APPENDIX J

WASTEWATER MASTER PLAN

BROOKFIELD RESIDENTIAL

Amoruso Ranch Specific Plan Area

September 2015

WASTEWATER MASTER PLAN

IN SUPPORT OF ADMINISTRATIVE DRAFT ENVIRONMENTAL IMPACT REPORT

Prepared for:
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Amoruso Ranch Specific Plan Area

Wastewater Master Plan

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INTRODUCTION

The Amoruso Ranch Specific Plan (ARSP) Area Wastewater Master Plan (Plan) has been prepared at the request of Brookfield Residential Properties, Inc. (Brookfield) to meet the City of Roseville's (City) requirements and in support of the Amoruso Ranch Specific Plan process.

WASTEWATER MASTER PLAN PURPOSE

The purpose of this master plan study is to provide preliminary design and analysis for the sanitary sewer infrastructure to serve the Amoruso Ranch Specific Plan Area. The information presented herein builds on the 2010 Creekview Sanitary Sewer Master Plan by MacKay & Somps and the 2010 Trunk Sewer Model memorandum by RMC Water and Environment. These reports discuss the Creekview sewage system strategies along with an allowance for the Brookfield Urban Growth Area (UGA).

The Brookfield sanitary sewer flows discharge to a point of connection on the Creekview system that ultimately conveys the combined Brookfield/Creekview flows to the Pleasant Grove Wastewater Treatment Plant. The following items are discussed as part of this report:

- The wastewater generation rates for the ARSP sewershed
- Sanitary sewer generation from Toad Hill Ranches
- The sanitary sewer system infrastructure that conveys the projected ARSP flows to the Creekview point of connection

The results and conclusions of the sanitary sewer modeling are based on serving the ARSP Area and receiving sanitary sewer flows from the Toad Hill development. Flows from the ARSP sewershed will be pumped through a force main to a point of connection in the Creekview area where flows continue via gravity to the Pleasant Grove Wastewater Treatment Plant.

The design and analysis presented in this report will also be used to support the environmental review process and utility demand planning required by the City. Background information including wastewater generation rates, peaking factors, proposed plan area land uses, and tributary areas are used to plan the location and size of proposed sanitary sewer facilities for the ARSP. The proposed topography will require the use of two pump stations and force mains to carry wastewater flows to the gravity system for conveyance to the Pleasant Grove Wastewater Treatment Plant.

ARSP AREA LOCATION AND DESCRIPTION

Project Vicinity

The ARSP Area consists of approximately 694.4 acres located in the northwest edge of the City of Roseville. Prior to the Specific Plan's adoption, the plan area was recognized as a logical growth extension for the City. The Specific Plan Area is bounded on the southwest by the Al Johnson Wildlife Area, to the west by the Gleason property, to the south by the Creekview Specific Plan Area, to the east by the future proposed Placer Ranch Specific Plan Area and to the north by the existing Toad Hills Ranches #1 area and unincorporated Placer County. The project vicinity is shown on Figure 1.

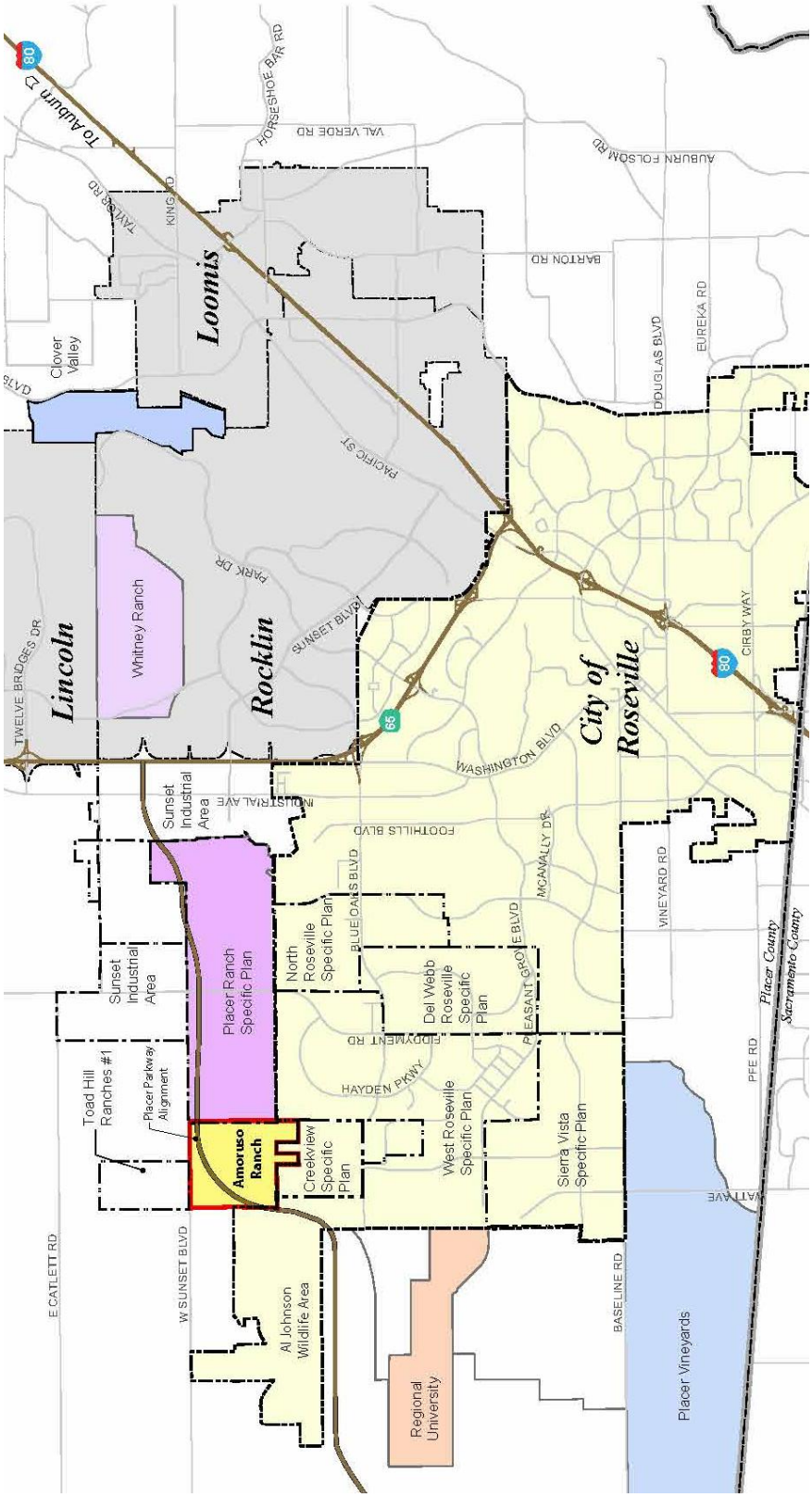

Figure 1 – Amoruso Ranch Specific Plan Area Project Vicinity

Pre-Development Conditions

The pre-development conditions of the ARSP Area were as a cattle ranch and for irrigated crops. The primary use was open grazing land, but included a small ranch house and out buildings. The land is gently rolling terrain generally trending to the west and south. Minor drainages flow in a radial pattern from a slight rise in the northeast quadrant of the property. The elevation changes from approximately 115 feet to 71 feet gently from the northeast down to the southwest.

The site vegetation is generally limited to short, seasonal grasses. There are several oak trees located along University Creek and a number of non-native trees located around the former ranch house. Wetland conditions and their associated flora and fauna are located in small areas typically along the drainage corridors and in flats along the southern boundary. Figure 2 highlights the ARSP Area pre-development conditions.

