	ON TTR./		0.207	950.6 MCC C
t ru	n u	507	101	216 485	500.0	505 U	0.177 Free Surface	2.304	0.601	0.673	0.501	0.39	0.619	ON 727.0		0.501	2.304
9	2	9	10	454.235	0.003	0.5	0.175 Free Surface	2.3	0.592	0.658	0.493	0.388	0.633	0.76 No		0.493	2.3
7	00	7	10	326.3	0.003	0.496	0.174 Free Surface	2.358	0.576	0.631	0.48	0.387	0.661	0.786 No		0.48	2.358
00	6	8	10	320.345	0.003	0.492	0.173 Free Surface	2.276	0.59	0.654	0.491	0.385	0.628	0.753 No		0.491	2.276
6	10	6	10	63.296	0.032	0.453	0.157 Free Surface	5.419	0.287	0.179	0.239	0.369	2.307	2.524 Yes	S	0.315	3.706
D	11	10	10	70.177	0.03	0.452	0.157 Free Surface	5.314	0.291	0.184	0.242	0.368	2.245	2.456 No		0.242	5.314
1	12	11	10	341.948	0.003	0.377	0.128 Free Surface	2.169	0.495	0.492	0.412	0.335	0.672	0.768 No		0.412	2.169
12	13	12	10	308.562	0.003	0.37	0.126 Free Surface	2.156	0.489	0.482	0.408	0.332	0.673	0.767 No		0.408	2.156
13	14	13	10	265.327	0.003	0.361	0.122 Free Surface	2.064	0.497	0.496	0.414	0.328	0.638	0.729 No		0.414	2.064
14	15	14	10	357.904	0.003	0.355	0.12 Free Surface	2.099	0.484	0.473	0.403	0.325	0.66	0.75 No		0.403	2.099
15	16	15	10	427.411	0.003	0.351	0.119 Free Surface	2.098	0.48	0.467	0.4	0.323	0.663	0.752 No		0.4	2.098
16	17	16	10	402.545	0.003	0.341	0.115 Free Surface	2.061	0.476	0.46	0.397	0.318	0.655	0.742 No		0.397	2.061
17	18	17	10	365.878	0.003	0.319	0.106 Free Surface	2.025	0.458	0.429	0.381	0.307	0.659	0.742 No	-	0.381	2.025
18	19	18	10	356.948	0.003	0.253	0.082 Free Surface	1.923	0.4	0.336	0.333	0.272	0.679	0.752 No		0.333	1.923
19	20	19	10	300.778	0.003	0.253	0.082 Free Surface	1.886	0.405	0.345	0.338	0.272	0.66	0.732 No		0.338	1.886
20	21	20	10	296.064	0.003	0.081	0.023 Free Surface	1.375	0.224	0.11	0.186	0.152	0.669	0.738 Yes	s	0.212	1.145
21	22	21	10	212.183	0.031	0.069	0.02 Free Surface	3.101	0.114	0.028	0.095	0.14	2.141	2.504 No		0.095	3.101
22	23	24	00	296.287	0.004	0.053	0.015 Free Surface	1.441	0.221	0.107	0.147	0.13	0.789	0.498 No	-	0.147	1.441
23	24	26	00	339.292	0.004	0.069	0.019 Free Surface	1.563	0.25	0.137	0.167	0.149	0.801	0.503 Yes	S	0.171	1.514
24	26	20	∞	541.461	0.004	0.177	0.055 Free Surface	2.024	0.411	0.355	0.274	0.242	0.785	0.499 No		0.274	2.024
25	25	24	00	425.364	0.004	0.012	0.003 Free Surface	0.927	0.108	0.025	0.072	0.062	0.735	0.495 No		0.072	0.927
26	27 9	9014	80	383.033	0.004	0	0 Free Surface	0	0	0	0	0	0	0.506 Yes	s	0.667	0
27	29 9	9014	8	363.286	0.011	0.069	0.02 Free Surface	2.195	0.197	0.085	0.132	0.149	1.276	0.811 Ye	S	0.667	0.307
28	30	29	∞	293.983	0.01	0.053	0.014 Free Surface	1.965	0.176	0.068	0.117	0.13	1.213	0.778 No		0.117	1.965
29	31	30	∞	485.025	0.012	0.046	0.012 Free Surface	2.031	0.157	0.053	0.104	0.121	1.333	0.864 No	-	0.104	2.031
30	32	31	∞	63.505	0.005	0.019	0.005 Free Surface	1.118	0.128	0.035	0.085	0.077	0.814	0.538 Ye	S	0.667	0.084
31	34 9	0006	∞	87.398	0.005	0.025	0.006 Pressurized	1.202	0.148	0.047	0.098	0.089	0.813	0.53 Ye	S	0.667	0.111
32	35	34	80	371.162	0.004	0.016	0.004 Pressurized	1.005	0.122	0.032	0.082	0.071	0.749	0.498 Ye	S	0.667	0.07
33	36	35	∞	371.162	0.004	0.011	0.002 Free Surface	0.898	0.102	0.022	0.068	0.058	0.734	0.498 Ye	S	0.435	0.07
34	37	38	∞	236.618	0.004	0.028	0.007 Free Surface	1.166	0.163	0.058	0.109	0.094	0.748	0.483 No	•	0.109	1.166
35	38	39	00	148.794	0.004	0.03	0.008 Free Surface	1.212	0.166	0.06	0.111	0.097	0.771	0.497 No	•	0.111	1.212
36	39	40	80	442.009	0.006	0.037	0.01 Free Surface	1.451	0.169	0.062	0.113	0.108	0.915	0.589 No		0.113	1.451
37	41	40	80	241.801	0.004	0.01	0.002 Free Surface	0.871	0.096	0.019	0.064	0.055	0.736	0.504 No	~	0.064	0.871
38	43	42	∞	113.556	0.006	0.002	0 Free Surface	0.654	0.045	0.004	0.03	0.027	0.811	0.615 No	0	0.03	0.654
39	44	43	∞	195.225	0.007	0.001	0 Free Surface	0.587	0.034	0.002	0.023	0.021	0.838	0.663 No	0	0.023	0.587
40	44	45	8	364.177	0.004	0.001	0 Free Surface	0.43	0.034	0.002	0.023	0.018	0.614	0.486 No		0.023	0.43
41	45	42	80	172.302	0.004	0.006	0.001 Free Surface	0.737	0.075	0.011	0.05	0.042	0.707	0.499 No	•	0.05	0.737
42	40	46	∞	353.551	0.007	0.048	0.013 Free Surface	1.7	0.183	0.073	0.122	0.124	1.03	0.658 No	0	0.122	1.7
43	46	47	8	410.686	0.007	0.057	0.016 Free Surface	1.768	0.201	0.088	0.134	0.135	1.018	0.647 No	•	0.134	1.768
44	48	47	80	394.443	0.004	0.024	0.006 Free Surface	1.136	0.149	0.048	0.099	0.087	0.766	0.499 No		0.099	1.136
45	47	18	∞	352.132	0.007	0.084	0.024 Free Surface	1.976	0.243	0.13	0.162	0.164	1.028	0.646 Ye	S	0.222	1.276
46	49	50	00	397.266	0.013	0.002	0 Free Surface	0.84	0.038	0.003	0.025	0.027	1.131	0.879 No	0	0.025	0.84
47	54	53	80	62.433	0.01	0.006	0.001 Free Surface	1.009	0.062	0.008	0.042	0.043	1.061	0.768 No	0	0.042	1.009
48	53	52	00	195.632	0.021	0.007	0.001 Free Surface	1.376	0.055	0.006	0.037	0.046	1.54	1.134 No	0	0.037	1.376

1.421	1.486	0.919	1.379	0.988	0.984	0.785	1.204	1.479	1.588	1.677	1.774	1.687	0.503	0.722	0.887	1.057	2.139	2.212	0.344	0.914	1.583	1.674	1.123	1.451	0.438	1.462	1.459	1.486	1.769	0.544	0.554	1.321	1.93	1.938	0.862	1.156	1.491	1.32	1.119	1.549	1.992	0.403	0.578	1.621	0.527	1.524	1.189	1.375	0.642	0.864	0.9	1.279	0.639	0.98
0.039	0.041	0.071	0.02	0.08	0.082	0.018	0.035	0.048	0.054	0.059	0.059	0.092	0.028	0.047	0.031	0.057	0.037	0.04	0.016	0.016	0.059	0.066	0.099	0.147	0.034	0.15	0.151	0.151	0.134	0.031	0.033	0.031	0.132	0.133	0.018	0.02	0.028	0.018	0.025	0.034	0.043	0.02	0.034	0.023	0.031	0.033	0.013	0.043	0.02	0.014	0.02	0.021	0.039	0.014
1.127 No	1.134 No	0.499 No	1.716 No	0.497 No	0.485 No	1.021 No	1.024 No	1.031 No	1.019 No	1.032 Yes	1.08 No	0.777 No	0.49 No	0.505 No	0.817 No	0.656 No	1.751 No	1.73 No	0.491 No	1.306 No	0.961 No	0.952 No	0.492 No	0.503 No	1.605 Yes	0.5 No	0.497 No	0.507 No	0.648 No	0.503 No	0.492 No	1.372 Yes	0.712 No	0.711 No	1.143 No	1.396 No	1.464 No	1.731 No	1.193 No	1.353 No	1.478 No	0.493 No	0.497 No	1.833 No	0.486 No	1.344 No	1.941 No	1.02 No	0.79 No	1.331 No	1.093 No	1.515 No	0.504 No	1.511 No
1.544	1.566	0.738	2.121	0.746	0.731	1.249	1.381	1.452	1.46	1.493	1.563	1.184	0.641	0.71	1.083	0.946	2.381	2.377	0.587	1.562	1.392	1.397	0.756	0.796	1.945	0.792	0.788	0.804	1.02	0.666	0.658	1.8	1.12	1.119	1.392	1.738	1.911	2.114	1.529	1.814	2.054	0.612	0.668	2.317	0.644	1.798	2.25	1.418	0.979	1.564	1.358	1.894	0.691	1.775
0.049	0.052	0.061	0.029	0.069	0.07	0.02	0.041	0.057	0.066	0.072	0.074	0.1	0.023	0.04	0.032	0.056	0.057	0.062	0.012	0.02	0.07	0.078	0.086	0.131	0.024	0.133	0.134	0.135	0.135	0.025	0.027	0.039	0.14	0.141	0.021	0.027	0.039	0.026	0.031	0.045	0.062	0.016	0.028	0.035	0.025	0.045	0.019	0.052	0.02	0.018	0.024	0.029	0.033	0.019
0.039	0.041	0.071	0.02	0.08	0.082	0.018	0.035	0.048	0.054	0.058	0.059	0.092	0.028	0.047	0.031	0.057	0.037	0.04	0.016	0.016	0.059	0.066	660.0	0.147	0.017	0.15	0.151	0.151	0.134	0.031	0.033	0.029	0.132	0.133	0.018	0.02	0.028	0.018	0.025	0.034	0.043	0.02	0.034	0.023	0.031	0.033	0.013	0.043	0.02	0.014	0.02	0.021	0.039	0.014
0.007	0.008	0.024	0.002	0.03	0.032	0.001	0.005	0.01	0.013	0.016	0.016	0.041	0.003	0.01	0.004	0.015	0.006	0.007	0.001	0.001	0.016	0.02	0.048	0.106	0.001	0.111	0.113	0.112	0.088	0.004	0.005	0.004	0.086	0.088	0.001	0.002	0.003	0.001	0.003	0.005	0.008	0.002	0.005	0.002	0.004	0.005	0.001	0.008	0.002	0.001	0.002	0.002	0.007	0.001
0.058	0.062	0.106	0.029	0.119	0.123	0.027	0.053	0.071	0.081	0.088	0.088	0.138	0.043	0.071	0.046	0.086	0.056	0.06	0.024	0.024	0.089	0.098	0.149	0.22	0.026	0.225	0.227	0.226	0.201	0.046	0.049	0.043	0.198	0.2	0.027	0.031	0.042	0.027	0.037	0.05	0.065	0.03	0.052	0.034	0.046	0.05	0.019	0.065	0.03	0.021	0.03	0.032	0.059	0.021
1.421	1.486	0.919	1.379	0.988	0.984	0.785	1.204	1.479	1.588	1.687	1.774	1.687	0.503	0.722	0.887	1.057	2.139	2.212	0.344	0.914	1.583	1.674	1.123	1.451	1.188	1.462	1.459	1.486	1.769	0.544	0.554	1.426	1.93	1.938	0.862	1.156	1.491	1.32	1.119	1.549	1.992	0.403	0.578	1.621	0.527	1.524	1.189	1.375	0.642	0.864	0.9	1.279	0.639	0.98
0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0.001 Free Surface	0.004 Free Surface	0.004 Free Surface	0 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.008 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0 Free Surface	0 Free Surface	0.004 Free Surface	0.005 Free Surface	0.006 Free Surface	0.015 Free Surface	0 Free Surface	0.015 Free Surface	0.015 Free Surface	0.016 Free Surface	0.016 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.017 Free Surface	0.017 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.003 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0 Free Surface	0.002 Free Surface	0 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface
0.008	0.009	0.012	0.003	0.015	0.016	0.001	0.005	0.011	0.014	0.016	0.017	0.032	0.002	0.005	0.003	0.01	0.011	0.012	0	0.001	0.016	0.019	0.024	0.054	0.002	0.056	0.056	0.057	0.057	0.002	0.002	0.005	0.061	0.062	0.001	0.002	0.005	0.002	0.003	0.007	0.012	0.001	0.003	0.004	0.002	0.006	0.001	0.009	0.001	0.001	0.002	0.003	0.003	0.001
0.021	0.021	0.004	0.048	0.004	0.004	0.017	0.017	0.017	0.017	0.017	0.019	0.01	0.004	0.004	0.011	0.007	0.05	0.049	0.004	0.028	0.015	0.015	0.004	0.004	0.042	0.004	0.004	0.004	0.007	0.004	0.004	0.031	0.008	0.008	0.021	0.032	0.035	0.049	0.023	0.03	0.036	0.004	0.004	0.055	0.004	0.029	0.061	0.017	0.01	0.029	0.019	0.037	0.004	0.037
8 149.617	8 281.246	8 246.573	8 397.956	8 297.517	8 156.441	8 246.976	8 339.135	8 161.42	8 230.204	8 218.731	8 63.095	8 467.723	8 383.205	8 264.797	8 275.324	8 427.97	8 160.05	8 323.635	8 534.984	8 449.724	8 464.538	8 216.582	8 456.072	8 291.108	8 431.076	8 49.096	8 297.755	8 190.799	8 350.787	8 169.341	8 252.812	8 329.037	8 399.213	8 412.712	8 136.11	8 122.633	8 168.858	8 386.658	8 340.288	8 97.09	8 336.753	8 176.786	8 198.851	8 271.916	8 129.806	8 166.297	8 405.195	8 229.643	8 186.72	8 204.095	8 97.574	8 414.07	8 72.565	8 212.221
52 51	51 50	50 55	56 55	55 57	57 64	58 59	59 60	60 61	61 62	62 63	63 64	64 75	65 66	66 68	67 68	69 89	69 70	70 71	73 71	73 74	71 72	72 74	74 75	75 77	76 77	77 78	78 79	79 80	80 84	81 82	83 82	82 84	84 85	85 86	91 92	92 93	93 90	87 89	88 89	89 90	98 06	94 95	95 96	96 98	97 98	98 100	99 100	100 101	107 108	108 109	109 110	110 111	111 114	108 112
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	06	91	92	93	94	95	96	97	98	66	100	101	102	103