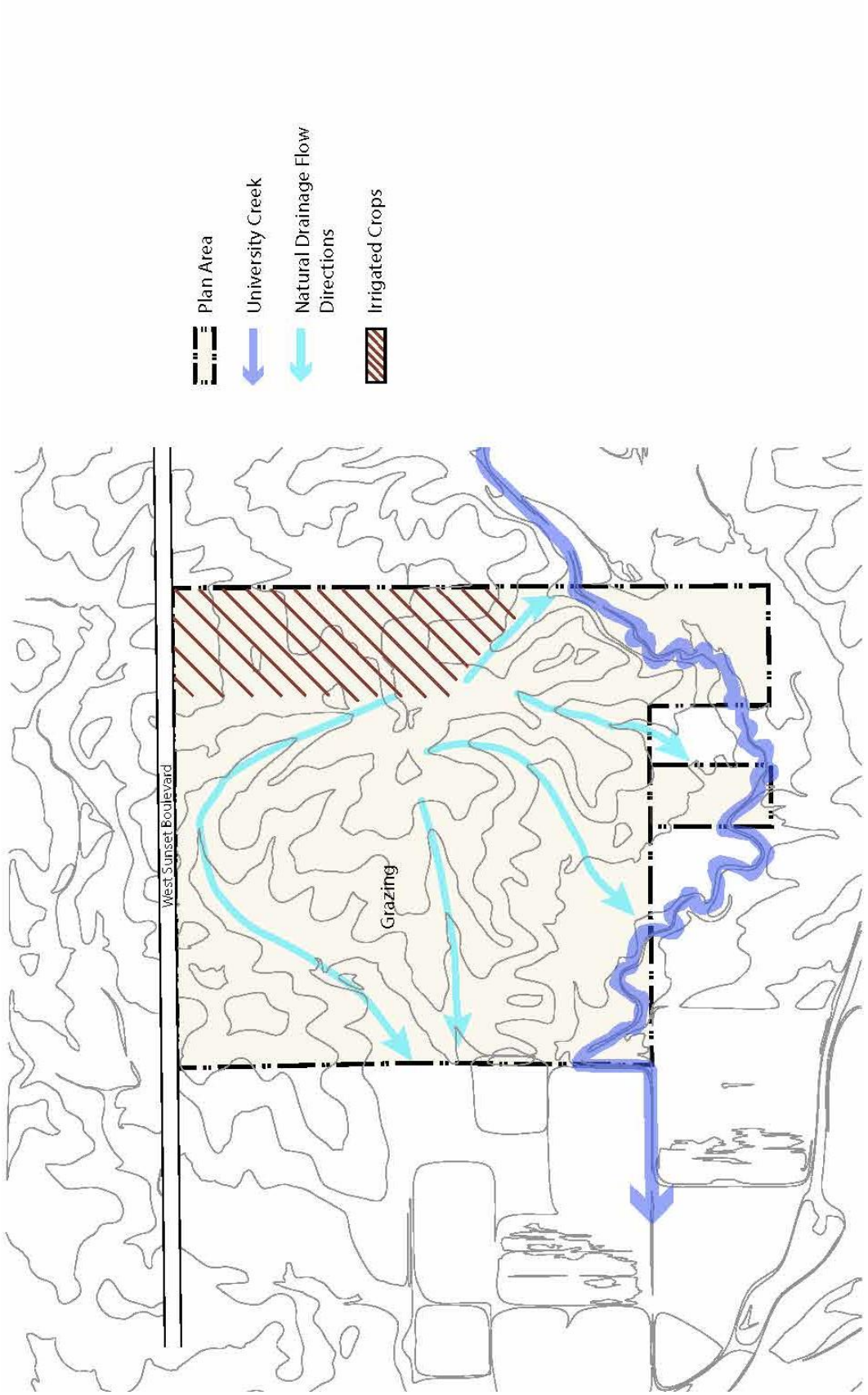

Figure 2 – ARSP Area Pre-Development Conditions

ARSP Area Development Opportunities and Constraints

The proposed ARSP Area land use plan is influenced by several factors, including the physical setting, land use and circulation conditions, and public policies. Two significant aspects that influence the development of the land use plan are described below and depicted on Figure 3.

Placer Parkway

The proposed Placer Parkway will be a dominant feature that sweeps through the ARSP Area. Interchanges at Fiddyment Road and Santucci Boulevard will provide access to the ARSP Area.

Open Space and Resources Preservation

The ARSP Area will support open space and resource preservation by providing permanent open space. In combination with the 1,700-acre open space afforded by the City of Roseville Al Johnson Wildlife Area, this open space provides connectivity with open space within the Creekview Specific Plan Area, and lands to the east of the ARSP Area.

The Amoruso Ranch Specific Plan will provide an open space corridor that includes a pedestrian and bike path linkage between this major open space area and the City's regional trail system. In addition, the corridor will provide a permanent preservation area for wetland resources.

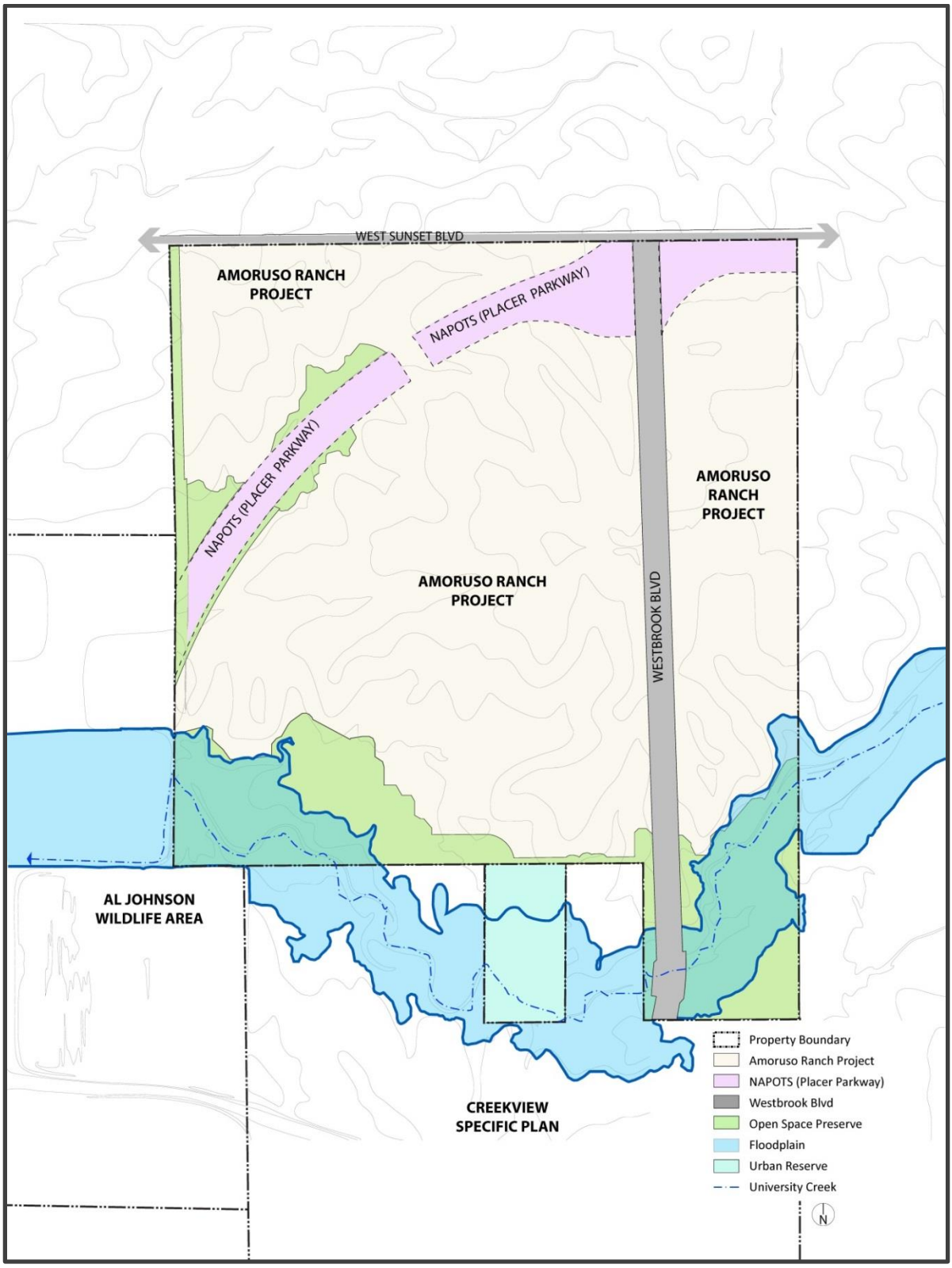

Figure 3 – ARSP Area Opportunities and Constraints

ARSP Area Land Use Plan

The ARSP Area provides for a mix of land uses to achieve the desired community form and objectives. These land use designations include low-, medium- and high- density residential uses; commercial and office uses; which in some cases are sited with one another and/or with residential uses; public and quasi-public uses for the schools and civic activities such as a fire station; parks and open space uses; and an urban reserve.

At buildout, the ARSP Area will provide for approximately 2,827 dwelling units, it adds approximately 51 acres of commercial retail and office land uses, and provides approximately 22-acres of parks and 146-acres of open space. The ARSP Area Land Use Plan is shown in Figure 4.

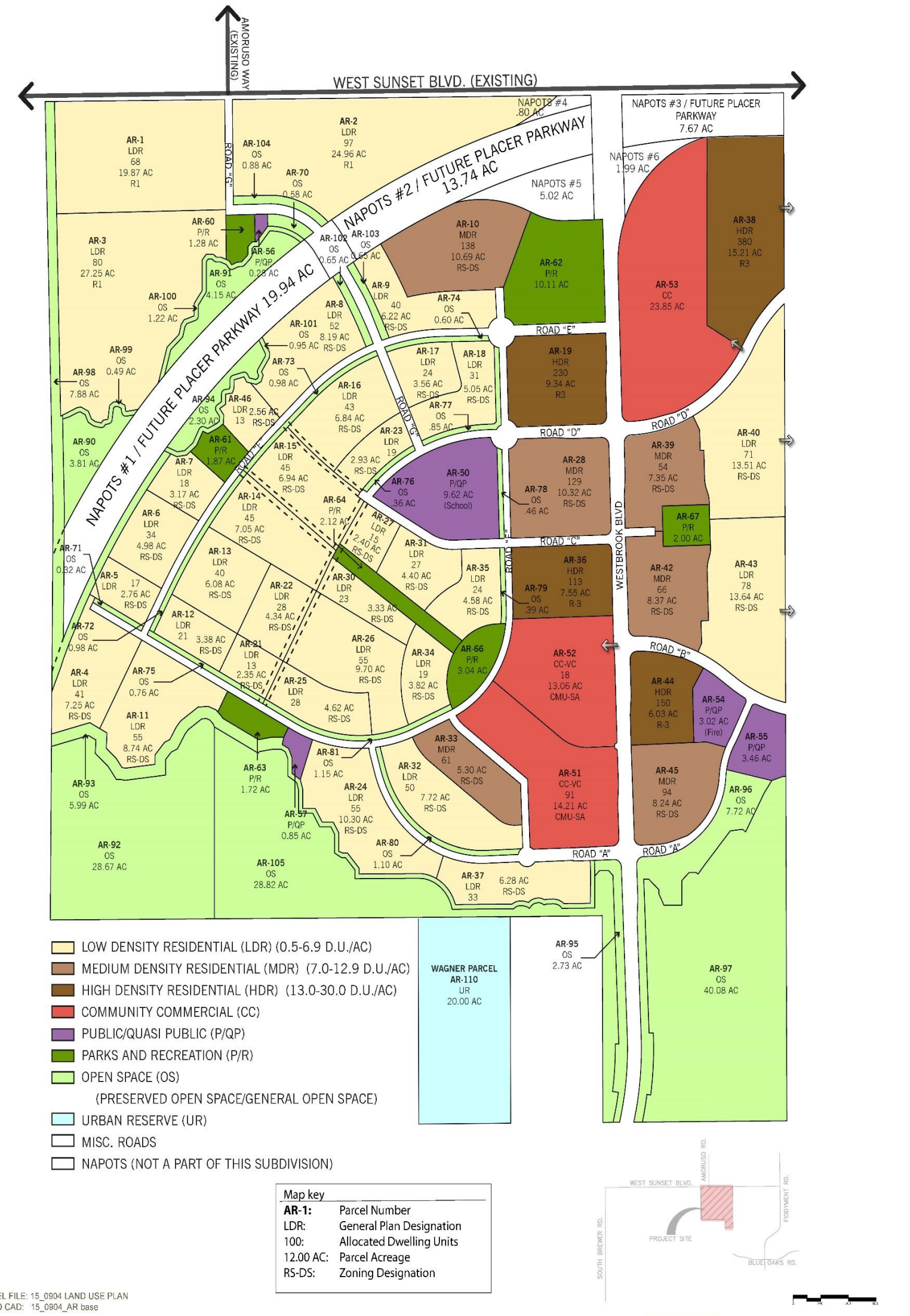

Figure 4 – ARSP Area Land Use Plan

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WASTEWATER STUDY PROCESS

As noted above, the ARSP Area is proposed to be divided into multiple parcels with a variety of land uses including residential, commercial mixed use, open space, schools, and parks. Each land use generates wastewater flow based on unit factors as designated by the City. The Average Dry Weather Flows (ADWF) Unit Flow Factors that are used for the ARSP are shown below in Table 1.

Table 1
Amoruso Ranch Specific Plan
Wastewater Master Plan
Average Dry Weather Unit Flow Factors

Land Use	Land Use Abbreviation	Flow Rate(1)
Low Density Residential	LDR	190 gpd/du
Medium Density Residential	MDR	190 gpd/du
High Density Residential	HDR	130 gpd/du
Community Commercial	CC	850 gpd/ac
Community Commercial Village Center	CC-VC	2300 gpd/ac
Open Space	OS	0 gpd/ac
Parks & Recreation (> 10 acres)	P/R	10 gpd/ac
Public / Quasi Public	P/QP	660 gpd/ac
Public / Quasi Public (School)	P/QP	170 gpd/ac
Public / Quasi Public (Fire Station & Utility Site)	P/QP	660 gpd/ac

(1) Average Dry Weather Flow Factors per City of Roseville Design and Construction Standards, Section 9 (Sanitary Sewer Design), dated January 2013

The ARSP Area is identified as an Urban Growth Area in the South Placer Regional Wastewater and Recycled Water Systems Evaluation prepared by RMC Water and Environment (RMC) for the South Placer Wastewater Authority (SPWA), an entity comprised of the City of Roseville, Placer County, and the South Placer Municipal Utility District (SPMUD). As defined by the Systems Evaluation, the CSP will be tributary to the Pleasant Grove Wastewater Treatment Plant (PGWWTP). The regional wastewater, recycled water and water facilities are shown on Figure 5.

Figure 5 - Regional Wastewater, Recycled Water and Water Facilities Location Plan

A summary of the proposed land use acreages and residential unit counts that generate wastewater flows is shown in Table 2.

Table 2
Amoruso Ranch Specific Plan
Wastewater Master Plan
Wastewater Generation by Land Use

Land Use	Land Use Abbreviation/ Zoning	Total Area (Acres)	Dwelling Unit Count	ADWF (MGD)
Low Density Residential	LDR	248.77	1,302	0.247
Medium Density Residential	MDR	50.27	542	0.103
High Density Residential	HDR	38.13	873	0.114
Community Commercial - Village Center - Residential	CMU-SA (Commercial Mixed-Use - Special Area)	Included On Next Line	109	Included On Next Line
Community Commercial - Village Center – Non-Residential	CMU-SA (Commercial Mixed-Use - Special Area)	27.27	-	0.063
Community Commercial	CC (Community Commercial)	23.85	-	0.020
Open Space (Paseos)	OS	10.71	-	0
Open Space (General)	OS	37.24	-	0
Open Space (Preserve)	OS	97.58	-	0
Parks & Recreation	PR	22.14	-	0
Public / Quasi Public (school)	P/QP (School)	9.62	-	0.002
Public / Quasi Public (Fire Station & Utility Site)	P/QP	7.61	-	0.005
Urban Reserve	UR	20.00	1	0
Rights-of-Way	ROW	52.04	-	0
Not a Part of this Subdivision	NAPOTS	49.16	-	0
Subtotal		**694.4**	**2,827**	**0.554**
Toad Hill[1]	LDR	**-**	274	0.052
Total		**-**	**3,101**	**0.606**

[1] A pipeline stub (manhole) will be provided at the north boundary of the ARSP that will facilitate a future connection by Toad Hill, if they desire in the future.