	1.553	0.997	1.228	1.255	1.604	1.463	1.495	1.487	2.214	1.858	1.917	2.061	2.407	2.777	0.514	1.42	0.599	0.742	1.62	1.615	0.686	0.872	1.097	1.534	2.091	1.76	1.972	1.47	1.963	1.329	2.522	2.572	107.1	1 U2	2.088	0.894	0.98	1.099	0.821	1.486	0./8/	1.816	1 077	1.074	1.967	1.429	1.019	1.052	1.504	1.611	2.892	2.079
	0.015	0.021	0.022	0.027	0.026	0.032	0.039	0.054	0.043	0.066	0.067	0.067	0.065	0.139	0.04	0.144	0.268	0.027	0.023	0.03	0.031	0.061	0.056	0.049	0.048	0.057	0.069	0.034	0.035	0.025	0.064	0.064	001 U	0.038	0.035	0.067	0.076	0.022	0.097	0.026	0.053	0.037	1 CU-U	0.027	0.036	0.016	0.083	0.092	0.018	0.023	1.0.0	0.101
	2.348 No	1.198 No	1.434 No	1.279 No	1.655 No	1.315 No	1.186 No	0.956 No	1.647 No	1.056 No	1.071 No	1.156 No	1.379 No	1.043 Yes	0.484 Yes	0.499 No	0.494 Yes	0.744 No	1.788 No	1.504 No	0.633 No	0.52 No	0.69 No	1.051 No	1.449 No	1.099 No	1.088 No	1.287 No	1.68 No	1.409 No	1.455 NO	1.485 No	0.49 NO	0.821 NO	1.777 No	0.503 No	0.507 No	1.271 No	0.502 Yes	0N 912.1	ON 12.0	1.686 NO	D FOF NO	1.086 No	1.655 No	2.001 No	0.501 No	0.484 No	1.949 No	1.798 No	1.924 NO	0.902 No
	2.771	1.493	1.799	1.656	2.137	1.752	1.624	1.368	2.288	1.55	1.576	1.701	2.021	1.644	0.657	0.788	0.782	0.966	2.273	1.988	0.839	0.756	0.992	1.485	2.043	1.583	1.605	1.725	2.263	1.808	2.129	2.172	0770	1.171	2.396	0.739	0.757	1.598	0.757	1.962	0.729	2.23	0.267 0	1.408	2.237	2.406	0.755	0.738	2.386	2.28 7.77	2./35 1 731	1.388 1.388
	0.024	0.025	0.029	0.034	0.038	0.043	0.05	0.063	0.065	0.082	0.085	0.088	0.092	0.175	0.03	0.127	0.127	0.027	0.035	0.043	0.028	0.053	0.056	0.06	0.069	0.071	0.087	0.044	0.052	0.034	0.094	0.095	0.098	0.04	0.054	0.057	0.066	0.028	0.072	0.03/	0.046	0.046		0.032	0.053	0.025	0.072	0.079	0.028	0.035	280.0	0.119
	0.015	0.021	0.022	0.027	0.026	0.032	0.039	0.054	0.043	0.066	0.067	0.067	0.065	0.136	0.037	0.144	0.144	0.027	0.023	0.03	0.031	0.061	0.056	0.049	0.048	0.057	0.069	0.034	0.035	0.025	0.064	0.064	7110	0.038	0.035	0.067	0.076	0.022	0.083	0.026	0.053	0.031	10.088	0.027	0.036	0.016	0.083	0.092	0.018	0.023	1.20.0	0.101
	0.001	0.002	0.002	0.003	0.003	0.004	0.007	0.013	0.008	0.02	0.021	0.021	0.02	0.091	0.006	0.102	0.103	0.003	0.002	0.004	0.004	0.017	0.014	0.011	0.01	0.015	0.022	0.005	0.005	0.003	010.0	0.019	0.174	0.006	0.005	0.021	0.027	0.002	0.033	0.003	0.013	0.004	000.0	0.003	0.006	0.001	0.033	0.041	0.001	0.002	0.071	0.05
х	0.022	0.031	0.032	0.04	0.039	0.048	0.059	0.081	0.065	0.098	0.101	0.1	0.097	0.203	0.055	0.215	0.216	0.041	0.035	0.046	0.046	0.091	0.084	0.073	0.072	0.085	0.103	0.05	0.052	0.037	0.096	0.096	60T-0	0.057	0.052	0.1	0.114	0.033	0.124	0.04	0.08	0.046	CCU.U CEL U	0.04	0.053	0.025	0.124	0.138	0.028	250.0 770.0	0.07	0.151
	1.553	0.997	1.228	1.255	1.604	1.463	1.495	1.487	2.214	1.858	1.917	2.061	2.407	2.873	0.587	1.42	1.412	0.742	1.62	1.615	0.686	0.872	1.097	1.534	2.091	1.76	1.972	1.47	1.963	1.329	222.2	2.572	102.1	1.02	2.088	0.894	0.98	1.099	1.024	1.486 0.707	0./8/	918.L	1 072	1.074	1.967	1.429	1.019	1.052	1.504	119.1	268.2	2.079
	0 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0.003 Free Surface	0.005 Free Surface	0.006 Free Surface	0.006 Free Surface	0.007 Free Surface	0.028 Free Surface	0.001 Free Surface	0.014 Free Surface	0.014 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.006 Free Surface	0.001 Free Surface	0.002 Free Surface	0.001 Free Surface	0.00/ Free Surface	0.007 Free Surface	0.000 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0 Free Surface	0.004 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.005 Free Surface	0.001 Free Surface	0.002 Free Surface	0 Free Surface	0.004 Free Surface	0.005 Free Surface	0.001 Free Surface	0.001 Free Surface	0.006 Free Surface	0.012 Free Surface
	0.002	0.002	0.003	0.004	0.005	0.006	0.008	0.013	0.014	0.021	0.023	0.024	0.027	0.095	0.003	0.051	0.051	0.002	0.004	0.006	0.003	0.00	0.01	0.011	0.015	0.016	0.024	0.006	600.0	0.004	0.028	0.028	0.025	0.005	0.00	0.011	0.014	0.002	0.017	0.004	0.007	0.00	910 0	0.003	0.009	0.002	0.016	0.02	0.003	0.004	0.025	0.045
	0.09	0.023	0.034	0.027	0.045	0.028	0.023	0.015	0.044	0.018	0.019	0.022	0.031	0.018	0.004	0.004	0.004	0.00	0.052	0.037	0.007	0.004	0.008	0.018	0.034	0.02	0.019	0.027	0.046	0.032	0.035	0.036	0.004	0.011	0.051	0.004	0.004	0.026	0.004	0.037	0.004	0.046	+00.00	0.019	0.045	0.065	0.004	0.004	0.062	0.053	90.0	0.013
	8 110.124	8 209.484	8 146.155	8 108.773	8 87.313	8 102.815	8 257.304	8 261.838	8 88.122	8 186.965	8 122.982	8 458.845	8 322.258	8 225.329	8 78.536	8 616.798	8 753.252	8 210.667	8 151.499	8 322.552	8 137.608	8 203.904	8 116.062	8 438.774	8 113.865	8 45.726	8 150.355	8 366.48	8 367.068	8 367.62	80 162.198	8 2/8.04 • 2/8.04	0 203.521	8 263.946	8 143.781	8 388.076	8 381.265	8 144.322	8 486.742	8 3/8.888	8 164.888	8 329.9UL 0 250.160	8 191 973	8 515.156	8 290.964	8 275.609	8 293.24	8 130.756	8 143.654	8 149.806	8 138 001	8 369.136
	113	103	104	105	106	113	114	115	101	116	117	118	86	11	120	121	6	123	124	126	126	127	128	129	130	133	135	132	133	135	130	13/ 120	1150	140	141	142	144	144	145 145	14/ 150	051	1E0	151	151	154	154	156	159	158	150	151 151	162
	112	102	103	104	105	106	113	114	115	101	116	117	118	86	119	120	121	122	123	124	125	126	127	128	129	130	133	131	132	134	135	136	128 138	139	140	141	142	143	144	140 117	14/	140	150	152	153	155	154	156	157	150	160 160	151
	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134 131	135 126	137	138	139	140	141	142	143	144	145 215	147	148	149	150	151	152	153	154	156	157	159

2.426	1.685	3.428	1.14	0.773	0.859	0.93	2.213	2.265	0.999	1.032	1.051	1.086	0.937	0.655	1.982	1.355	0.627	0.873	0.895	1.336	0.574	1.443	1.003	1.126	1.11	3.018	3.69	2.784	1.528	1.591	1.612	0.396	1.668	1.697	1.42	0.463	1.744	1.827	1.911	2.044	2.068	2.034	1.326	1.354	3.69	3.843	0.84	2.523
0.037	0.137	0.087	0.022	0.054	0.063	0.066	0.04	0.045	0.085	0.085	0.087	0.094	0.115	0.042	0.028	0.018	0.04	0.067	0.07	0.011	0.032	0.032	0.092	0.027	0.041	0.063	0.075	0.1	0.167	0.168	0.178	0.056	0.191	0.197	0.021	0.079	0.203	0.205	0.218	0.231	0.23	0.233	0.129	0.131	0.21	0.224	0.059	0.47
2.12 Yes	0.607 No	1.681 Yes	1.314 No	0.499 No	0.499 No	0.524 No	1.717 No	1.632 No	0.482 No	0.498 No	0.499 No	0.492 No	0.513 Yes	0.499 No	1.959 No	1.763 No	0.485 No	0.488 No	0.489 No	2.39 No	0.514 No	1.307 No	0.917 Yes	1.142 No	0.85 No	1.762 No	1.933 No	1.216 No	0.492 No	0.51 No	0.5 No	2.007 Yes	0.498 No	0.497 No	1.711 No	0.502 Yes	0.502 No	0.524 No	0.53 No	0.55 No	0.558 No	0.545 No	0.496 No	0.502 No	1.044 No	1.05 No	0.512 No	0.847 No
2.865	0.957	2.543	1.654	0.713	0.729	0.77	2.363	2.282	0.729	0.753	0.757	0.752	0.787	0.689	2.554	2.157	0.668	0.719	0.723	2.709	0.686	1.738	1.348	1.48	1.173	2.571	2.88	1.869	0.782	0.813	0.797	2.507	0.795	0.793	2.131	0.72	0.802	0.837	0.845	0.875	0.889	0.867	0.779	0.789	1.667	1.673	0.741	0.718
0.061	0.134	0.138	0.028	0.045	0.054	0.058	0.062	0.069	0.073	0.074	0.076	0.081	0.088	0.034	0.045	0.027	0.033	0.057	0.059	0.019	0.027	0.042	0.077	0.033	0.045	0.101	0.128	0.137	0.147	0.151	0.159	0.033	0.169	0.175	0.03	0.047	0.182	0.187	0.2	0.216	0.216	0.217	0.114	0.116	0.274	0.293	0.05	0.395
0.036	0.137	0.086	0.022	0.054	0.063	0.066	0.04	0.045	0.085	0.085	0.087	0.094	0.099	0.042	0.028	0.018	0.04	0.067	0.07	0.011	0.032	0.032	0.066	0.027	0.041	0.063	0.075	0.1	0.167	0.168	0.178	0.021	0.191	0.197	0.021	0.055	0.203	0.205	0.218	0.231	0.23	0.233	0.129	0.131	0.21	0.224	0.059	0.47
0.006	0.093	0.035	0.002	0.013	0.019	0.021	0.007	0.009	0.035	0.035	0.037	0.043	0.047	0.008	0.003	0.001	0.007	0.021	0.023	0	0.004	0.004	0.021	0.003	0.008	0.018	0.026	0.049	0.138	0.139	0.156	0.002	0.178	0.191	0.002	0.014	0.202	0.205	0.232	0.258	0.255	0.263	0.082	0.084	0.215	0.244	0.016	0.61
0.053	0.206	0.129	0.033	0.081	0.095	0.1	0.061	0.068	0.128	0.128	0.131	0.141	0.148	0.062	0.042	0.027	0.061	0.101	0.105	0.017	0.048	0.048	0.1	0.04	0.062	0.094	0.112	0.15	0.251	0.252	0.267	0.031	0.286	0.296	0.031	0.083	0.305	0.307	0.328	0.347	0.345	0.35	0.194	0.196	0.315	0.337	0.088	0.564
2.52	1.685	3.499	1.14	0.773	0.859	0.93	2.213	2.265	0.999	1.032	1.051	1.086	1.166	0.655	1.982	1.355	0.627	0.873	0.895	1.336	0.574	1.443	1.626	1.126	1.11	3.018	3.69	2.784	1.528	1.591	1.612	1.688	1.668	1.697	1.42	0.79	1.744	1.827	1.911	2.044	2.068	2.034	1.326	1.354	3.69	3.843	0.84	2.523
0.003 Free Surface	0.016 Free Surface	0.016 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.004 Free Surface	0.004 Free Surface	0.005 Free Surface	0.006 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.005 Free Surface	0.001 Free Surface	0.001 Free Surface	0.008 Free Surface	0.014 Free Surface	0.016 Free Surface	0.019 Free Surface	0.02 Free Surface	0.022 Free Surface	0.001 Free Surface	0.026 Free Surface	0.028 Free Surface	0.001 Free Surface	0.002 Free Surface	0.03 Free Surface	0.032 Free Surface	0.037 Free Surface	0.043 Free Surface	0.044 Free Surface	0.044 Free Surface	0.011 Free Surface	0.011 Free Surface	0.072 Free Surface	0.084 Free Surface	0.002 Free Surface	0.182 Free Surface
0.012	0.057	0.059	0.003	0.007	600.0	0.011	0.012	0.015	0.017	0.017	0.018	0.021	0.024	0.004	0.006	0.002	0.004	0.01	0.011	0.001	0.002	0.006	0.019	0.003	0.006	0.033	0.051	0.059	0.068	0.071	0.078	0.004	0.089	0.095	0.003	0.007	0.102	0.107	0.123	0.142	0.142	0.143	0.041	0.042	0.225	0.256	0.008	0.517
0.073	0.006	0.046	0.028	0.004	0.004	0.004	0.048	0.043	0.004	0.004	0.004	0.004	0.004	0.004	0.063	0.051	0.004	0.004	0.004	0.093	0.004	0.028	0.014	0.021	0.012	0.051	0.061	0.024	0.004	0.004	0.004	0.066	0.004	0.004	0.048	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.004	0.004	0.018	0.018	0.004	0.004
8 476.385	8 815.727	8 143.29	8 411.951	8 345.155	8 295.384	8 89.272	8 330.589	8 382.094	8 79.222	8 123.742	8 320.11	8 328.773	8 163.41	8 517.705	8 413.703	8 163.713	8 130.301	8 128.611	8 179.668	8 53.676	8 138.999	8 294.385	8 634.099	8 277.324	8 415.982	8 215.385	8 326.528	8 443.903	8 253.79	8 164.746	8 318.998	8 274.072	8 247.368	8 521.693	8 473.422	8 146.098	8 218.688	8 156.31	8 655.22	8 649.431	8 216.536	8 206.776	8 274.413	8 389.567	8 298.065	8 139.089	8 116.826	10 477.296
162	163	138	165	166	167	168	169	170	171	172	173	174	201	176	177	180	177	178	184	183	183	184	200	186	188	188	189	190	191	192	194	194	195	196	198	196	199	200	201	202	203	145	205	206	206	4	41	4
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	179	180	177	178	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	197	198	196	199	200	201	202	203	204	205	145	206	42	207
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	279	467