As previously noted, the ARSP Plan builds upon and is consistent with the wastewater master plan that was developed for the Creekview scenario that includes the generation rates associated with the ARSP sewershed. The methodology that has been used for the evaluation and sizing of the wastewater infrastructure is consistent with the criteria established by the City's Environmental Utilities Department (EU). The City's current Design Standards were used as a guide for development of the hydraulic model.

As noted on page 7 of Technical Memorandum 2b, from the South Placer Regional Wastewater and Recycled Water Systems Evaluation prepared by RMC (see Appendix D of this report), an estimated ADWF of 0.73 MGD would be tributary to the PGWWTP from buildout of the Brookfield UGA (now referenced as Amoruso Ranch Specific Plan Area). This flow exceeds the 0.621 MGD dry weather flow calculated for the Brookfield UGA in this master plan. The difference in the flow calculations is primarily due to the difference in residential unit counts used in each study.

It should be noted that the flows calculated for the ARSP Area as part of this Master Plan are further reduced from the flows utilized in the Creekview Sanitary Sewer Master Plan. Within the Creekview study the projected wastewater flow was 0.621 ADWF. Within this study, the flow is 0.554 for the ARSP Area and 0.606 if flows from Toad Hill are included. Therefore, the ARSP wastewater flows are less than the original planning numbers, as it relates to flows being conveyed to and treated at the PGWWTP.

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WASTEWATER SYSTEM CONSIDERATIONS

The ARSP Wastewater system will need to take into consideration several important aspects to allow the logical and systematic development of the system. These considerations include the proposed phasing of the development and the corresponding infrastructure that will be required and expanded as development phases are brought online. In addition, the wastewater flows that are generated by the ARSP development directly relate to the recycled water that will be available to serve the development.

PHASING

The ARSP Plan is designed to allow the sewer backbone infrastructure, as shown in the pipe network within this report, to be installed as part of different construction phases throughout the ARSP. The phases may be developed in any sequence provided that they comply with public safety, health, and welfare issues, and are subject to the approval of the City. Parcel-specific improvements can be determined as part of small lot tentative maps or subsequent entitlements.

Due to current fluctuations in market conditions and other variables, the actual phasing of the project has not been determined. We understand that subsequent technical memorandum(s) may be required once a phasing plan has been determined to demonstrate both operational and capacity compliance with the overall wastewater system as phases are developed.

WASTEWATER SYSTEM INFRASTRUCTURE

The sewer system is designed to serve the Land Use Plan areas shown in Figure 4. A sanitary sewer system, comprised of gravity trunk pipelines and two pump stations, has been designed to collect wastewater flows within the ARSP Area as shown in Figures 6 and 7. The gravity pipelines and pump station force mains were placed within the proposed road system serving the ARSP Area. Figures for the system component layout and tabular flow and velocity information for the manholes and preliminary pipes are shown in Appendices.

Although the Toad Hill Ranches area is not included as an Urban Growth Area (UGA) for the PGWWTP, the ARSP has an allowance for single-family residential land use sanitary flows for up to 274 dwelling units from the Toad Hill area. For purposes of the wastewater model, flows from the Toad Hill area are introduced into the ARSP wastewater system at Manhole MH#4 (refer to Figure 7 in the Appendix A). An actual physical connection in the form of a transition manhole is more likely to be installed at the property line between the Toad Hill and ARSP developments prior to discharging into MH#4.

Flows from northwest of the future Placer Parkway, in addition to flows from the Toad Hill area, are pumped approximately 1,200 feet to Manhole MH#P2G-1 where they are conveyed by gravity to a central pump station that captures all of the flows from the ARSP (refer to Figure 7 in the Appendix). The sewer lift station serving the northwest portion of the ARSP Area is proposed to be located within a "P/QP" parcel (AR-56). As identified in the overall site and grading plan, a lift station is required to serve this portion of the project due to the overall flat topography of the site and the distance required to convey flows to the main lift station that would result in an unacceptable depth of gravity sewer. The deep gravity sewer would have corresponding resultant impacts to the remainder of the sewer connection points causing these points of connection to also be deep.

The lift station serving the northwest portion of the project will be designed with a submersible pump in a manhole-type wet well and will meet the City's design standards. It is our understanding that while a lift station is not preferred, when required, the City has installed these submersible pump-style lift stations.

The remainder of the project is designed to flow by gravity to the central lift station located along the southern boundary of the project at a "P/QP" parcel (AR-57). Again, area topography and the distance required for conveyance of wastewater flows prevent gravity flow to the PGWWTP. This is a similar situation to Creekview that also requires a lift station to convey their wastewater to the PGWWTP. The lift station design for both Creekview and Amoruso will be similar in both design features and capacity.

Flows from the central lift station are conveyed through the Creekview Specific Plan area to Node 350 of the Creekview sanitary sewer system. This point of connection also receives flows from the Creekview Lift Station. It is acknowledged that this junction structure will require specific design requirements due to the connection with the two force main discharges and the overall volume of wastewater being conveyed through the system at this point. The design will also require coordination with the downstream gravity sewer that connects to the PGWWTP to make sure there is sufficient capacity (sewer pipe diameter and slope) for the conveyance of both pumped flows simultaneously.

Previous coordination was completed with the City of Roseville on the recommended and agreed upon alternative for the force main from the ARSP development through the Creekview Specific Plan Area. As noted above, the City and both of the development teams agreed upon a common force main discharge point located north of Blue Oaks Boulevard.

RECYCLED WATER

This Specific Plan anticipates receiving a commitment for recycled water from the City for a minimum amount equal to the average dry weather flow (ADWF) generated and conveyed

by the ARSP to the Pleasant Grove Wastewater Treatment Plant. Every effort will be made to optimize the use of recycled water on the project, where feasible. As estimated in this master plan, the ARSP will generate an ADWF of 0.554 MGD and anticipates receiving this minimum volume of recycled water from the City.

INTERIM IMPROVEMENTS/SUBSHED BOUNDARY MODIFICATIONS

Interim sanitary sewer improvements will be allowed on a temporary basis to provide sewer service for parcel development within the plan area. Interim improvements may include pipe alignments or points of connection that differ from what is shown within this master plan for individual land use parcels. Interim improvements may also include temporary sewer lift stations for individual land use parcels to provide sewer service until permanent infrastructure is constructed along with other types of interim improvements. All interim improvements shall be designed and constructed per the City of Roseville standards and appropriate Department of Health regulations.

During the final grading and utility design for individual development projects within the ARSP Area, it may become apparent that there is a more efficient method of conveying wastewater flows to the sanitary sewer trunk system than at the specific node defined in this master plan. Minor wastewater shed boundary adjustments may be necessary during the final design process. All interim sewer improvements and shed boundary adjustments will be subject to review and approval by the City of Roseville.

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HYDRAULIC MODELING ANALYSIS

This section of the Plan summarizes the procedures, criteria and assumptions used in the hydraulic modeling analyses and presents the conclusions developed from review of the model output data.

HYDRAULIC MODEL ANALYSIS CRITERIA

The following procedure was used for the preliminary design and analysis of the sanitary sewer system proposed in the CSP Sewer Master Plan:

- The primary wastewater generation areas within the plan area were delineated.
- A sewer trunk system alignment was defined to collect wastewater flows within the Specific Plan Area. The gravity sewer system was placed within the proposed road system shown on the Specific Plan Land Use Map wherever feasible.
- Node points were inserted into the sewer system alignment to define flow collection points within the sewer system.
- The use areas, with their respective generation rates, were assigned a manhole node to tie into the trunk system.
- Proposed land use acreages and residential unit counts for each manhole point of connection were tabulated.
- Wastewater flows, including average dry weather flows, factored flows, and peak wet weather flows were calculated at each node point using the design methodology defined in Section 9 – Sanitary Sewer Design, of the City of Roseville Design and Construction Standards.
- Average dry weather flows were calculated using the Average Dry Weather Unit Flow Factors for the land use types within each secondary wastewater shed.
- Factored flows were calculated by multiplying average dry weather flows by a factor of safety of 2.0.
- Peak wet weather flows within the trunk system were calculated by summing factored flows at the nodes along the trunk system alignment and

applying appropriate peaking factors from the Peaking Factor Curve shown in Figure SS-1 of Section 9 of the Design Standards.

- Trunk system pipe sizes were initially sized based on peak wet weather flows and pipe capacities based on minimum pipe slopes. The hydraulic modeling results can be found in the Appendix to this Plan.

- Trunk sewer pipes initially calculated to be 18" or larger were re-examined using hydraulic modeling and resized as appropriate.

- Preliminary pipe inverts were calculated and compared to proposed finished grades to verify the ability of the gravity system to serve the tributary areas.

PIPELINE SIZING CRITERIA

The proposed pipe size diameters were selected using the following pipe criteria:

- A Manning's "n" value of 0.013 was used for all pipe-sizing calculations.

- Pipes 10 inches and less in diameter and pipes with lateral connections are designed to have a maximum depth of flow 70% of the pipe diameter.

- Pipes 12 inches and larger with no lateral connections are designed to flow full.

- Pipe sizes have been selected assuming pipes will be installed at minimum slopes.

- The minimum slope for a pipe is a slope that yields a minimum 2 feet per second velocity when flowing at design capacity.

- Pipes proposed to be placed deeper than 20 feet shall conform to the pipe manufacturer's construction recommendations and comply with the City of Roseville improvement standards.

HYDRAULIC MODEL ASSUMPTIONS

The following are the assumptions that were utilized in the preparation and analysis of the hydraulic models for the proposed wastewater system serving the ARSP Area:

- The minimum pipeline diameter for modeling purposes is 6-inches.
- A Hazen-Williams Coefficient "C" Factor of 130 was used. This represents a typical value for new pipe.
- The Hydraulic Grade Line (HGL) of the system at the point of connection with Creekview was modeled as a free outfall at the ARSP central pump station, since the pump station will be sized to meet the peak wet weather flows (PWWF) into the wet well.

MODELING SCENARIOS

A system hydraulic model for the ARSP wastewater system was developed utilizing H20Map Sewer software. Both model input and output data were reviewed for consistency with City criteria and design standards. The system was modeled to the central pump station where force main flows discharge into the Creekview gravity system.

MODELING RESULTS COMPARISON WITH STANDARDS

Based on the system configuration and piping layout recommended for the ARSP wastewater system, the results of the hydraulic model runs were compared with the standards and criteria established by the City. The manhole and pipe tables in the Appendix to this Plan present the results of the proposed land use flows.

The City standards specify that the minimum permitted size of a sanitary main is a 6-inch diameter pipe. Since flows at end runs of an infrastructure pipe network typically do not generate sufficient wastewater to fill the pipe to a design flow, velocities at these locations are usually below the design velocities. The Brookfield piping network has velocities for design flows in excess of the minimum 2.0 feet per second requirement for all network pipes not associated with end conditions. All pipes greater than 6 inches flow at 2.0 feet per second or more. All pipes have design flows below 10.0 feet per second and have the capacity to convey the PWWF from the entire tributary shed area upstream of the pipe. All sanitary sewer lines have been placed in a right-of-way dedicated for public streets.

The ARSP sewershed is serviced by the North and Central Pump Stations. Force main pipes are sized for discharge velocities between 3 and 5 feet per second. The North Pump Station will receive flows of up to 100 gallons per minute (gpm) during PWWF. The 1,200 foot long 6-inch force main pipe for the North Pump Station is sized to maintain velocities of 3.4 feet per second at a pumping rate of 300 gallons per minute. The Central Pump station will receive flows of up to 2,900 gpm during PWWF. A primary 9,000 foot long 18-inch force main pipe will convey flows from the ARSP Central Pump Station to Node 350 of the Creekview sanitary system point of connection and is sized to maintain velocities of 3.2 feet per second at a pumping rate of 2,500 gpm during PWWF. A secondary, parallel 12-inch force main pipe is proposed as part of the Central Pump Station discharge alignment to provide conveyance during the lower flows anticipated during the ARSP buildout phase. This parallel line could then serve as a discharge conduit during maintenance operations once the ARSP is fully online.

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CONCLUSIONS

Based on the information contained within this Wastewater Master Plan and the results of the hydraulic modeling, the following conclusions are noted:

- The proposed system accommodates an allowance for flows from the Toad Hill area of up to 274 dwelling units zoned as R1.
- ARSP area flows are similar to flows anticipated in the Creekview Sanitary Sewer Master Plan.
- ARSP Average Dry Weather Flow is greater than the Maximum Peak Day Demand anticipated in the Recycled Water Master Plan.
- Gravity lines throughout the sanitary sewer system are between 4 feet and 25 feet deep.
- The proposed pipe network meets the City standards for velocities (minimum 2 fps, maximum 10 fps) for all pipes in excess of 6-inch diameter.
- Minimum 6-inch diameter pipe mains at minimum slope near end runs do not allow for velocities of 2.0 fps or greater until tributary flows meet a minimum generation rate of 89 gpm.
- The North Pump Station will have the capacity to convey Peak Wet Weather Flows from the areas northwest of the future Placer Parkway to the gravity elements of the Brookfield sanitary system.
- The Central Pump Station will have the capacity to convey Peak Wet Weather Flows from the ARSP sewershed to Node 350 of the Creekview Sanitary Sewer Master Plan.
- The respective force mains will be approximately 1,200 foot long 6-inch diameter pressure pipe and a dual approximately 9,000 foot long 18-inch diameter pressure pipe (with a parallel 12-inch force main for redundancy) that will convey flows within the 3 to 5 feet per second range required by the City design standards.
- The ARSP sanitary system conveys almost 90% of its sanitary flows to the Central Pump Station by gravity.

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References

MacKay & Somps. 2010. *Creekview Specific Plan Sanitary Sewer Master Plan*. November.

RMC Water and Environment. 2010. *Creekview Sewer Modeling, Trunk Sewer Model for Creekview Final Technical Memorandum*. August.

RMC Water & Environment. 2006. *South Placer Regional Wastewater & Recycled Water Systems Evaluation Project Technical Memorandum*. October.

Amoruso Ranch Specific Plan Area

Wastewater Master Plan

Appendix A

Figure 6 – ARSP Wastewater System Pipe Layout
Figure 7 – Manhole Layout
Figure 8 – Conduit Layout
Figure 9 – Conceptual North Pump Station Site Plan
Figure 10 – Conceptual Central Pump Station Site Plan
Table 3 – Wastewater Flow by Node
Average Dry Weather Flow Manhole Report
Average Dry Weather Flow Pipe Report
Peak Wet Weather Flow Manhole Report
Peak Wet Weather Flow Pipe Report