2039 PEAK FLOW REPORT (FORCE MAINS)

ID	From ID	To ID	Diameter (in)	Length (ft)	Total Flow (mgd)	Peakable Flow (mgd)	Velocity (ft/s)	Headloss (ft)
433	33	31	6	467.78	0.035	0.009	3.402	3.727
435	28	22	6	2,093.99	0.26	0.085	3.402	16.686

2.181 2.371 2.16 2.429 2.423 2.322 2.376 2.379 2.346 2.284 0.913 1.488 1.581 1.562 0.894 0.845 0.382 2.158 2.184 0.084 1.332 1.146 0.946 1.424 1.084 0.995 0.968 0.709 3.073 10.699 2.207 2.19 2.334 2.231 2.03 1.379 1.66 0.873 1.955 1.99 0.756 6.03 0.84 Depth (ft) Velocity (ft/s) Adjusted Adjusted 0.118 0.648 0.399 0.833 0.156 0.176 0.073 0.117 0.049 0.049 0.249 0.833 0.307 0.573 0.59 0.575 0.571 0.559 0.499 0.502 0.667 0.667 0.137 0.667 0.101 0.074 0.144 0.145 0.25 0.833 0.833 0.717 0.833 0.531 0.57 0.571 0.34 0.141 0.0 0.057 0.065 0.154 0.164 0.07 0.318 0.02 Adjustment Backwater 1.42 No 7.743 No 0.786 Yes 0.499 Yes 0.495 Yes 0.506 Yes 0.811 Yes 0.538 Yes 2.524 Yes 0.738 Yes 2.504 Yes 0.503 Yes 0.778 No 0.864 No 0.498 No 0.499 Yes 0.646 Yes 7.811 No 0.757 No 0.747 No 0.76 No 0.753 No 2.456 No 0.768 No 0.767 No 0.729 No 0.75 No 0.752 No 0.742 No 0.742 No 0.752 No 0.732 No 0.498 No 0.53 No 0.498 No 0.483 No 0.497 No 0.589 No 0.504 No 0.615 No 0.663 No 0.486 No 0.499 No 0.658 No 0.647 No å 0.879 | Full Flow (mgd) 0.734 0.793 1.347 0.814 0.766 4.473 0.426 0.423 0.417 2.232 0.584 0.624 0.606 0.802 1.284 1.226 0.825 0.766 0.741 0.764 Number 0.721 4.511 0.421 0.537 2.295 0.595 0.596 0.554 0.58 0.577 0.584 0.651 2.279 0.791 0.784 0.787 0.93 0.887 0.937 0.686 1.045 L.029 0.73 0.731 .031 1.131 Froude 0.386 0.309 0.155 0.244 0.545 0.545 0.479 0.428 0.389 0.138 0.061 0.251 0.167 0.152 0.137 0.088 0.064 0.126 0.547 0.483 0.483 0.485 0.436 0.435 0.433 0.432 0.422 0.317 0.077 0.106 0.128 0.136 0.079 0.054 0.047 0.055 0.158 0.166 0.055 0.179 0.481 0.467 0.467 0.437 0.04 0.027 Depth (ft) Depth (ft) Critical 0.074 0.648 0.249 0.307 0.559 0.499 0.502 0.202 0.156 0.283 0.147 0.137 0.118 0.085 0.117 0.101 0.144 0.145 0.049 0.049 0.25 0.833 0.833 0.833 0.664 0.833 0.302 0.573 0.57 0.59 0.575 0.571 0.571 0.396 0.174 0.277 0.071 0.141 0.09 0.057 0.065 0.154 0.164 0.064 0.176 0.025 Water 0.753 0.137 0.136 1.033 1.012 0.973 1.012 0.282 0.289 0.818 0.812 0.814 0.813 0.79 0.669 0.677 0.459 0.129 0.149 0.376 0.106 0.093 0.068 0.035 0.067 0.049 0.026 0.103 0.098 0.015 0.011 0.011 0.117 0.133 0.019 0.153 1.027 0.85 0.821 0.12 0.362 0.024 0.104 0.02 0.003 0.04 g/p 0.648 0.598 0.22 0.176 0.128 0.175 0.216 0.476 0.416 0.206 0.151 0.111 0.368 0.685 0.603 0.242 0.261 0.107 0.217 0.25 0.249 0.797 0.363 0.688 0.684 0.708 0.69 0.686 0.671 0.234 0.425 0.212 0.136 0.086 0.073 0.073 0.097 0.231 0.246 0.096 0.264 0.038 d/b 3.073 0.919 2.184 1.332 0.946 2.049 2.034 1.118 1.1461.379 1.42410.699 2.541 6.151 2.429 2.423 2.376 2.379 2.346 2.231 4.886 1.488 2.085 2.34 2.158 1.084 0.995 0.968 0.709 0.873 1.955 0.864 2.073 10.758 2.207 2.19 2.181 2.16 2.322 2.334 2.284 1.601 1.66 1.99 0.84 6.03 Velocity (ft/s) 0.108 Free Surface 0.06 Free Surface 0.006 Free Surface 0.005 Free Surface 0.002 Free Surface 0.001 Free Surface 0.002 Free Surface 0.409 Free Surface 0.406 Free Surface 0.405 Free Surface 0.282 Free Surface 0.259 Free Surface 0.259 Free Surface 0.226 Free Surface 0.224 Free Surface 0.223 Free Surface 0.222 Free Surface 0.22 Free Surface 0.216 Free Surface 0.21 Free Surface 0.177 Free Surface 0.174 Free Surface 0.114 Free Surface 0.017 Free Surface 0.021 Free Surface 0.057 Free Surface 0.003 Free Surface 0.025 Free Surface 0.02 Free Surface 0.016 Free Surface 0.005 Free Surface 0.009 Free Surface 0.003 Free Surface 0.013 Free Surface 0.014 Free Surface 0.016 Free Surface 0.002 Free Surface 0.022 Free Surface 0.025 Free Surface 0.002 Free Surface Free Surface Free Surface 0.28 Pressurized 0.283 Pressurized 0.287 Pressurized 0.284 Pressurized Flow (mgd) Flow Type 0.029 | 0 Total Flow Peakable 0.628 0.339 0.019 0.778 0.616 0.613 0.503 0.495 0.075 0.035 0.058 0.099 1.069 1.064 1.062 0.772 0.769 0.765 0.762 0.711 0.623 0.62 0.603 0.587 0.322 0.06 0.181 0.012 0.191 0.086 0.072 0.059 0.025 0.013 0.05 0.051 0.02 0.009 0.007 0.005 0.077 0.086 0.71 0.01 0.01 0.002 (mgd) 0.114 0.003 0.003 0.003 0.003 0.003 0.003 0.004 0.004 0.005 Slope 0.004 0.112 0.003 0.003 0.003 0.032 0.003 0.003 0.003 0.003 0.003 0.031 0.004 0.004 0.004 0.011 0.012 0.005 0.004 0.004 0.004 0.004 0.006 0.007 0.013 0.003 0.03 0.004 0.006 0.007 0.004 0.004 0.007 0.007 0.004 0.01 87.398 236.618 326.3 300.778 212.183 63.505 371.162 442.009 353.551 317.12 492.18 320.345 63.296 356.948 296.064 485.025 371.162 148.794 113.556 70.177 341.948 402.545 365.878 296.287 339.292 425.364 363.286 241.801 172.302 410.686 394.443 128.027 131.943 216.485 154.235 265.327 357.904 427.411 541.461 383.033 293.983 195.225 364.177 352.132 397.266 From ID To ID Diameter (in) Length (ft) 308.562 00

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144 145	00	486.742 0.004	0.017	0.004 Free Surface	1.024 0.124 0.03	0.083	0.072	0.757	0.502 Yes	0.116	0.63
147	80	378.888 0.037	0.006	0.001 Free Surface	1.626 0.046 0.00	t 0.03	0.043	2.003	1.516 No	0.03	1.626
150	80	164.888 0.004	0.008	0.002 Free Surface	0.836 0.088 0.016	0.059	0.05	0.738	0.51 No	0.059	0.836
149	80	329.901 0.046	0.034	0.009 Free Surface	2.969 0.098 0.0	0.066	0.104	2.475	1.686 No	0.066	2.969
150	80	358.169 0.064	0.038	0.01 Free Surface	3.45 0.097 0.019	0.064	0.11	2.905	1.984 No	0.064	3.45
151	8	191.973 0.004	0.046	0.012 Free Surface	1.394 0.204 0.09	0.136	0.121	0.797	0.506 No	0.136	1.394
151	80	515.156 0.019	0.004	0.001 Free Surface	1.115 0.043 0.00	3 0.028	0.034	1.42	1.086 Yes	0.033	0.894
154	80	290.964 0.045	0.024	0.006 Free Surface	2.65 0.085 0.01	0.057	0.088	2.384	1.655 No	0.057	2.65
154	80	275.609 0.065	0.002	0 Free Surface	1.429 0.025 0.00	1 0.016	0.025	2.406	2.001 No	0.016	1.429
156	80	293.24 0.004	0.031	0.008 Free Surface	1.233 0.169 0.06	2 0.113	0.099	0.778	0.501 No	0.113	1.233
159	80	130.756 0.004	0.034	0.009 Free Surface	1.239 0.18 0.07	1 0.12	0.104	0.756	0.484 No	0.12	1.239
158	80	143.654 0.062	0.003	0.001 Free Surface	1.504 0.028 0.00	1 0.018	0.028	2.386	1.949 No	0.018	1.504
159	80	149.806 0.053	0.004	0.001 Free Surface	1.611 0.035 0.00	0.023	0.035	2.28	1.798 No	0.023	1.611
160	80	81.176 0.06	0.037	0.01 Free Surface	3.346 0.097 0.01	9 0.064	0.109	2.817	1.924 No	0.064	3.346
151	80	438.991 0.023	0.039	0.01 Free Surface	2.406 0.125 0.03	3 0.083	0.111	1.774	1.176 No	0.083	2.406
162	80	369.136 0.013	0.084	0.024 Free Surface	2.506 0.206 0.093	3 0.138	0.165	1.423	0.902 No	0.138	2.506
1 162	80	476.385 0.073	0.012	0.003 Free Surface	2.52 0.053 0.00	5 0.036	0.061	2.865	2.12 Yes	0.059	1.188
2 163	80	815.727 0.006	0.1	0.029 Free Surface	1.987 0.274 0.16	4 0.183	0.18	0.968	0.607 No	0.183	1.987
3 138	80	143.29 0.046	0.103	0.03 Free Surface	4.129 0.168 0.06	2 0.112	0.183	2.61	1.681 Yes	0.122	3.64
4 165	80	411.951 0.028	0.003	0.001 Free Surface	1.14 0.033 0.00	2 0.022	0.028	1.654	1.314 No	0.022	1.14
5 166	80	345.155 0.004	0.007	0.001 Free Surface	0.773 0.081 0.01	3 0.054	0.045	0.713	0.499 No	0.054	0.773
6 167	80	295.384 0.004	0.009	0.002 Free Surface	0.859 0.095 0.01	90.063	0.054	0.729	0.499 No	0.063	0.859
7 168	80	89.272 0.004	0.011	0.002 Free Surface	0.93 0.1 0.02	1 0.066	0.058	0.77	0.524 No	0.066	0.93
8 169	80	330.589 0.048	0.012	0.003 Free Surface	2.213 0.061 0.00	0.04	0.062	2.363	1.717 No	0.04	2.213
9 170	80	382.094 0.043	0.015	0.004 Free Surface	2.265 0.068 0.00	9 0.045	0.069	2.282	1.632 No	0.045	2.265
171 0	80	79.222 0.004	0.017	0.004 Free Surface	0.999 0.128 0.03	5 0.085	0.073	0.729	0.482 No	0.085	0.999
l 172	8	123.742 0.004	0.017	0.004 Free Surface	1.032 0.128 0.03	0.085	0.074	0.753	0.498 No	0.085	1.032
2 173	ø	320.11 0.004	0.018	0.004 Free Surface	1.051 0.131 0.03	7 0.087	0.076	0.757	0.499 No	0.087	1.051
3 174	80	328.773 0.004	0.021	0.005 Free Surface	1.086 0.141 0.04	3 0.094	0.081	0.752	0.492 No	0.094	1.086
t 201	80	163.41 0.004	0.024	0.006 Free Surface	1.166 0.148 0.04	7 0.099	0.088	0.787	0.513 Yes	0.135	0.745
5 176	80	517.705 0.004	0.004	0.001 Free Surface	0.655 0.062 0.00	8 0.042	0.034	0.689	0.499 No	0.042	0.655
177	80	413.703 0.063	0.006	0.001 Free Surface	1.982 0.042 0.00	3 0.028	0.045	2.554	1.959 No	0.028	1.982
9 180	8	163.713 0.051	0.002	0 Free Surface	1.355 0.027 0.00	1 0.018	0.027	2.157	1.763 No	0.018	1.355
177	80	130.301 0.004	0.004	0.001 Free Surface	0.627 0.061 0.00	7 0.04	0.033	0.668	0.485 No	0.04	0.627
7 178	80	128.611 0.004	0.01	0.002 Free Surface	0.873 0.101 0.02	1 0.067	0.057	0.719	0.488 No	0.067	0.873
3 184	8	179.668 0.004	0.011	0.003 Free Surface	0.895 0.105 0.02	3 0.07	0.059	0.723	0.489 No	0.07	0.895
l 183	80	53.676 0.093	0.001	0 Free Surface	1.336 0.017	0.011	0.019	2.709	2.39 No	0.011	1.336
2 183	8	138.999 0.004	0.002	0 Free Surface	0.574 0.048 0.00	4 0.032	0.027	0.686	0.514 No	0.032	0.574
3 184	8	294.385 0.028	0.006	0.001 Free Surface	1.443 0.048 0.00	4 0.032	0.042	1.738	1.307 No	0.032	1.443
t 200	80	634.099 0.014	0.019	0.005 Free Surface	1.626 0.1 0.02	1 0.066	0.077	1.348	0.917 Yes	0.114	0.74
5 186	8	277.324 0.021	0.003	0.001 Free Surface	1.126 0.04 0.00	3 0.027	0.033	1.48	1.142 No	0.027	1.126
188	∞	415.982 0.012	0.006	0.001 Free Surface	1.11 0.062 0.00	8 0.041	0.045	1.173	0.85 No	0.041	1.11
188	80	215.385 0.051	0.033	0.008 Free Surface	3.018 0.094 0.01	8 0.063	0.101	2.571	1.762 No	0.063	3.018
3 189	00	326.528 0.061	0.051	0.014 Free Surface	3.69 0.112 0.02	5 0.075	0.128	2.88	1.933 No	0.075	3.69
9 190	00	443.903 0.024	0.059	0.016 Free Surface	2.784 0.15 0.04	9 0.1	0.137	1.869	1.216 No	0.1	2.784
191 0	00	253.79 0.004	0.068	0.019 Free Surface	1.528 0.251 0.13	8 0.167	0.147	0.782	0.492 No	0.167	1.528
1 192	00	164.746 0.004	0.123	0.037 Free Surface	1.86 0.334 0.2	4 0.222	0.2	0.814	0.51 No	0.222	1.86
194	8	318.998 0.004	0.129	0.039 Free Surface	1.86 0.347 0.25	9 0.231	0.206	0.796	0.5 No	0.231	1.86