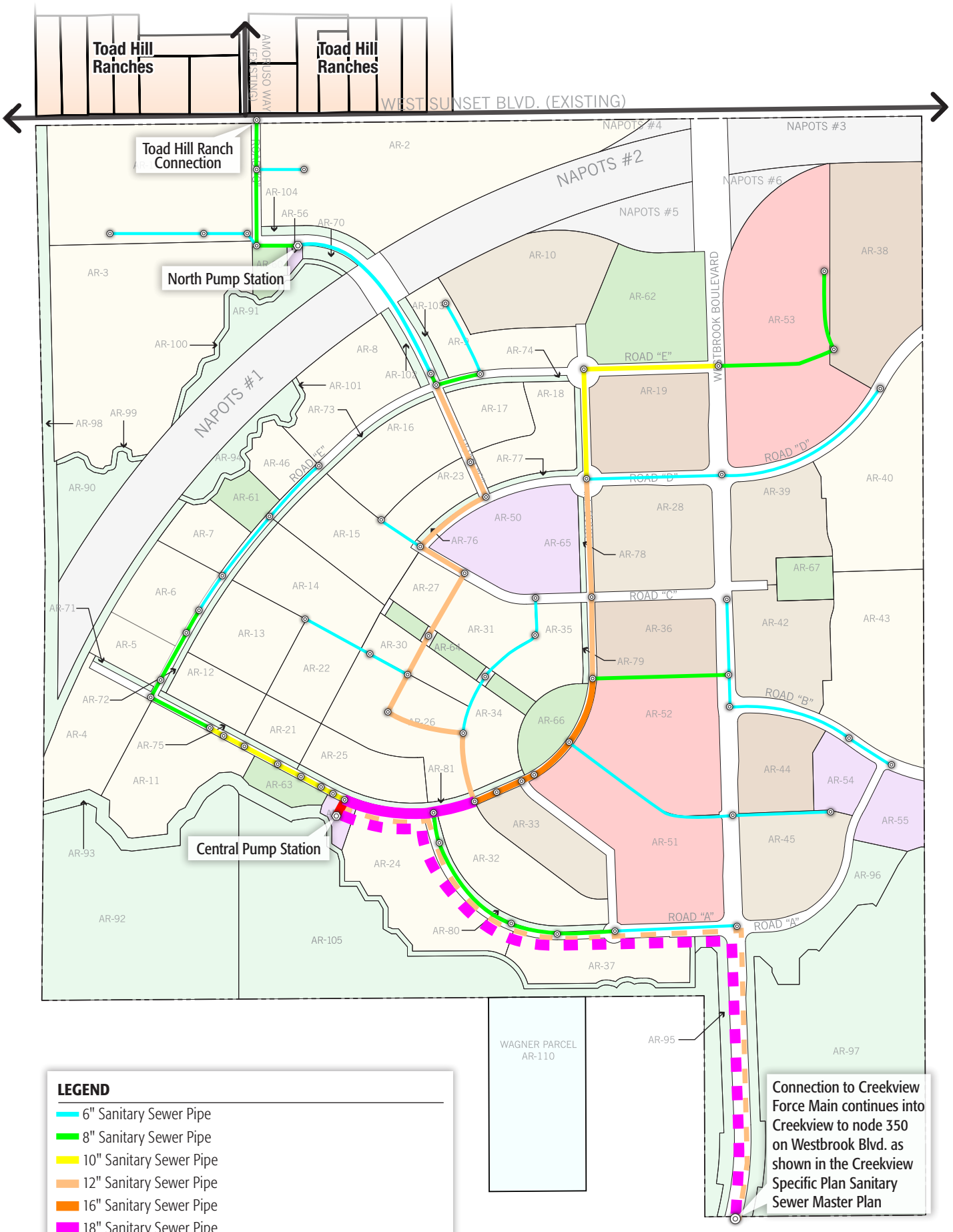

Figure 6: Amoruso Ranch *(Wastewater System Pipe Network)*

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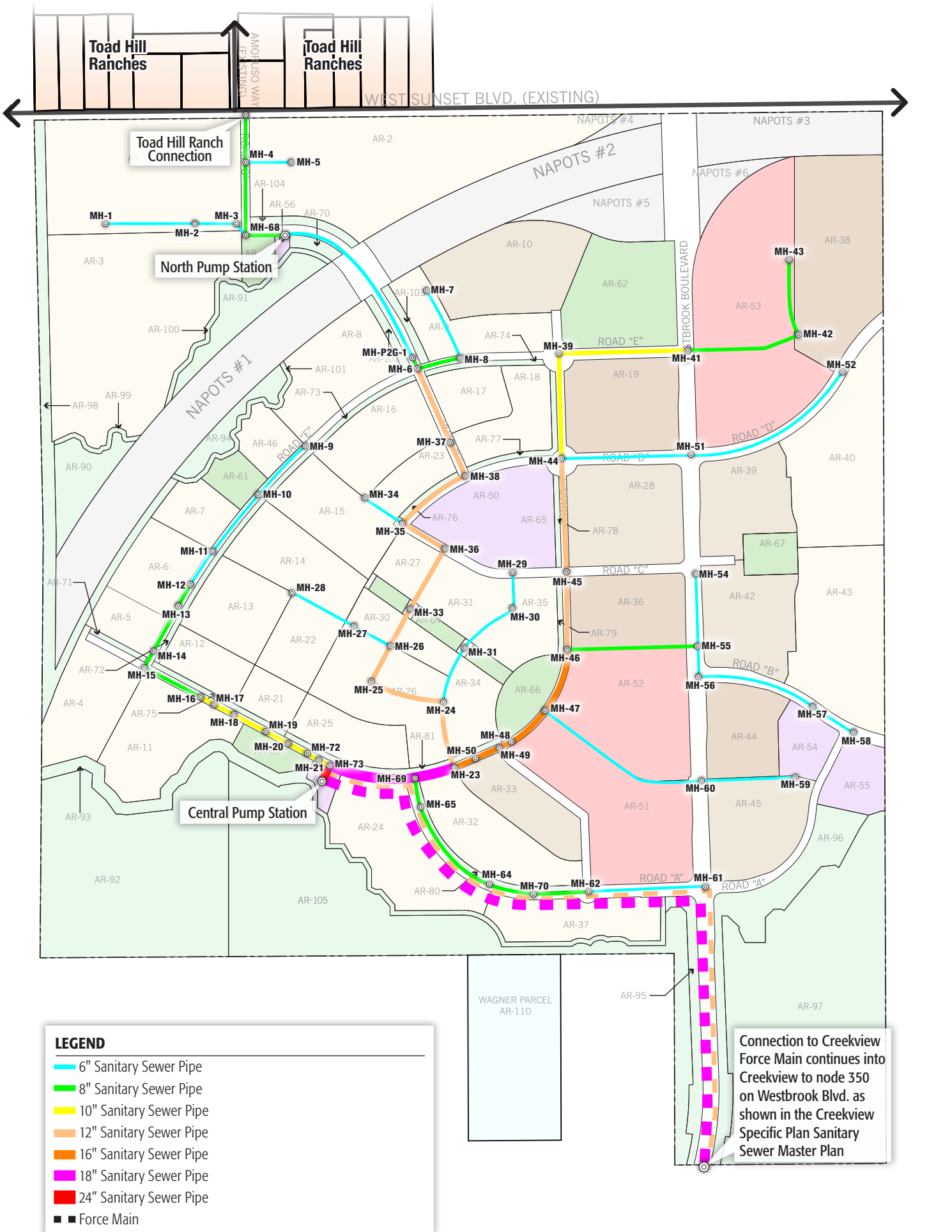

Figure 7: Amoruso Ranch *(Wastewater System Manhole Layout)*

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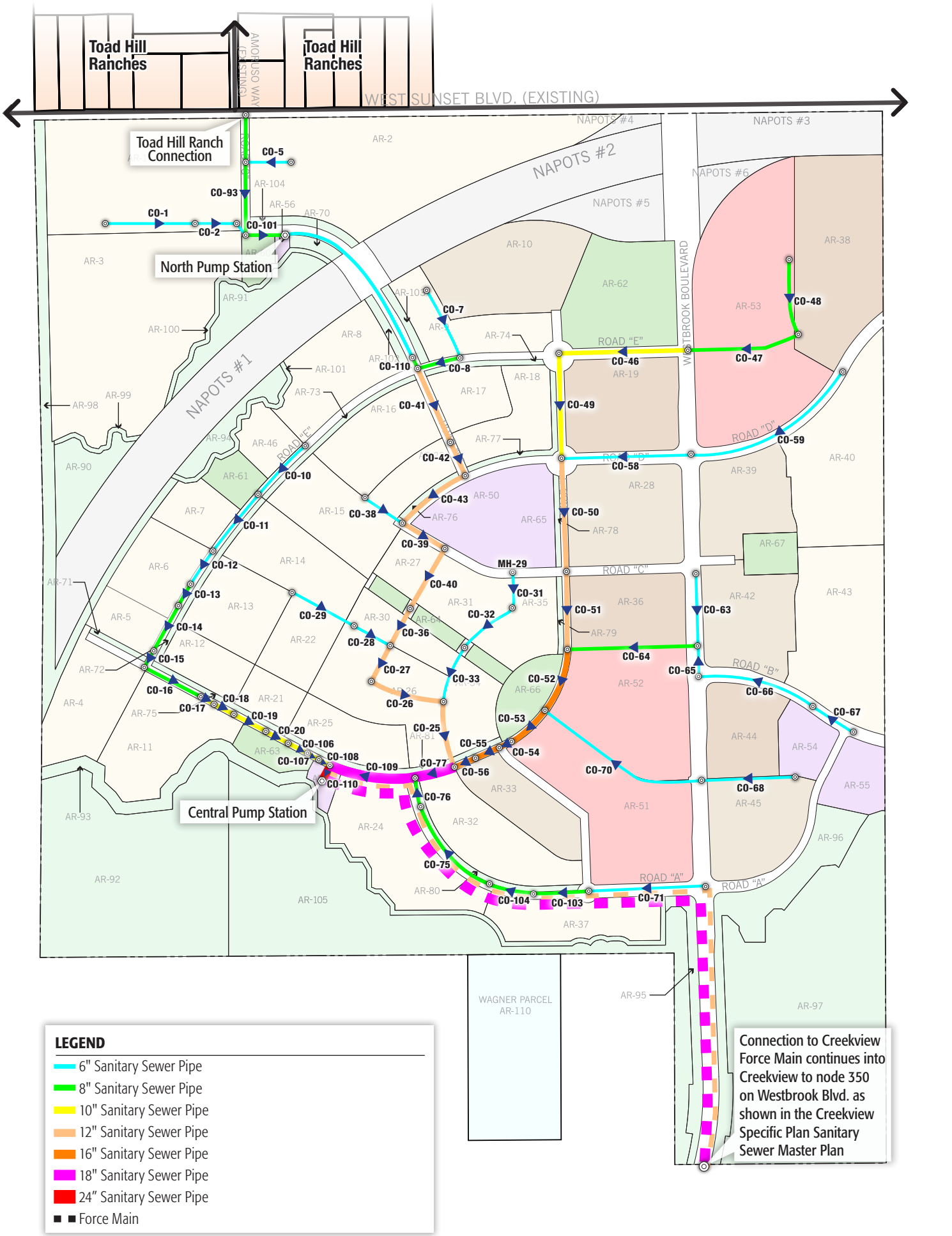