0.228	1.893	1.912	1.42	0.315	1.95	2.031	2.098	2.215	2.242	2.204	1.321	1.152	4.034	4.168	1.075	2.729
0.081	0.241	0.247	0.021	0.103	0.251	0.251	0.261	0.271	0.269	0.273	0.128	0.147	0.249	0.263	0.087	0.633
2.007 Yes	0.498 No	0.497 No	1.711 No	0.502 Yes	0.502 No	0.524 No	0.53 No	0.55 No	0.558 No	0.545 No	0.496 No	0.502 Yes	1.044 No	1.05 No	0.512 No	0.847 No
2.507	0.791	0.788	2.131	0.72	0.796	0.831	0.837	0.866	0.88	0.857	0.778	0.789	1.656	1.658	0.776	0.609
0.033	0.214	0.218	0.03	0.047	0.223	0.228	0.238	0.251	0.252	0.252	0.113	0.116	0.324	0.342	0.076	0.491
0.021	0.241	0.247	0.021	0.055	0.251	0.251	0.261	0.271	0.269	0.273	0.128	0.131	0.249	0.263	0.087	0.633
1.688 0.031 0.002	1.893 0.362 0.28	1.912 0.371 0.293	1.42 0.031 0.002	0.79 0.083 0.014	1.95 0.377 0.302	2.031 0.376 0.3	2.098 0.392 0.325	2.215 0.406 0.347	2.242 0.404 0.342	2.204 0.41 0.352	1.321 0.192 0.081	1.355 0.197 0.085	4.034 0.373 0.297	4.168 0.394 0.328	1.075 0.13 0.036	2.729 0.759 0.925
0.001 Free Surface	0.043 Free Surface	0.045 Free Surface	0.001 Free Surface	0.002 Free Surface	0.047 Free Surface	0.049 Free Surface	0.054 Free Surface	0.06 Free Surface	0.06 Free Surface	0.061 Free Surface	0.011 Free Surface	0.011 Free Surface	0.103 Free Surface	0.116 Free Surface	0.005 Free Surface	0.289 Free Surface
0.004	0.14	0.145	0.003	0.007	0.152	0.157	0.172	0.191	0.191	0.192	0.04	0.043	0.31	0.345	0.019	0.783
274.072 0.066	247.368 0.004	521.693 0.004	473.422 0.048	146.098 0.004	218.688 0.004	156.31 0.004	655.22 0.005	649.431 0.005	216.536 0.005	206.776 0.005	274.413 0.004	389.567 0.004	298.065 0.018	139.089 0.018	116.826 0.004	477.296 0.004
∞	8	∞	8	8	8	8	8	80	8	8	80	80	80	80	8	10
194	195	196	198	196	199	200	201	202	203	145	205	206	206	4	41	4
193	194	195	197	198	196	199	200	201	202	203	204	205	145	206	42	207
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	279	467

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	Rim Elevation	Base Flow	Total Flow			Hydraulic	Surcharge	Unfilled
ID	(ft)	(mgd)	(mgd)	Grade (ft)	Status	Jump	Depth (ft)	Depth (ft)
2	759.3	0.002	0.01	751.948	Not Full	Yes	-0.352	7.352
3	779	0.001	0.005	769.05	Not Full	No	-0.75	9.95
4	795	0	0.001	784.249	Not Full	No	-0.751	10.751
5	800	0.002	0.011	788.217	Not Full	No	0.084	11.783
6	806.338	0.001	0.006	788.876	Not Full	No	0.043	17.462
7	808.224	0.001	0.007	790.271	Not Full	No	0.037	17.953
8	803.886	0.001	0.007	791.164	Not Full	No	-0.169	12.722
9	802.471	0.002	0.007	792.359	Not Full	Yes	0.026	10.112
10	805.824	0	0.001	793.902	Not Full	No	-0.531	11.921
11	808.802	0.001	0.005	796.107	Not Full	No	-0.526	12.695
12	809.318	0.002	0.009	797.473	Not Full	No	-0.26	11.845
13	809.901	0.001	0.006	798.47	Not Full	No	-0.263	11.431
14	813.11	0.001	0.006	799.29	Not Full	No	-0.243	13.82
15	811.417	0.001	0.007	800.375	Not Full	No	-0.258	11.042
16	814.33	0.004	0.016	801.671	Not Full	No	-0.262	12.659
17	818.439	0.007	0.026	802.871	Not Full	No	-0.263	15.569
18	815.4	0.004	0.017	803.959	Not Full	Yes	-0.274	11.441
19	810	0.003	0.012	804.999	Not Full	No	-0.335	5.001
20	810	0.003	0.014	805.902	Not Full	No	-0.331	4.098
21	818	0.006	0.025	806.696	Not Full	Yes	-0.437	11.304
22	818	0.023	0.079	818	Full	No	4.167	0
23	816.273	0.017	0.06	810.656	Not Full	No	-0.511	5.617
24	810	0.002	0.009	809.374	Not Full	No	-0.493	0.626
25	812.547	0.003	0.012	811.071	Not Full	No	-0.595	1.475
26	810	0.035	0.118	807.977	Not Full	No	-0.389	2.023
27	760	0.06	0.191	749.228	Not Full	No	-0.139	10.772
29	760.946	0.004	0.018	751.147	Not Full	No	-0.52	9.799
30	764.518	0.004	0.018	754.137	Not Full	No	-0.529	10.38
31	770	0.002	0.01	764.291	Not Full	No	3.625	5.709
32	770	0.005	0.019	760.485	Not Full	No	-0.581	9.515
34	767.515	0.003	0.013	758.617	Not Full	No	-0.55	8.898
35	768	0.003	0.013	760.201	Not Full	No	-0.566	7.799
36	769.536	0.003	0.013	761.774	Not Full	No	-0.593	7.762
37	820	0.013	0.05	815.844	Not Full	No	-0.522	4.156
38	820	0.001	0.003	814.845	Not Full	No	-0.522	5.155
39	820	0.002	0.009	814.141	Not Full	No	-0.526	5.859
40	815.188	0.001	0.006	811.554	Not Full	No	-0.512	3.634
41	818.593	0	0.002	812.59	Not Full	No	-0.576	6.002
42	820	0	0.001	813.187	Not Full	No	-0.58	6.813
43	820	0	0.002	813.957	Not Full	No	-0.609	6.043
44	820	0.003	0.012	815.449	Not Full	No	-0.618	4.551
45	820	0.001	0.005	813.965	Not Full	No	-0.602	6.035
46	815.964	0.003	0.012	808.964	Not Full	No	-0.503	7
47	819.261	0.002	0.009	806.076	Not Full	No	-0.49	13.185

48	812.164	0.002	0.01	807.664 Not Full	No	-0.603	4.5	
49	836.378	0	0.002	826.025 Not Full	No	-0.641	10.352	
50	826.443	0	0.002	820.991 Not Full	Yes	-0.576	5.452	
51	832.898	0	0.001	826.957 Not Full	No	-0.61	5.941	
52	836.402	0	0.001	830.156 Not Full	No	-0.611	6.247	
53	836.235	0.001	0.003	834.354 Not Full	No	-0.613	1.881	
54	841.564	0.003	0.013	835.059 Not Full	No	-0.607	6.505	
55	840	0	0.002	819.898 Not Full	Yes	-0.569	20.102	
56	850	0.001	0.003	839.02 Not Full	No	-0.647	10.98	
57	840	0	0.001	818.6 Not Full	No	-0.566	21.4	
58	850	0.001	0.003	840.026 Not Full	No	-0.641	9.974	
59	849.487	0.001	0.005	835.741 Not Full	No	-0.626	13.746	
60	843.253	0.001	0.006	829.852 Not Full	No	-0.615	13.401	
61	841.529	0.001	0.004	826.958 Not Full	No	-0.609	14.571	
62	841.446	0.001	0.003	822.962 Not Full	No	-0.605	18.484	
63	837.029	0	0.002	819.162 Not Full	No	-0.605	17.867	
64	837.799	0	0.001	817.904 Not Full	No	-0.563	19.895	
65	864.088	0	0.002	855.328 Not Full	No	-0.638	8.759	
66	860	0.001	0.004	853.747 Not Full	No	-0.619	6.253	
67	862.952	0.002	0.011	855.654 Not Full	No	-0.613	7.298	
68	860	0.001	0.003	852.575 Not Full	Yes	-0.592	7.425	
69	856.185	0	0.001	849.448 Not Full	No	-0.619	6.737	
70	848.023	0	0.002	841.35 Not Full	No	-0.617	6.673	
71	840	0.001	0.004	825.471 Not Full	No	-0.596	14.529	
72	829.491	0.001	0.005	818.376 Not Full	No	-0.59	11.115	
73	833.619	0	0.002	827.616 Not Full	No	-0.651	6.003	
74	820	0.001	0.005	815.113 Not Full	Yes	-0.554	4.887	
75	820	0.001	0.003	813.267 Not Full	Yes	-0.5	6.733	
76	840	0	0.002	830.017 Not Full	No	-0.649	9.983	
77	820	0	0.002	811.97 Not Full	Yes	-0.497	8.03	
78	820	0	0.001	811.67 Not Full	No	-0.496	8.33	
79	820	0	0.001	810.37 Not Full	No	-0.497	9.63	
80	816.389	0	0	809.45 Not Full	No	-0.516	6.939	
81	824.315	0	0.002	817.831 Not Full	No	-0.636	6.484	
82	830	0	0.001	817.029 Not Full	No	-0.638	12.971	
83	829.557	0	0.002	818.133 Not Full	No	-0.634	11.425	
84	819.881	0	0.001	806.947 Not Full	No	-0.519	12.934	
85	815.552	0	0.002	803.548 Not Full	No	-0.518	12.003	
86	814.842	0	0.003	800.046 Not Full	No	-0.521	14.796	
87	844.047	0	0.002	834.018 Not Full	No	-0.649	10.028	
88	833.26	0.001	0.003	823.025 Not Full	No	-0.642	10.236	
89	825.496	0	0.002	815.034 Not Full	No	-0.633	10.462	
90	822.886	0	0.002	812.043 Not Full	No	-0.623	10.843	
91	835.856	0	0.001	825.018 Not Full	No	-0.649	10.838	
92	832.265	0	0.001	822.02 Not Full	No	-0.646	10.245	
93	828.425	0.001	0.003	818.028 Not Full	No	-0.639	10.397	
94	864.2	0	0.001	851.72 Not Full	No	-0.647	12.48	

95	867.654	0	0.002	850.934 Not Full	No	-0.632	16.719	
96	861.704	0	0.002	850.023 Not Full	No	-0.644	11.681	
97	845.698	0	0.002	835.631 Not Full	No	-0.636	10.067	
98	844.826	0	0.001	835.033 Not Full	No	-0.634	9.793	
99	865.019	0	0.001	855.013 Not Full	No	-0.654	10.006	
100	840	0	0.002	830.043 Not Full	No	-0.623	9.957	
101	840	0	0.001	826.066 Not Full	No	-0.601	13.934	
102	870	0	0.002	860.021 Not Full	No	-0.646	9.979	
103	868.219	0	0.001	855.022 Not Full	No	-0.645	13.198	
104	860.408	0	0.001	850.027 Not Full	No	-0.64	10.381	
105	857.102	0	0.001	847.026 Not Full	No	-0.641	10.075	
106	853.46	0	0.001	843.032 Not Full	No	-0.635	10.428	
107	870	0	0.001	860.02 Not Full	No	-0.647	9.98	
108	867.954	0	0.001	858.014 Not Full	No	-0.653	9.94	
109	866.887	0	0.001	852.02 Not Full	No	-0.646	14.867	
110	863.26	0	0.001	850.021 Not Full	No	-0.646	13.239	
111	842.541	0	0.001	834.439 Not Full	Yes	-0.627	8.102	
112	856.209	0	0.001	850.015 Not Full	No	-0.652	6.195	
113	850	0	0.001	840.039 Not Full	No	-0.628	9.961	
114	844.516	0.001	0.003	834.054 Not Full	No	-0.613	10.462	
115	840	0	0.001	830.043 Not Full	No	-0.624	9.957	
116	833.66	0	0.002	822.567 Not Full	No	-0.599	11.093	
117	830.645	0	0.002	820.167 Not Full	No	-0.6	10.478	
118	819.91	0.001	0.004	810.065 Not Full	No	-0.602	9.845	
119	805.003	0.001	0.004	797.642 Not Full	No	-0.625	7.361	
120	802.076	0.012	0.044	797.337 Not Full	No	-0.53	4.739	
121	805.637	0.007	0.027	794.767 Not Full	No	-0.499	10.87	
122	861.89	0	0.002	850.027 Not Full	No	-0.639	11.863	
123	860.783	0	0.002	848.023 Not Full	No	-0.643	12.76	
124	852.271	0	0.002	840.03 Not Full	No	-0.636	12.24	
125	837.04	0.001	0.003	829.031 Not Full	No	-0.636	8.009	
126	838.974	0	0.001	828.061 Not Full	Yes	-0.606	10.913	
127	839.721	0	0.001	827.056 Not Full	No	-0.611	12.665	
128	844.232	0	0.002	826.049 Not Full	No	-0.618	18.183	
129	828.475	0.001	0.005	818.048 Not Full	No	-0.619	10.427	
130	824.629	0	0.002	814.057 Not Full	No	-0.61	10.572	
131	851.033	0.001	0.006	840.034 Not Full	No	-0.633	10.999	
132	841.202	0.001	0.003	830.035 Not Full	No	-0.632	11.167	
133	823.242	0	0.001	813.069 Not Full	No	-0.598	10.174	
134	832.363	0.001	0.004	822.025 Not Full	No	-0.642	10.338	
135	819.997	0	0.002	810.064 Not Full	No	-0.603	9.933	
136	815.207	0	0.001	804.364 Not Full	No	-0.603	10.843	
137	803.943	0.001	0.003	794.312 Not Full	Yes	-0.554	9.63	
138	802.426	0	0.001	793.533 Not Full	Yes	-0.434	8.893	
139	818.184	0.001	0.005	808.038 Not Full	No	-0.629	10.146	
140	815.888	0.001	0.005	805.035 Not Full	No	-0.632	10.853	
141	809.941	0	0.001	797.567 Not Full	Yes	-0.6	12.374	

142	807.964	0.001	0.004	795.876 Not Full	No	-0.591	12.088
143	808.572	0	0.002	798.022 Not Full	No	-0.645	10.55
144	804.445	0	0.001	794.183 Not Full	Yes	-0.584	10.262
145	800	0	0.001	792.249 Not Full	No	-0.418	7.751
146	836.873	0.001	0.006	826.03 Not Full	No	-0.636	10.842
147	823.921	0.001	0.003	811.759 Not Full	Yes	-0.608	12.163
148	858.667	0.009	0.034	849.466 Not Full	No	-0.601	9.201
149	844.033	0.001	0.006	834.064 Not Full	No	-0.602	9.968
150	820	0	0.002	811.036 Not Full	Yes	-0.531	8.964
151	820	0.001	0.004	810.138 Not Full	No	-0.529	9.862
152	830.035	0.001	0.004	820.028 Not Full	No	-0.638	10.006
153	850.165	0.006	0.024	840.057 Not Full	No	-0.61	10.109
154	840	0.001	0.007	827.013 Not Full	Yes	-0.554	12.987
155	855.296	0	0.002	845.016 Not Full	No	-0.65	10.28
156	830	0.001	0.004	825.72 Not Full	No	-0.547	4.28
157	852.474	0.001	0.003	842.018 Not Full	No	-0.648	10.455
158	843.866	0	0.002	833.023 Not Full	No	-0.644	10.843
159	834.396	0	0.001	825.064 Not Full	No	-0.602	9.331
160	831.024	0.001	0.003	820.083 Not Full	No	-0.583	10.941
161	852.492	0.003	0.012	840.036 Not Full	No	-0.631	12.456
162	814.912	0.002	0.01	805.183 Not Full	Yes	-0.484	9.729
163	810.553	0.001	0.006	800.112 Not Full	No	-0.555	10.441
164	860.529	0.001	0.003	850.022 Not Full	No	-0.645	10.507
165	846.723	0.001	0.004	838.354 Not Full	Yes	-0.613	8.369
166	854.79	0.001	0.003	836.863 Not Full	No	-0.603	17.927
167	851.534	0	0.002	835.566 Not Full	No	-0.6	15.968
168	850	0	0.002	835.04 Not Full	No	-0.626	14.96
169	829.653	0.001	0.003	819.045 Not Full	No	-0.621	10.608
170	809.77	0	0.002	802.385 Not Full	Yes	-0.582	7.385
171	809.174	0	0.001	801.985 Not Full	No	-0.582	7.189
172	810	0	0.001	801.387 Not Full	No	-0.579	8.613
173	809.525	0.001	0.004	799.994 Not Full	No	-0.573	9.531
174	808.987	0.001	0.004	798.599 Not Full	No	-0.568	10.389
175	849.201	0.001	0.004	839.242 Not Full	No	-0.625	9.959
176	847.063	0.001	0.003	837.028 Not Full	No	-0.639	10.035
177	827.817	0	0.002	811.067 Not Full	Yes	-0.599	16.75
178	820	0	0.001	810.47 Not Full	No	-0.597	9.53
179	830.702	0	0.002	820.018 Not Full	No	-0.648	10.683
180	820	0	0.001	811.64 Not Full	Yes	-0.626	8.36
181	833.135	0	0.001	823.011 Not Full	No	-0.655	10.124
182	825.016	0	0.002	818.632 Not Full	No	-0.634	6.383
183	828.382	0.001	0.003	817.932 Not Full	No	-0.635	10.45
184	819.748	0.001	0.004	809.666 Not Full	No	-0.6	10.082
185	857.016	0.001	0.003	851.027 Not Full	No	-0.64	5.989
186	850	0.001	0.003	845.041 Not Full	No	-0.625	4.959
187	857.958	0.008	0.033	851.063 Not Full	No	-0.604	6.895
188	850.959	0.004	0.017	840.075 Not Full	No	-0.592	10.885

189	832.202	0.002	0.011	820.1 Not Full	No	-0.567	12.102
190	820.133	0.003	0.012	809.367 Not Full	Yes	-0.5	10.766
191	813.8	0.018	0.064	808.322 Not Full	No	-0.444	5.478
192	815.585	0.002	0.01	807.531 Not Full	No	-0.435	8.054
193	834.555	0.001	0.004	824.021 Not Full	No	-0.646	10.534
194	821.285	0.003	0.012	806.141 Not Full	Yes	-0.425	15.144
195	818.698	0.002	0.009	805.047 Not Full	No	-0.42	13.651
196	809.264	0.001	0.003	802.851 Not Full	No	-0.415	6.413
197	836.306	0.001	0.003	826.021 Not Full	No	-0.646	10.285
198	810.436	0.001	0.005	803.355 Not Full	Yes	-0.612	7.081
199	806.74	0.002	0.009	801.851 Not Full	No	-0.416	4.889
200	804.911	0	0.002	801.061 Not Full	Yes	-0.405	3.849
201	805.44	0	0.002	797.971 Not Full	No	-0.396	7.469
202	804.209	0	0.001	794.569 Not Full	No	-0.398	9.64
203	801.753	0	0.001	793.373 Not Full	No	-0.393	8.38
204	799.065	0.011	0.04	789.628 Not Full	No	-0.538	9.437
205	801.341	0.001	0.004	788.431 Not Full	No	-0.535	12.91
206	800	0.002	0.007	786.863 Not Full	No	-0.404	13.137
207	800	0.002	0.01	786.433 Not Full	No	-0.201	13.567

2039 OUTPAUL

ID Flow (mgd) Grade (ft) 1 1.069 750.748

2039 PUMP REPORT

ID	From ID	To ID	Flow (mgd)	Head Increase (ft)	Power (hp)	Usage	Speed
5000	9000	33	0.432	11.327	0.858	1	1
5002	9014	28	0.432	81.186	6.153	1	1

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BUILDOUT FORCE MAIN REPORT

				Diameter		Total Flow	Peakable		
ID	From ID	То	ID	(in)	Length (ft)	(mgd)	Flow (mgd)	Velocity (ft	Headloss (ft)
433		33	31	6	467.78	0.035	0.009	3.402	3.727
435		28	22.00	6	2,093.99	0.26	0.085	3.402	16.686

		ted	ity (ft/s) 3.187	11.486	11.552 2.846	2.83	2.821	2.811	2.801	2.66	2.246	2.233	2.224	CT 2.2	2.179	2.133	1.971	2.317	2.1/6	1 488	1.581	1.381	0.894	0.845	0.382	2.184	0.084	1.332	1.146	0.946	1.379	1.424	0.869	0.995	0.968	0.709	0.873	7 200	0.446	0.941	0.528	1.855	2.476	7.4/1 2 E01	106.2	0.608
		Adjus	 Veloc 788 	284	283 333	333	833	833	833	833 833	833	833	833	833	833	833	678	573).4 <i>1</i> 833	156	176	375	073	667	667	118	667	117	101	074	144	.145 210	105	057	049	049	065	27.0	101	514	035	109	093	.093 200	144	034
		Adjusted	Depth (ft. 0.7	0.2	0.0	0.0	0.5	0.8	0.0	3.0	0.8	0.8	0.0	0.0	0.0	0.8	0.0	0		o c	0	0	0.0	0.0	00	5 6	ö	0	0	0	0.0	0 0	i o	0	0	ō	o, ,		d c	0	0	ö	0 0		с с	; 0
		Backwater	Adjustment	No	No Yes	Yes	Yes	Yes	Yes Voc	Yes	l Yes) Yes) Yes	Yes) Yes) Yes) Yes	O NO) Yes Vec) Yes) Yes) Yes) Yes) Yes) Yes	0 No	O NO	0 No	O No	ON O) Yes	0 No	O No	O NO	0 No		Vec) Yes) Yes	O NO	O No	ON O		D Yes
		Coverage	Count	0	0 0	00	0	0	00			0	0.0			0	0				, 0	U	0	U			, 0	0	0	0	0			0	0	0	0.				U	U				, 0
		ull Flow	mgd) 1.42	7.743	7.811	0.747	0.76	0.786	0.753	2.456	0.768	0.767	0.729	0.757	0.742	0.742	0.752	0.732	0./38 2 504	0 498	0.503	0.499	0.495	0.506	0.811	0.770	0.538	0.53	0.498	0.498	0.483	0.497	0.504	0.615	0.663	0.486	0.499	7130	0.0499	0.646	0.879	0.768	1.134	/7T.I	0 499 D	1.716
		Froude F	Number (1 0.623	4.486	4.525 0.549	0.546	0.545	0.543	0.541	2.201	0.434	0.431	0.429	0.426	0.421	0.412	0.586	0.567	0.626	0.791	0.802	0.784	0.734	0.793	1.284	1.347	0.814	0.825	0.766	0.741	0.764	0.787	0.766	0.887	0.937	0.686	0.731	c0.1	CU.1	1.028	1.131	1.19	1.729	12/.1	L./35	2.121
		iritical	epth (ft) 0.622	0.62	0.62	0.479	0.483	0.492	0.481	0.539	0.486	0.486	0.473	0.40	0.478	0.478	0.429	0.427	0.366	0 138	0.155	0.244	0.061	0.251	0.167	751.0	0.077	0.106	0.088	0.064	0.126	0.128	0.079	0.054	0.047	0.04	0.055	977.0	0.055	0.241	0.027	0.119	0.122	0.123	0.128	0.029
		Vater C	epth (ft) D 0.788	0.284	0.283 0.833	0.833	0.833	0.833	0.833	0.357	0.833	0.833	0.833	0.833	0.833	0.833	0.567	0.573	0.467	0.156	0.174	0.277	0.071	0.283	0.147	0.118	0.085	0.117	0.101	0.074	0.144	0.145	0.09	0.057	0.049	0.049	0.065	77.0	0.064	0.237	0.025	0.109	0.093	0.093	0.144	0.02
		<pre></pre>	q/Q D/g	t 0.176	3 0.174 1 1 375	1 1.334	1 1.309	1 1.261	1 1.312	0.382	1 1.031	1 1.027	1 1.075	1 1.033	1 1.035	1 1.013	8 0.806	8 0.818	1 0.605 8 0.177	0 1 1 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2	1 0.149	6 0.362	7 0.024	5 0.376	2 0.106	0.068	8 0.035	5 0.067	1 0.049	1 0.026	6 0.103	7 0.104	6 0.04	6 0.015	3 0.011	3 0.011	7 0.02	1 U.235	5 0.019	6 0.271	8 0.003	4 0.058	9 0.041	4 0.042	L U.U45	9 0.002
		ity	d/D 187 0.788	486 0.284	552 0.283 846	. 83	821	811	801	498 0.429	246	233	224	505	179	133	372 0.6	317 0.68	192 0.56	488 D 73,	601 0.26	034 0.41	919 0.10	085 0.42	2.34 0.2	07.0 0CT	118 0.12	332 0.17	146 0.15	946 0.11	379 0.21	424 0.21	084 0.13	995 0.08	968 0.07	70.0 0.07	873 0.09	38/ U.33	864 0 009	437 0.35	0.84 0.03	855 0.16	476 0.13	4// 0.1 F01 0.14	41.0 102.	379 0.02
		Veloci	e (#/s) e 3.1	e 11.4	e 11.5	1	1 2.8	l 2.8	1 2.8	9.0	1 2.1	1 2.	5.7		1 2.	J 2.	e 2.	.e 2.	5 2.	ή 1, -	ы . 1.	ce 2.1	.0.	ce 2.1	е с е с	ъ ч с	се с 1 г	.1.	.e	.0.	. 1.	- 1. - 1.	се и 1. г	.0	.0	ce O	се о	2 C		ce 2.	e G	ce 1.	ce 2.	се 2.		. I.
		ן 1 1	gd) Flow Type).537 Free Surfac).535 Free Surfac).534 Free Surfac 381 Pressurized	0.378 Pressurized	0.377 Pressurized	0.375 Pressurized	0.374 Pressurized	0.353 Pressurized	0.293 Pressurized	0.291 Pressurized	0.289 Pressurized	0.287 Pressurized	0.283 Pressurized	0.276 Pressurized	0.217 Free Surfac	0.215 Free Surfac	0.155 Free Surfac	0.017 Free Surfac	0.021 Free Surfac	0.057 Free Surfac	0.003 Free Surfac	0.06 Free Surfac	0.025 Free Surfac	0.016 Free Surfac	0.005 Free Surfac	0.009 Free Surfac	0.006 Free Surfac	0.003 Free Surfac	0.013 Free Surfac	0.014 Free Surfac	0.005 Free Surfac	0.002 Free Surfac	0.002 Free Surfac	0.001 Free Surfac	0.002 Free Surfac	0.048 Free Surfac	0.007 Free Surfac	0.055 Free Surfac	0 Free Surfa	0.012 Free Surfac	0.013 Free Surfac	0.013 Free Surfac	0.013 Free Surfac	0.001 Free Surfac
		Peakable	How (m	. 0			4	1		0 00	5	7 0	4,			2 (9	6	9 0 9 0	n u	о го 0	1	2	Ę	9,0	7 0	הס	5	5	3	ъ.		0 0	0	1	5	ਦ :	0 0	2 5	9	12	Š	5	xo c	2.2	1 10
		ital Flow	1.36	1.36	1.36	66.0	0.99	0.99	0.98	0.93	0.79	0.78	0.78	0.77	0.76	0.75	0.60	0.59	0.44		0.07	0.18	0.01	0.19	0.08	0.05	0.01	0.03	0.02	0.01	0.0	0.05	0.0	0.00	0.00	0.00	0.0	ST.0	0.0	0.17	0.00	0.04	0.04	0.04	0.04 0.0	0.0
500	v	τ,	n) 0.004	0.112	0.114	0.003	0.003	0.003	0.003	0.03	0.003	0.003	0.003	500.0	0.003	0.003	0.003	0.003	0.003	TC0.0	0.004	0.004	0.004	0.004	0.011	10.0	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.006	0.007	0.004	0.004	100.0	0.004	0.007	0.013	0.01	0.021	170.0		0.048
126	MAN	ī) Slope 12	27	43 18	85	35	3	45	77	48	62	27	11 04	45	78	48	78	64 83	C0 78	92	61	64	33	86	00 25	05	98	62	62	18	94	01	56	25	77	02	10	43	32	.66	33	32	11/	13	56
50	JER.		Length (ft) 317.1	128.0	131.94	216.48	454.23	326	320.3	70.1	341.9	308.5	265.3	4774	402.5	365.8	356.9	300.7	296.0	1.212	339.2	541.4	425.3	383.0	363.2	485 D	63.5	87.3	371.1	371.1	236.6	148.7	241.8	113.5	195.2	364.1	172.3	3010	394.4	352.1	397.2	62.4	195.6	149.6	201.2	397.9
UILD	SEL	meter	17	12	12 1	10	10	10	10	10	10	10	10	01	10	10	10	10	10	ol «	00	00	∞	00	00 O	0 00	000	∞	00	00	00 0	00 0	00 00	80	80	00	00 0	o o	0 00	8	8	00	00 0	xo o	io o) 00
20	45	Dia	To ID (in, 1	2	307	о 2	9	7	∞ α	ب 10	11	12	13	15 ¹⁴	16	17	18	19	20	77	26	20	24	9014	9014 20	67 08	31	0006	34	35	38	39	6 4 0	42	43	45	42	46	47	18	50	53	22	51	у К	3 23
-un	SPAN	:	From ID	I M	4 v	9	7	∞	9 6	11	12	13	14	ст 16	17	18	19	20	21	22	24	26	25	27	29	00 15	32	34	35	36	37	38	41	43	44	44	45	40	48	47	49	54	53	52	TC U	56
And and	0		0	2	с 4	- n	9	2	∞ 0	10 4	11	12	13	4 Ľ	16	17	18	19	20	17	23	24	25	26	27	67	30	31	32	33	34	35	37	38	39	40	41	42	44	45	46	47	48	49	у С	52