Figure 8: Amoruso Ranch *(Wastewater System Conduit Layout)*

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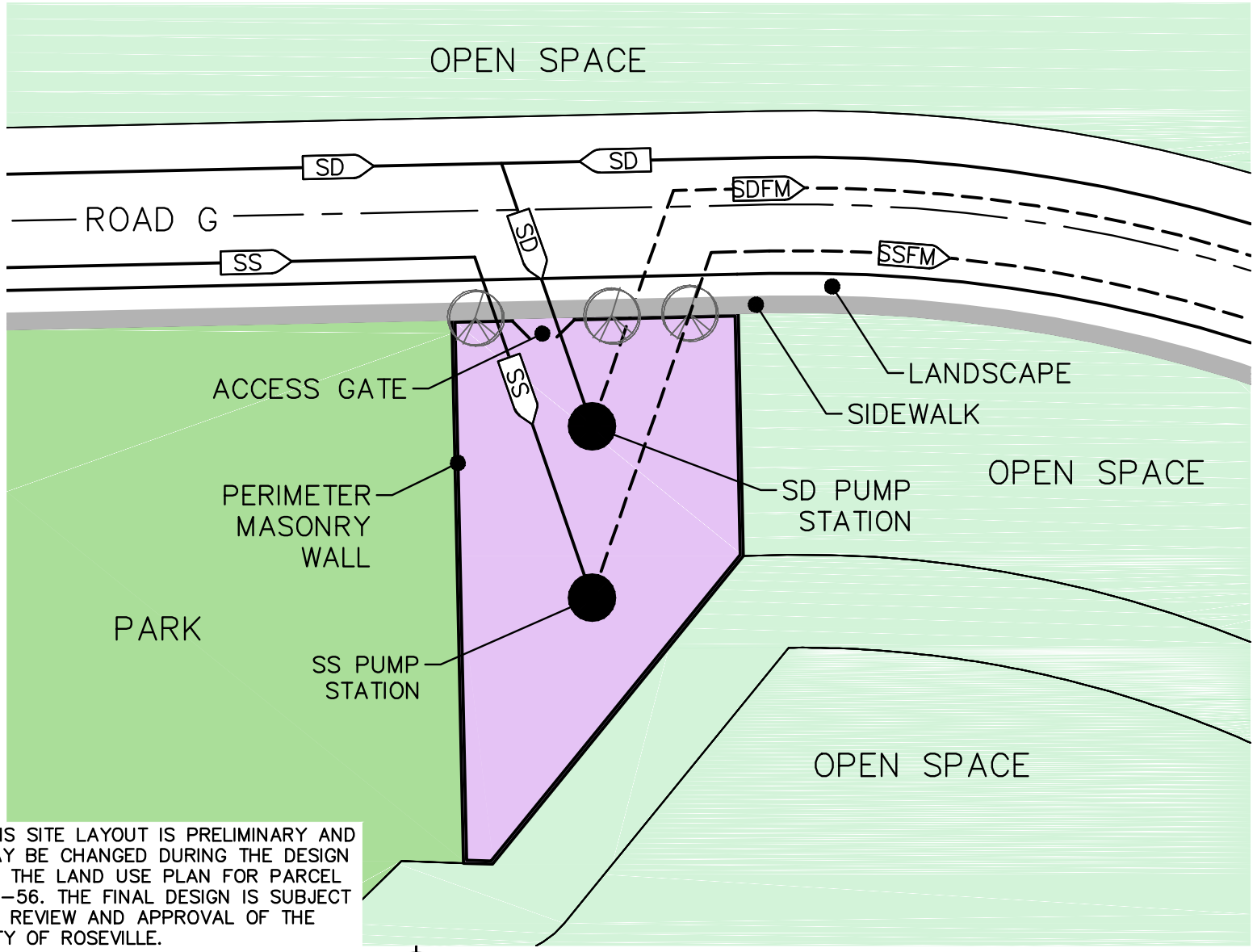

NOTE:

1. THIS SITE LAYOUT IS PRELIMINARY AND MAY BE CHANGED DURING THE DESIGN OF THE LAND USE PLAN FOR PARCEL AR-56. THE FINAL DESIGN IS SUBJECT TO REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100

FIGURE 9

CONCEPTUAL NORTH PUMP STATION SITE PLAN

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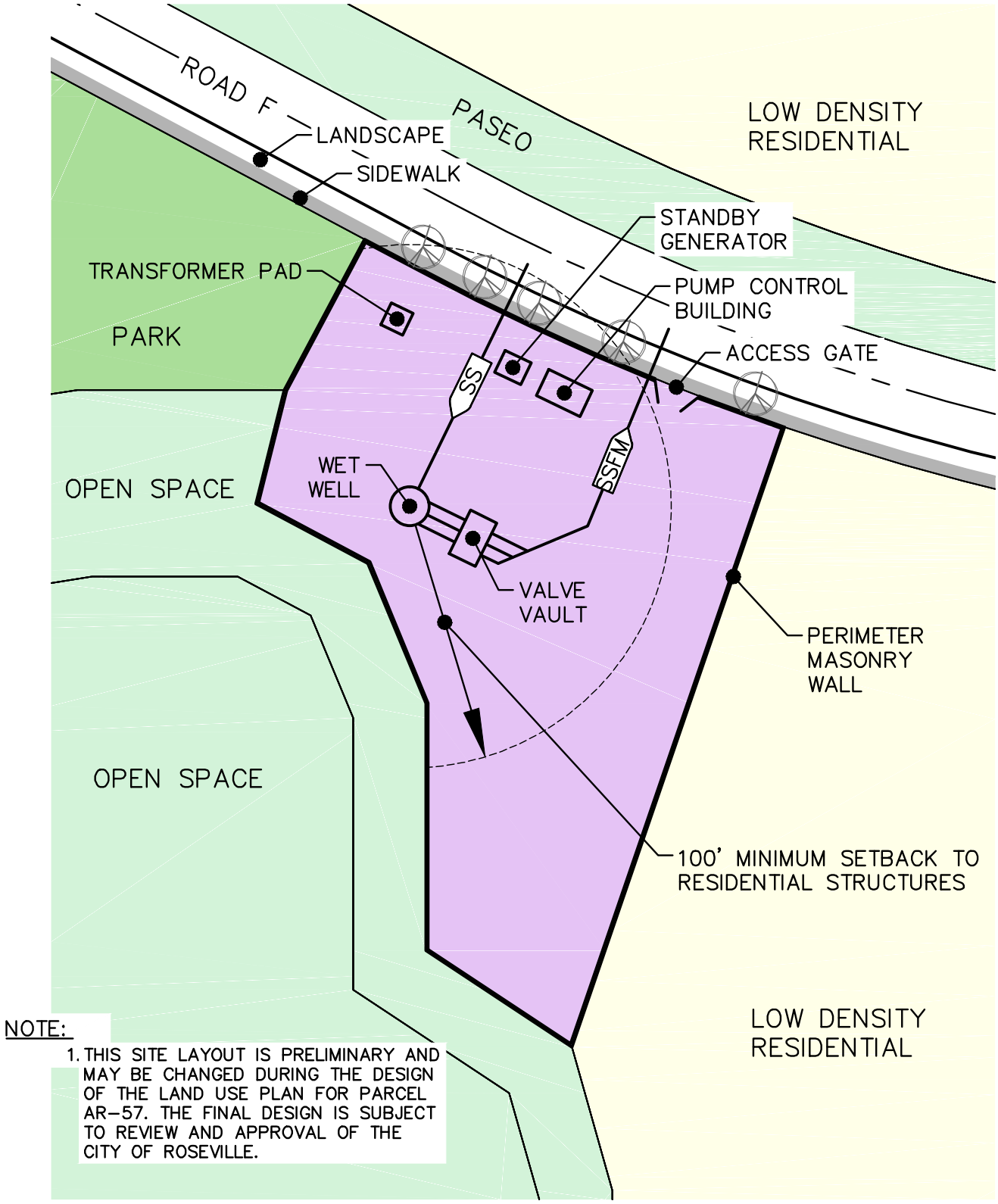