1.444	1.423	0.991	1.333	1.56	1.654	1./39	1.98 1.98	0.503	0.639	2.238	1.956	3.919	3.905	0.185	0.147	2.608	2.618	1.05 1.05	0117	1.948	1.941	1.972	2.355	0.544	0.554	0.377	2.538	2.539	0.862	1.156	1.491	1.32	1.119	1.549	0.403	0.578	1.621	0.527	1.524	1.189	1.375	0.642	0.864	9.0	1.279	0.035	0.55 1 553	500.0	1.228
0.148	0.151	0.026	0.041	0.052	0.058	0.062	0.143	0.028	0.051	0.134	0.156	0.096	0.098	0.024	0.054	0.132	0.135	0.193	102.0	0.253	0.254	0.252	0.222	0.031	0.033	0.071	0.213	0.214	0.018	0.02	0.028	0.018	0.025	0.034	0.02	0.034	0.023	0.031	0.033	0.013	0.043	0.02	0.014	0.02	0.021	0.039	0.015	5TD.D	0.022
0 No	0 Yes	0 Ves	0 No	0 Yes	O No	0 No	0 No	0 No	0 Yes	0 Yes	0 No	0 No				0 NO	0 No	0 No	0 No	0 No	0 Yes	0 No	0 No	0 No	0 No	0 No	0 No	0 N0		0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No				0 No					
0.497	0.485	1.021	1.024	1.031	1.019	1.032	20.1 0.777	0.49	0.505	0.817	0.656	1.751	1.73	0.491	1.306	0.961	0.952	0.492	1 605	500.1	0.497	0.507	0.648	0.503	0.492	1.372	0.712	0.711	1.143	1.396	1.464	1.731	1.193	1.353	0.493	0.497	1.833	0.486	1.344	1.941	1.02	0.79	1.331	1.093	1.515	0.504	112.1	2.348	1.434
0.788	0.769	1.319	1.412	1.468	1.472	1.503	1.274	0.641	0.71	1.287	1.041	2.681	2.653	0.587	1.562	1.512	1.499	C8/.0	1 945	CPC.1	0.787	0.803	1.033	0.666	0.658	1.8	1.136	1.134	1.392	1.738	1.911	2.114	1.529	1.814	0.617	0.668	2.317	0.644	1.798	2.25	1.418	0.979	1.564	1.358	1.894	1.69.U	۲//.T ۲۲۲ د	1///7	с с 4.т. 1.799
0.131	0.132	0.03	0.049	0.063	0.07	0.076	0.0/8	0.023	0.04	0.153	0.159	0.159	0.161	0.012	0.02	0.163	0.167	0.1/ 0	C22.0	0.274	0.225	0.225	0.225	0.025	0.027	0.039	0.228	0.229	0.021	0.027	0.039	0.026	0.031	0.045	0.016	0.028	0.035	0.025	0.045	0.019	0.052	0.02	0.018	0.024	0.029	0.035	410.0 ACO A	0.024	czu.u 0.029
0.148	0.151	0.026	0.041	0.052	0.058	0.062	0.136	0.028	0.047	0.134	0.156	0.096	0.098	0.016	0.016	0.132	0.135	0.193	1020	0.253	0.254	0.252	0.222	0.031	0.033	0.029	0.213	0.214	0.018	0.02	0.028	0.018	0.025	0.034	0.07	0.034	0.023	0.031	0.033	0.013	0.043	0.02	0.014	0.02	0.021	0.039	0.014	210.0	0.022
1.444 0.222 0.109	1.423 0.226 0.112	0.991 0.039 0.003	1.333 0.061 0.007	1.56 0.078 0.012	1.654 0.087 0.015	1.745 0.092 0.018	1.832 0.093 0.018 2 139 0 204 0 091	0.503 0.043 0.003	0.722 0.071 0.01	2.238 0.201 0.089	1.956 0.233 0.119	3.919 0.145 0.045	3.905 0.146 0.046	0.344 0.024 0.001	0.914 0.024 0.001	2.608 0.198 0.086	2.618 0.203 0.09	1.658 0.289 0.182 1.05 0.275 0.201	TOCO 0/CO CCT	1 948 0 38 0 307	1.941 0.381 0.309	1.972 0.378 0.304	2.355 0.332 0.239	0.544 0.046 0.004	0.554 0.049 0.005	1.426 0.043 0.004	2.538 0.32 0.222	2.539 0.322 0.224	0.862 0.027 0.001	1.156 0.031 0.002	1.491 0.042 0.003	1.32 0.027 0.001	1.119 0.037 0.003	1.549 0.05 0.005	0.00.0 200.0 266.1	0.578 0.052 0.005	1.621 0.034 0.002	0.527 0.046 0.004	1.524 0.05 0.005	1.189 0.019 0.001	1.375 0.065 0.008	0.642 0.03 0.002	0.864 0.021 0.001	0.9 0.03 0.002	1.279 0.032 0.002	0.639 U.U9 24U.U 24U.U	1000 CCC C 23 5	100.0 220.0 566.1	1.228 0.032 0.002
0.015 Free Surface	0.015 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.005 Free Surface	0 Free Surface	0.001 Free Surface	0.021 Free Surface	0.022 Free Surface	0.023 Free Surface	0.023 Free Surface	0 Free Surface	0 Free Surface	0.024 Free Surface	0.025 Free Surface	0.026 Free Surface	0.047 Free Surface	0 047 Free Surface	0.047 Free Surface	0.048 Free Surface	0.048 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.049 Free Surface	0.049 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.003 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0 Free Surface	0.002 Free Surface	0 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface	0 Free Surface	U Free Surface 0.001 Free Surface
0.054	0.055	0.003	0.008	0.013	0.016	0.018	0.019	0.002	0.005	0.073	0.078	0.079	0.08	0	0.001	0.083	0.086	0.09		0.002	0 154	0.154	0.154	0.002	0.002	0.005	0.158	0.159	0.001	0.002	0.005	0.002	0.003	0.007	7TU.U	0.003	0.004	0.002	0.006	0.001	0.009	0.001	0.001	0.002	0.003	0.003	100.0	200.0	0.003
0.004	0.004	0.017	0.017	0.017	0.017	0.017	0.019 10.0	0.004	0.004	0.011	0.007	0.05	0.049	0.004	0.028	0.015	0.015	0.004	0.004	7000	0.004	0.004	0.007	0.004	0.004	0.031	0.008	0.008	0.021	0.032	0.035	0.049	0.023	0.03	0.004	0.004	0.055	0.004	0.029	0.061	0.017	0.01	0.029	0.019	0.037	0.004	0.037	60.0	0.034
297.517	156.441	246.976	339.135	161.42	230.204	218.731	63.095 467 773	383,205	264.797	275.324	427.97	160.05	323.635	534.984	449.724	464.538	216.582	456.072	910 LCV		797 755	190.799	350.787	169.341	252.812	329.037	399.213	412.712	136.11	122.633	168.858	386.658	340.288	97.09	176 786	198.851	271.916	129.806	166.297	405.195	229.643	186.72	204.095	97.574	414.07	72.565	212.221	110.124	209.484 146.155
∞	80	8	∞	80	∞	∞ (x	0 00	00	00	8	∞	8	80	80	80	80	× 00	0 0	0 0	οα	00	00	80	8	8	80	∞	∞	∞	∞	80	00	∞ 0	×	∞	∞	80	80	∞	∞	80	8	∞ •	00 (xx c	xx c	× 0	x x
57	64	59	60	61	62	63	64 75	99	68	68	69	70	71	71	74	72	74	55 F		18	0,	80	84	82	82	84	85	86	92	93	06	68	68	06	80 95	96	98	98	100	100	101	108	109	110	111	114	112	113	104
55	57	58	59	60	61	62	63 64	59	<u>66</u>	67	68	69	70	73	73	71	72	74	C/ 2L	0, 11	78	62	80	81	83	82	84	85	91	92	93	87	88	89	06 70	95	96	67	98	66	100	107	108	109	110	111	108	112	103 103
53	54	55	56	57	58	59	60	5	63	64	65	99	67	68	69	70	71	72	C/	4	26	12	78	79	80	81	82	83	84	85	86	87	80	68	06 19	92	93	94	95	96	97	98	66	100	101	102	103	104	105

1.255	1.604	1.463	1.495	1.487	2.214	1 917	2.061	1.819	0.906	0.64	0.205	0.302	0.742	1.62	1.615	0.686	0.872	1.097	1.534	2:093	T0/.T	1.9/3	1.4/	1.963 I.903	C7C.T	2.574	0.756	2.064	1.02	2.088	0.894	0.98	1.099	0.505	1.626	3.784	4.307	1.679	0.371	2.65	1.429	1.233	1.568	1.504	1.611	4.198	2.989	3.027	0.031 2.331
0.027	0.026	0.032	0.039	0.054	0.043	0.067	0.067	0.078	0.58	0.042	0.667	0.667	0.027	0.023	0.03	0.031	0.061	0.056	0.049	0.048	1.0.0	90.0 2002	0.034	0.035	C20.0	0.064	0.156	0.299	0.038	0.035	0.067	0.076	0.022	0.135	0.03	2000	0.092	0.188	0.06	0.057	0.016	0.113	0.179	0.018	0.023	0.092	0.119	0.191	0.246
0 No		0 No	0 Yes	0 Yes	0 No	0 Yes	0 Yes	0 No	0 No	0 No	0 No	0 No	0 No	0 N0	O NO	O NO	0 NO	O NO			ON O	0 Yes	0 No	0 No	0 Yes	0 NO	0 No	0 No	0 No	0 Yes	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	U Yes O No									
1.279	1.655	1.315	1.186	0.956	1.647	1 071	1.156	1.379	1.043	0.484	0.499	0.494	0.744	1.788	1.504	0.633	0.52	0.69	1.051	1.449	660'T	1.088	1.28/	1.68	1.403	1.485	0.49	0.488	0.821	1.777	0.503	0.507	1.271	0.502	1.516	1.686	1.984	0.506	1.086	1.655	2.001	0.501	0.484	1.949	1.798	1.924	1.176	0.902	21.2 0.607
1.656	2.137	1.752	1.624	1.368	2.288	1 576	1.701	2.021	1.666	0.67	0.786	0.787	0.966	2.273	1.988	0.839	0.756	0.992	1.485	2.043	1.583	1.6U5	1./25	2.263	000 T	671.2 7.173	0.762	0.76	1.121	2.396	0.739	0.757	1.598	0.757	2.003	2.584	3.024	0.807	1.42	2.384	2.406	0.778	0.772	2.386	2.28	2.934	1.835	1.44	0.963 cos
0.034	0.038	0.043	0.05	0.063	0.065	0.085	0.088	0.092	0.25	0.034	0.121	0.148	0.027	0.035	0.043	0.028	0.053	0.056	0.06	0.069	1/0.0	0.087	0.044	250.0	400.0	0.095	0.098	0.26	0.04	0.054	0.057	0.066	0.028	0.072	0.043	0.157	0.161	0.168	0.034	0.088	0.025	0.099	0.157	0.028	0.035	0.16	0.162	0.231	0.241
0.027	0.026	0.032	0.039	0.054	0.043	0.067	0.067	0.065	0.192	0.042	0.137	0.167	0.027	0.023	0.03	0.031	0.061	0.056	0.049	0.048	140.0	0.069	0.034	0.035	C20.0	0.064	0.112	0.299	0.038	0.035	0.067	0.076	0.022	0.083	0.03	760'0	0.092	0.188	0.028	0.057	0.016	0.113	0.179	0.018	0.023	0.092	0.119	0.191	0.246
1.255 0.04 0.003	1.604 0.039 0.003	1.463 0.048 0.004	1.495 0.059 0.007	1.487 0.081 0.013	2.214 0.065 0.008	1.858 U.U98 U.U 848.1	2.061 0.1 0.021	2.407 0.097 0.02	3.509 0.288 0.181	0.64 0.063 0.008	1.382 0.206 0.093	1.538 0.251 0.138	0.742 0.041 0.003	1.62 0.035 0.002	1.615 0.046 0.004	0.686 0.046 0.004	0.872 0.091 0.017	1.097 0.084 0.014	1.534 0.073 0.011	2.093 0.0/2 0.011	210.0 280.0 19/.1	1.9/3 0.103 0.022	1.47 0.05 0.005	1.963 0.052 0.005 1.270 0.027 0.005	1.329 U.U3/ U.U3	2.523 0.096 0.019 2.574 0.096 0.019	1.207 0.169 0.062	2.064 0.449 0.415	1.02 0.057 0.006	2.088 0.052 0.005	0.894 0.1 0.021	0.98 0.114 0.027	1.099 0.033 0.002	1.024 0.124 0.033	1.626 0.046 0.004	3.784 0.145 0.045	4.307 0.137 0.041	1.679 0.282 0.173	1.115 0.043 0.003	2.65 0.085 0.015	1.429 0.025 0.001	1.233 0.169 0.062	1.568 0.269 0.158	1.504 0.028 0.001	1.611 0.035 0.002	4.198 0.139 0.041	2.989 0.178 0.069	3.027 0.287 0.179	2.331 0.369 0.291
0.001 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0.003 Free Surface	0.005 Free Surface	0.006 Free Surface	0.007 Free Surface	0.059 Free Surface	0.001 Free Surface	0.012 Free Surface	0.019 Pressurized	0 Free Surface	0.001 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.006 Free Surface	0.001 Free Surface	0.002 Free Surface	0.001 Free Surface	0.007 Free Surface	0.008 Free Surface	0.064 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0 Free Surface	0.004 Free Surface	0.001 Free Surface	0.022 Free Surface	0.023 Free Surface	0.025 Free Surface	0.001 Free Surface	0.006 Free Surface	0 Free Surface	0.008 Free Surface	0.022 Free Surface	0.001 Free Surface	0.001 Free Surface	0.023 Free Surface	0.023 Free Surface	0.05 Free Surface	0.003 Free Surface 0.055 Free Surface
0.004	0.005	0.006	0.008	0.013	0.014	120.0	0.024	0.027	0.189	0.004	0.046	0.068	0.002	0.004	0.006	0.003	0.009	0.01	0.011	0.015	0.016	0.024	0.006	00.00	0.004	0.028	0.03	0.203	0.005	0.009	0.011	0.014	0.002	0.017	0.006	0.077	0.081	0.088	0.004	0.024	0.002	0.031	0.077	0.003	0.004	0.079	0.081	0.162	0.176 0.176
0.027	0.045	0.028	0.023	0.015	0.044	0.018	6T0.0	0.031	0.018	0.004	0.004	0.004	0.009	0.052	0.037	0.007	0.004	0.008	0.018	0.034	0.02	0.019	0.027	0.046	0.032	0.035	0.004	0.004	0.011	0.051	0.004	0.004	0.026	0.004	0.037	0.046	0.064	0.004	0.019	0.045	0.065	0.004	0.004	0.062	0.053	0.06	0.023	0.013	0.006
108.773	87.313	102.815	257.304	261.838	88.122	126.965	458.845	322.258	225.329	78.536	616.798	753.252	210.667	151.499	322.552	137.608	203.904	116.062	438.774	113.865	45./26	150.355	366.48	367.068	30/.02	162.198 778 04	203.921	308.634	263.946	143.781	388.076	381.265	144.322	486.742	378.888	329.901	358.169	191.973	515.156	290.964	275.609	293.24	130.756	143.654	149.806	81.176	438.991	369.136	4/6.385 815.727
00	∞	8	8	∞	∞ (∞ ∘	0 00	0 00	80	00	80	80	∞	∞	80	∞	80	8	00	∞ (× ·	× •	00 (00 C	xo o	xo ox	0 00	000	80	80	80	8	80	00	∞ c	0 00	00	80	80	8	8	∞	80	80	80	00	00	∞ (x x
104 105	105 106	106 113	113 114	114 115	115 101	101 116 116 117	117 118	118 86	86 11	119 120	120 121	121 9	122 123	123 124	124 126	125 126	126 127	127 128	128 129	129 130	130 133	133 135	131 132	132 133 134 135	134 135	135 136 136 137	137 138	138 145	139 140	140 141	141 142	142 144	143 144	144 145	146 147	147 149 148 149	149 150	150 151	152 151	153 154	155 154	154 156	156 159	157 158	158 159	159 160	160 151	151 162	161 162 162 163
107	108	109	110	111	112	113	115 115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	135 135	136	137	138	139	140	141	142	143	144	146 146	147	148	149	150	151	152	153	154	155	156	157	159	16U 161

3.856	1.14	0.773	0.859	0.93	2.213	2.265	0.999	1.032	1.051	1.086	0.674	0.655	1.982	1.355	0.627	0.873	0.895	1.336	0.574	1.443	0.652	1.126	1.11	3.676	4.223	3.131	1.69	1.964	1.958	0.187	1.985	2	1.42	0.271	2.036	2.118	2.179	2.291	2.318	2.278	1.321	0.975	4.329	4.439	1.075	2.861
0.173	0.022	0.054	0.063	0.066	0.04	0.045	0.085	0.085	0.087	0.094	0.145	0.042	0.028	0.018	0.04	0.067	0.07	0.011	0.032	0.032	0.124	0.027	0.041	0.086	0.093	0.121	0.2	0.247	0.256	0.093	0.265	0.27	0.021	0.115	0.274	0.272	0.282	0.291	0.288	0.293	0.128	0.165	0.287	0.3	0.087	0.833
0 Yes	0 No	O No	O No	0 Yes	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 No	0 Yes	0 No	0 Yes	0 No	0 No	0 No	0 Yes	0 No	0 No	0 No	0 Yes	0 No	0 No	0 No	0 No																		
1.681	1.314	0.499	0.499	0.524	1.717	1.632	0.482	0.498	0.499	0.492	0.513	0.499	1.959	1.763	0.485	0.488	0.489	2.39	0.514	1.307	0.917	1.142	0.85	1.762	1.933	1.216	0.492	0.51	0.5	2.007	0.498	0.497	1.711	0.502	0.502	0.524	0.53	0.55	0.558	0.545	0.496	0.502	1.044	1.05	0.512	0.847
2.661	1.654	0.713	0.729	0.77	2.363	2.282	0.729	0.753	0.757	0.752	0.787	0.689	2.554	2.157	0.668	0.719	0.723	2.709	0.686	1.738	1.348	1.48	1.173	2.667	2.949	1.9	0.785	0.81	0.791	2.507	0.786	0.783	2.131	0.72	0.79	0.825	0.831	0.859	0.873	0.85	0.778	0.789	1.634	1.633	0.776	0.552
0.244	0.028	0.045	0.054	0.058	0.062	0.069	0.073	0.074	0.076	0.081	0.088	0.034	0.045	0.027	0.033	0.057	0.059	0.019	0.027	0.042	0.077	0.033	0.045	0.142	0.161	0.168	0.176	0.221	0.227	0.033	0.234	0.238	0.03	0.047	0.243	0.246	0.256	0.268	0.269	0.269	0.113	0.116	0.371	0.387	0.076	0.512
0.147	0.022	0.054	0.063	0.066	0.04	0.045	0.085	0.085	0.087	0.094	0.099	0.042	0.028	0.018	0.04	0.067	0.07	0.011	0.032	0.032	0.066	0.027	0.041	0.086	0.093	0.121	0.2	0.247	0.256	0.021	0.265	0.27	0.021	0.055	0.274	0.272	0.282	0.291	0.288	0.293	0.128	0.131	0.287	0.3	0.087	0.833
4.858 0.221 0.107	1.14 0.033 0.002	0.773 0.081 0.013	0.859 0.095 0.019	0.93 0.1 0.021	2.213 0.061 0.007	2.265 0.068 0.009	0.999 0.128 0.035	1.032 0.128 0.035	1.051 0.131 0.037	1.086 0.141 0.043	1.166 0.148 0.047	0.655 0.062 0.008	1.982 0.042 0.003	1.355 0.027 0.001	0.627 0.061 0.007	0.873 0.101 0.021	0.895 0.105 0.023	1.336 0.017 0	0.574 0.048 0.004	1.443 0.048 0.004	1.626 0.1 0.021	1.126 0.04 0.003	1.11 0.062 0.008	3.676 0.129 0.036	4.223 0.139 0.041	3.131 0.182 0.072	1.69 0.3 0.195	1.964 0.371 0.293	1.958 0.384 0.312	1.688 0.031 0.002	1.985 0.398 0.333	2 0.406 0.346	1.42 0.031 0.002	0.79 0.083 0.014	2.036 0.411 0.354	2.118 0.409 0.35	2.179 0.424 0.374	2.291 0.436 0.393	2.318 0.433 0.388	2.278 0.439 0.399	1.321 0.192 0.081	1.355 0.197 0.085	4.329 0.431 0.386	4.439 0.45 0.416	1.075 0.13 0.036	2.861 1 1.19
0.056 Free Surface	0.001 Free Surface	0.001 Free Surface	0.002 Free Surface	0.002 Free Surface	0.003 Free Surface	0.004 Free Surface	0.004 Free Surface	0.004 Free Surface	0.004 Free Surface	0.005 Free Surface	0.006 Free Surface	0.001 Free Surface	0.001 Free Surface	0 Free Surface	0.001 Free Surface	0.002 Free Surface	0.003 Free Surface	0 Free Surface	0 Free Surface	0.001 Free Surface	0.005 Free Surface	0.001 Free Surface	0.001 Free Surface	0.017 Free Surface	0.023 Free Surface	0.025 Free Surface	0.028 Free Surface	0.046 Free Surface	0.048 Free Surface	0.001 Free Surface	0.052 Free Surface	0.054 Free Surface	0.001 Free Surface	0.002 Free Surface	0.056 Free Surface	0.058 Free Surface	0.063 Free Surface	0.069 Free Surface	0.069 Free Surface	0.07 Free Surface	0.011 Free Surface	0.011 Free Surface	0.138 Free Surface	0.151 Free Surface	0.005 Free Surface	0.383 Pressurized
0.18	0.003	0.007	0.00	0.011	0.012	0.015	0.017	0.017	0.018	0.021	0.024	0.004	0.006	0.002	0.004	0.01	0.011	0.001	0.002	0.006	0.019	0.003	0.006	0.063	0.08	0.088	0.096	0.149	0.156	0.004	0.166	0.172	0.003	0.007	0.178	0.184	0.198	0.216	0.217	0.217	0.04	0.043	0.403	0.437	0.019	1.009
0.046	0.028	0.004	0.004	0.004	0.048	0.043	0.004	0.004	0.004	0.004	0.004	0.004	0.063	0.051	0.004	0.004	0.004	0.093	0.004	0.028	0.014	0.021	0.012	0.051	0.061	0.024	0.004	0.004	0.004	0.066	0.004	0.004	0.048	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.004	0.004	0.018	0.018	0.004	0.004
143.29	411.951	345.155	295.384	89.272	330.589	382.094	79.222	123.742	320.11	328.773	163.41	517.705	413.703	163.713	130.301	128.611	179.668	53.676	138.999	294.385	634.099	277.324	415.982	215.385	326.528	443.903	253.79	164.746	318.998	274.072	247.368	521.693	473.422	146.098	218.688	156.31	655.22	649.431	216.536	206.776	274.413	389.567	298.065	139.089	116.826	477.296
80	80	80	80	8	∞	8	8	8	8	8	80	80	∞	∞	∞	∞	80	80	80	∞	00	80	80	80	∞	80	80	8	80	8	8	8	80	∞	∞	80	80	8	∞	80	80	80	80	∞	80	10
138	165	166	167	168	169	170	171	172	173	174	201	176	177	180	177	178	184	183	183	184	200	186	188	188	189	190	191	192	194	194	195	196	198	196	199	200	201	202	203	145	205	206	206	4	41	4
163	164	165	166	167	168	169	170	171	172	173	174	175	176	179	180	177	178	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	197	198	196	199	200	201	202	203	204	205	145	206	42	207
162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	279	467
FULL BUILDOUT

MANHOLE REPORT

	Rim Elevation	Base Flow	Total Flow	Grade	Hydraulic	Surcharge	Unfilled
ID	(ft)	(mgd)	(mgd)	(ft) Status	Jump	Depth (ft)	Depth (ft)
2	759.3	0.002	0.01	752.088 Not Full	Yes	-0.212	7.212
3	779	0.001	0.005	769.084 Not Full	No	-0.716	9.916
4	795	0	0.001	784.283 Not Full	No	-0.717	10.717
5	800	0.002	0.011	789.821 Not Full	No	1.688	10.179
6	806.338	0.001	0.006	790.894 Not Full	No	2.061	15.444
7	808.224	0.001	0.007	793.131 Not Full	No	2.898	15.092
8	803.886	0.001	0.007	794.727 Not Full	No	3.394	9.158
9	802.471	0.002	0.007	796.283 Not Full	Yes	3.95	6.188
10	805.824	0	0.001	796.561 Not Full	No	2.127	9.263
11	808.802	0.001	0.005	796.868 Not Full	No	0.235	11.934
12	809.318	0.002	0.009	797.936 Not Full	No	0.203	11.381
13	809.901	0.001	0.006	798.889 Not Full	No	0.156	11.012
14	813.11	0.001	0.006	799.702 Not Full	No	0.168	13.408
15	811.417	0.001	0.007	800.789 Not Full	No	0.156	10.628
16	814.33	0.004	0.016	802.075 Not Full	No	0.142	12.255
17	818.439	0.007	0.026	803.259 Not Full	No	0.126	15.18
18	815.4	0.004	0.017	804.29 Not Full	Yes	0.056	11.11
19	810	0.003	0.012	805.067 Not Full	No	-0.266	4.933
20	810	0.003	0.014	805.973 Not Full	No	-0.26	4.027
21	818	0.006	0.025	806.767 Not Full	Yes	-0.366	11.233
22	818	0.063	0.2	818 Full	No	4.167	0
23	816.273	0.017	0.06	810.656 Not Full	No	-0.511	5.617
24	810	0.002	0.009	809.374 Not Full	No	-0.493	0.626
25	812.547	0.003	0.012	811.071 Not Full	No	-0.595	1.475
26	810	0.035	0.118	807.977 Not Full	No	-0.389	2.023
27	760	0.06	0.191	749.228 Not Full	No	-0.139	10.772
29	760.946	0.004	0.018	751.147 Not Full	No	-0.52	9.799
30	764.518	0.004	0.018	754.137 Not Full	No	-0.529	10.38
31	770	0.002	0.01	764.291 Not Full	No	3.625	5.709
32	770	0.005	0.019	760.485 Not Full	No	-0.581	9.515
34	767.515	0.003	0.013	758.617 Not Full	No	-0.55	8.898
35	768	0.003	0.013	760.201 Not Full	No	-0.566	7.799
36	769.536	0.003	0.013	761.774 Not Full	No	-0.593	7.762
37	820	0.013	0.05	815.844 Not Full	No	-0.522	4.156
38	820	0.001	0.003	814.845 Not Full	No	-0.522	5.155
39	820	0.028	0.095	814.219 Not Full	No	-0.447	5.781
40	815.188	0.001	0.006	811.62 Not Full	No	-0.446	3.568
41	818.593	0	0.002	812.59 Not Full	No	-0.576	6.002
42	820	0	0.001	813.187 Not Full	No	-0.58	6.813
43	820	0	0.002	813.957 Not Full	No	-0.609	6.043
44	820	0.003	0.012	815.449 Not Full	No	-0.618	4.551
45	820	0.001	0.005	813.965 Not Full	No	-0.602	6.035
46	815.964	0.003	0.012	809.028 Not Full	No	-0.438	6.935
47	819.261	0.002	0.009	806.137 Not Full	No	-0.429	13.124

48	812.164	0.002	0.01	807.664 Not Full	No	-0.603	4.5
49	836.378	0	0.002	826.025 Not Full	No	-0.641	10.352
50	826.443	0	0.002	821.044 Not Full	Yes	-0.522	5.399
51	832.898	0	0.001	826.994 Not Full	No	-0.573	5.904
52	836.402	0	0.001	830.193 Not Full	No	-0.573	6.209
53	836.235	0.001	0.003	834.393 Not Full	No	-0.574	1.842
54	841.564	0.012	0.045	835.109 Not Full	No	-0.558	6.455
55	840	0	0.002	819.948 Not Full	Yes	-0.518	20.052
56	850	0.001	0.003	839.02 Not Full	No	-0.647	10.98
57	840	0	0.001	818.651 Not Full	No	-0.516	21.349
58	850	0.001	0.003	840.026 Not Full	No	-0.641	9.974
59	849.487	0.001	0.005	835.741 Not Full	No	-0.626	13.746
60	843.253	0.001	0.006	829.852 Not Full	No	-0.615	13.401
61	841.529	0.001	0.004	826.958 Not Full	No	-0.609	14.571
62	841.446	0.001	0.003	822.962 Not Full	No	-0.605	18.484
63	837.029	0	0.002	819.162 Not Full	No	-0.605	17.867
64	837.799	0	0.001	817.936 Not Full	No	-0.531	19.863
65	864.088	0	0.002	855.328 Not Full	No	-0.638	8.759
66	860	0.001	0.004	853.747 Not Full	No	-0.619	6.253
67	862.952	0.021	0.073	855.734 Not Full	No	-0.532	7.217
68	860	0.001	0.003	852.656 Not Full	No	-0.511	7.344
69	856.185	0	0.001	849.496 Not Full	No	-0.57	6.688
70	848.023	0	0.002	841.398 Not Full	No	-0.569	6.625
71	840	0.001	0.004	825.532 Not Full	No	-0.534	14.468
72	829.491	0.001	0.005	818.435 Not Full	No	-0.531	11.056
73	833.619	0	0.002	827.616 Not Full	No	-0.651	6.003
74	820	0.001	0.005	815.193 Not Full	Yes	-0.474	4.807
75	820	0.001	0.003	813.351 Not Full	Yes	-0.416	6.649
76	840	0	0.002	830.017 Not Full	No	-0.649	9.983
77	820	0	0.002	812.053 Not Full	Yes	-0.413	7.947
78	820	0	0.001	811.754 Not Full	No	-0.412	8.246
79	820	0	0.001	810.452 Not Full	No	-0.414	9.548
80	816.389	0	0	809.522 Not Full	No	-0.445	6.867
81	824.315	0	0.002	817.831 Not Full	No	-0.636	6.484
82	830	0	0.001	817.029 Not Full	No	-0.638	12.971
83	829.557	0	0.002	818.133 Not Full	No	-0.634	11.425
84	819.881	0	0.001	807.013 Not Full	No	-0.453	12.868
85	815.552	0	0.002	803.614 Not Full	No	-0.452	11.937
86	814.842	0	0.003	800.092 Not Full	No	-0.475	14.75
87	844.047	0	0.002	834.018 Not Full	No	-0.649	10.028
88	833.26	0.001	0.003	823.025 Not Full	No	-0.642	10.236
89	825.496	0	0.002	815.034 Not Full	No	-0.633	10.462
90	822.886	0	0.002	812.043 Not Full	No	-0.623	10.843
91	835.856	0	0.001	825.018 Not Full	No	-0.649	10.838
92	832.265	0	0.001	822.02 Not Full	No	-0.646	10.245
93	828.425	0.001	0.003	818.028 Not Full	No	-0.639	10.397
94	864.2	0	0.001	851.72 Not Full	No	-0.647	12.48

95	867.654	0	0.002	850.934 Not Full	No	-0.632	16.719	
96	861.704	0	0.002	850.023 Not Full	No	-0.644	11.681	
97	845.698	0	0.002	835.631 Not Full	No	-0.636	10.067	
98	844.826	0	0.001	835.033 Not Full	No	-0.634	9.793	
99	865.019	0	0.001	855.013 Not Full	No	-0.654	10.006	
100	840	0	0.002	830.043 Not Full	No	-0.623	9.957	
101	840	0	0.001	826.066 Not Full	No	-0.601	13.934	
102	870	0	0.002	860.021 Not Full	No	-0.646	9.979	
103	868.219	0	0.001	855.022 Not Full	No	-0.645	13.198	
104	860.408	0	0.001	850.027 Not Full	No	-0.64	10.381	
105	857.102	0	0.001	847.026 Not Full	No	-0.641	10.075	
106	853.46	0	0.001	843.032 Not Full	No	-0.635	10.428	
107	870	0	0.001	860.02 Not Full	No	-0.647	9.98	
108	867.954	0	0.001	858.014 Not Full	No	-0.653	9.94	
109	866.887	0	0.001	852.02 Not Full	No	-0.646	14.867	
110	863.26	0	0.001	850.021 Not Full	No	-0.646	13.239	
111	842.541	0	0.001	834.439 Not Full	Yes	-0.627	8.102	
112	856.209	0	0.001	850.015 Not Full	No	-0.652	6.195	
113	850	0	0.001	840.039 Not Full	No	-0.628	9.961	
114	844.516	0.001	0.003	834.054 Not Full	No	-0.613	10.462	
115	840	0	0.001	830.043 Not Full	No	-0.624	9.957	
116	833.66	0	0.002	822.567 Not Full	No	-0.599	11.093	
117	830.645	0	0.002	820.167 Not Full	No	-0.6	10.478	
118	819.91	0.001	0.004	810.065 Not Full	No	-0.602	9.845	
119	805.003	0.001	0.004	797.642 Not Full	No	-0.625	7.361	
120	802.076	0.012	0.044	797.337 Not Full	No	-0.53	4.739	
121	805.637	0.007	0.027	796.34 Not Full	No	1.074	9.297	
122	861.89	0	0.002	850.027 Not Full	No	-0.639	11.863	
123	860.783	0	0.002	848.023 Not Full	No	-0.643	12.76	
124	852.271	0	0.002	840.03 Not Full	No	-0.636	12.24	
125	837.04	0.001	0.003	829.031 Not Full	No	-0.636	8.009	
126	838.974	0	0.001	828.061 Not Full	Yes	-0.606	10.913	
127	839.721	0	0.001	827.056 Not Full	No	-0.611	12.665	
128	844.232	0	0.002	826.049 Not Full	No	-0.618	18.183	
129	828.475	0.001	0.005	818.048 Not Full	No	-0.619	10.427	
130	824.629	0	0.002	814.057 Not Full	No	-0.61	10.572	
131	851.033	0.001	0.006	840.034 Not Full	No	-0.633	10.999	
132	841.202	0.001	0.003	830.035 Not Full	No	-0.632	11.167	
133	823.242	0	0.001	813.069 Not Full	No	-0.598	10.174	
134	832.363	0.001	0.004	822.025 Not Full	No	-0.642	10.338	
135	819.997	0	0.002	810.064 Not Full	No	-0.603	9.933	
136	815.207	0	0.001	804.364 Not Full	No	-0.603	10.843	
137	803.943	0.001	0.003	794.312 Not Full	Yes	-0.554	9.63	
138	802.426	0	0.001	793.599 Not Full	Yes	-0.367	8.826	
139	818.184	0.001	0.005	808.038 Not Full	No	-0.629	10.146	
140	815.888	0.001	0.005	805.035 Not Full	No	-0.632	10.853	
141	809.941	0	0.001	797.567 Not Full	Yes	-0.6	12.374	

142	807.964	0.001	0.004	795.876 Not Full	No	-0.591	12.088
143	808.572	0	0.002	798.022 Not Full	No	-0.645	10.55
144	804.445	0	0.001	794.183 Not Full	Yes	-0.584	10.262
145	800	0	0.001	792.287 Not Full	No	-0.379	7.713
146	836.873	0.001	0.006	826.03 Not Full	No	-0.636	10.842
147	823.921	0.001	0.003	811.759 Not Full	Yes	-0.608	12.163
148	858.667	0.022	0.077	849.497 Not Full	No	-0.57	9.17
149	844.033	0.001	0.006	834.092 Not Full	No	-0.575	9.941
150	820	0	0.002	811.088 Not Full	Yes	-0.479	8.912
151	820	0.001	0.004	810.191 Not Full	No	-0.476	9.809
152	830.035	0.001	0.004	820.028 Not Full	No	-0.638	10.006
153	850.165	0.006	0.024	840.057 Not Full	No	-0.61	10.109
154	840	0.001	0.007	827.013 Not Full	Yes	-0.554	12.987
155	855.296	0	0.002	845.016 Not Full	No	-0.65	10.28
156	830	0.014	0.051	825.779 Not Full	No	-0.487	4.221
157	852.474	0.001	0.003	842.018 Not Full	No	-0.648	10.455
158	843.866	0	0.002	833.023 Not Full	No	-0.644	10.843
159	834.396	0	0.001	825.092 Not Full	No	-0.574	9.303
160	831.024	0.001	0.003	820.119 Not Full	No	-0.548	10.906
161	852.492	0.003	0.012	840.036 Not Full	No	-0.631	12.456
162	814.912	0.002	0.01	805.246 Not Full	Yes	-0.421	9.666
163	810.553	0.001	0.006	800.147 Not Full	No	-0.519	10.406
164	860.529	0.001	0.003	850.022 Not Full	No	-0.645	10.507
165	846.723	0.001	0.004	838.354 Not Full	Yes	-0.613	8.369
166	854.79	0.001	0.003	836.863 Not Full	No	-0.603	17.927
167	851.534	0	0.002	835.566 Not Full	No	-0.6	15.968
168	850	0	0.002	835.04 Not Full	No	-0.626	14.96
169	829.653	0.001	0.003	819.045 Not Full	No	-0.621	10.608
170	809.77	0	0.002	802.385 Not Full	Yes	-0.582	7.385
171	809.174	0	0.001	801.985 Not Full	No	-0.582	7.189
172	810	0	0.001	801.387 Not Full	No	-0.579	8.613
173	809.525	0.001	0.004	799.994 Not Full	No	-0.573	9.531
174	808.987	0.001	0.004	798.599 Not Full	No	-0.568	10.389
175	849.201	0.001	0.004	839.242 Not Full	No	-0.625	9.959
176	847.063	0.001	0.003	837.028 Not Full	No	-0.639	10.035
177	827.817	0	0.002	811.067 Not Full	Yes	-0.599	16.75
178	820	0	0.001	810.47 Not Full	No	-0.597	9.53
179	830.702	0	0.002	820.018 Not Full	No	-0.648	10.683
180	820	0	0.001	811.64 Not Full	Yes	-0.626	8.36
181	833.135	0	0.001	823.011 Not Full	No	-0.655	10.124
182	825.016	0	0.002	818.632 Not Full	No	-0.634	6.383
183	828.382	0.001	0.003	817.932 Not Full	No	-0.635	10.45
184	819.748	0.001	0.004	809.666 Not Full	No	-0.6	10.082
185	857.016	0.001	0.003	851.027 Not Full	No	-0.64	5.989
186	850	0.001	0.003	845.041 Not Full	No	-0.625	4.959
187	857.958	0.017	0.063	851.086 Not Full	No	-0.581	6.872
188	850.959	0.004	0.017	840.093 Not Full	No	-0.574	10.867

189	832.202	0.002	0.011	820.121 Not Full	No	-0.545	12.081
190	820.133	0.003	0.012	809.4 Not Full	Yes	-0.467	10.733
191	813.8	0.018	0.064	808.347 Not Full	No	-0.42	5.453
192	815.585	0.002	0.01	807.556 Not Full	No	-0.411	8.029
193	834.555	0.001	0.004	824.021 Not Full	No	-0.646	10.534
194	821.285	0.003	0.012	806.165 Not Full	Yes	-0.402	15.12
195	818.698	0.002	0.009	805.07 Not Full	No	-0.396	13.628
196	809.264	0.001	0.003	802.874 Not Full	No	-0.393	6.39
197	836.306	0.001	0.003	826.021 Not Full	No	-0.646	10.285
198	810.436	0.001	0.005	803.355 Not Full	Yes	-0.612	7.081
199	806.74	0.002	0.009	801.872 Not Full	No	-0.394	4.868
200	804.911	0	0.002	801.082 Not Full	Yes	-0.384	3.828
201	805.44	0	0.002	797.991 Not Full	No	-0.376	7.45
202	804.209	0	0.001	794.588 Not Full	No	-0.378	9.621
203	801.753	0	0.001	793.393 Not Full	No	-0.374	8.36
204	799.065	0.011	0.04	789.628 Not Full	No	-0.538	9.437
205	801.341	0.001	0.004	788.431 Not Full	No	-0.535	12.91
206	800	0.002	0.007	786.9 Not Full	No	-0.367	13.1
207	800	0.002	0.01	787.353 Not Full	No	0.719	12.647

FULL BUILD OUT OUTFALL

 ID
 Flow (mgd)
 Grade (ft)

 1
 1.368
 750.888

FULL BUILDOUT PUMP REPORT

ID	From ID	To ID	Flow (mgd)	Head Increase (ft)	Power (hp)	Usage	Speed
5000	9000	33	0.432	11.327	0.858	1	1
5002	9014	28	0.432	81.186	6.153	1	1