NOTE:

1. THIS SITE LAYOUT IS PRELIMINARY AND MAY BE CHANGED DURING THE DESIGN OF THE LAND USE PLAN FOR PARCEL AR-57. THE FINAL DESIGN IS SUBJECT TO REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

FIGURE 10

CONCEPTUAL CENTRAL PUMP STATION SITE PLAN

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Table 3 -
Wastewater Flow by Node

Model Manhole #	AR #	LAND USE	AREA (AC)	DWELLING UNITS	DENSITY	FLOW RATE	AVERAGE DRY WEATHER FLOW (GPD)	AVERAGE DRY WEATHER FLOW (MGD)	FACTORED FLOW (GPD)	FACTORED FLOW (MGD)	Peaking Factor for FACTORED FLOW	PEAK WET WEATHER FLOWS (GPD)	PEAK WET WEATHER FLOWS (MGD)	DELTA BETWEEN FACTORED FLOW AND PEAK WET WEATHER FLOW (MGD)	Model Manhole #	Contributing Manhole (Node) #
CPS											3.65	0	0.0000	0.0000	CPS	73
MH-01	**3**	LDR	27.35	80	2.9	190	15,200	0.01520	30,400	0.0304	3.50	106,400	0.1064	0.0760	MH-01	
MH-02	**1**	LDR	19.87	68	3.4	190	12,920	0.01292	25,840	0.0258	3.50	90,440	0.0904	0.0646	MH-02	1
MH-03	**60**	P/R	1.28			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-03	2
MH-04		Toad Hill		274		190	52,060	0.05206	104,120	0.1041	3.22	335,266	0.3353	0.2311	MH-04	5
MH-05	**2**	LDR	24.96	97	3.9	190	18,430	0.01843	36,860	0.0369	3.46	127,536	0.1275	0.0907	MH-05	
MH-06	**9**	LDR	6.22	40	6.4	190	7,600	0.00760	15,200	0.0152	3.54	53,808	0.0538	0.0386	MH-06	7, NPS
MH-07	**10**	MDR	10.69	138	12.9	190	26,220	0.02622	52,440	0.0524	3.41	178,820	0.1788	0.1264	MH-07	
MH-08	**null**													0.0000		
MH-09	**8**	LDR	8.19	52	6.3	190	9,880	0.00988	19,760	0.0198	3.54	69,950	0.0700	0.0502	MH-09	
MH-10	**61**	P/R	1.87			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-10	9
MH-11	**7,46**	LDR	5.73	31	5.4	190	5,890	0.00589	11,780	0.0118	3.58	42,172	0.0422	0.0304	MH-11	10
MH-12	**13**	LDR	6.08	40	6.6	190	7,600	0.00760	15,200	0.0152	3.54	53,808	0.0538	0.0386	MH-12	11
MH-13	**6**	LDR	4.98	34	6.8	190	6,460	0.00646	12,920	0.0129	3.58	46,254	0.0463	0.0333	MH-13	12
MH-14	**5**	LDR	2.76	17	6.2	190	3,230	0.00323	6,460	0.0065	3.58	23,127	0.0231	0.0167	MH-14	13
MH-15	**4**	LDR	7.25	41	5.7	190	7,790	0.00779	15,580	0.0156	3.54	55,153	0.0552	0.0396	MH-15	14
MH-16	**11**	LDR	8.74	55	6.3	190	10,450	0.01045	20,900	0.0209	3.54	73,986	0.0740	0.0531	MH-16	15
MH-17	**12**	LDR	3.38	21	6.2	190	3,990	0.00399	7,980	0.0080	3.58	28,568	0.0286	0.0206	MH-17	16
MH-18	**null**										3.65	0	0.0000	0.0000		
MH-19	**21**	LDR	2.35	13	5.5	190	2,470	0.00247	4,940	0.0049	3.65	18,031	0.0180	0.0131	MH-19	18
MH-20	**63**	P/R	1.72			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-20	19
MH-21	**25**	LDR	4.62	28	6.1	190	5,320	0.00532	10,640	0.0106	3.58	38,091	0.0381	0.0275	MH-21	72
MH-23	**33**	MDR	5.30	61	11.5	190	11,590	0.01159	23,180	0.0232	3.54	82,057	0.0821	0.0589	MH-23	24, 50
MH-24	**30**	LDR	3.60	23	6.4	190	4,370	0.00437	8,740	0.0087	3.58	31,289	0.0313	0.0225	MH-24	25, 31
MH-25	**26**	LDR	9.70	55	5.7	190	10,450	0.01045	20,900	0.0209	3.54	73,986	0.0740	0.0531	MH-25	26
MH-26	**27**	LDR	2.32	15	6.5	190	2,850	0.00285	5,700	0.0057	3.58	20,406	0.0204	0.0147	MH-26	33, 27
MH-27	**22**	LDR	4.34	28	6.5	190	5,320	0.00532	10,640	0.0106	3.58	38,091	0.0381	0.0275	MH-27	28
MH-28	**14**	LDR	7.05	45	6.4	190	8,550	0.00855	17,100	0.0171	3.54	60,534	0.0605	0.0434	MH-28	
MH-29	**null**					0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-29	
MH-30	**35**	LDR	4.55	24	5.3	190	4,560	0.00456	9,120	0.0091	3.58	32,650	0.0326	0.0235	MH-30	29
MH-31	**31**	LDR	4.20	27	6.4	190	5,130	0.00513	10,260	0.0103	3.58	36,731	0.0367	0.0265	MH-31	30
MH-33	**64**	P/R	2.12			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-33	36
MH-34	**15,16**	LDR	13.78	88	6.4	190	16,720	0.01672	33,440	0.0334	3.50	117,040	0.1170	0.0836	MH-34	
MH-35	**23**	LDR	2.93	19	6.5	190	3,610	0.00361	7,220	0.0072	3.58	25,848	0.0258	0.0186	MH-35	34, 38
MH-36	**50**	P/QP	9.62			170	1,635	0.00164	3,271	0.0033	3.65	11,938	0.0119	0.0087	MH-36	35
MH-37	**17**	LDR	3.56	24	6.7	190	4,560	0.00456	9,120	0.0091	3.58	32,650	0.0326	0.0235	MH-37	6
MH-38	**18**	LDR	5.05	31	6.1	190	5,890	0.00589	11,780	0.0118	3.58	42,172	0.0422	0.0304	MH-38	37
MH-39	**62**	P/R	10.11			10	101	0.00010	202	0.0002	3.65	738	0.0007	0.0005	MH-39	41
MH-41	**53**	CC	23.85			850	20,273	0.02027	40,545	0.0405	3.46	140,286	0.1403	0.0997	MH-41	43
MH-42	**null**													0.0000	MH-42	
MH-43	**38**	HDR	15.21	380	25.0	130	49,400	0.04940	98,800	0.0988	3.22	318,136	0.3181	0.2193	MH-43	
MH-44	**19**	HDR	9.34	230	24.6	130	29,900	0.02990	59,800	0.0598	3.38	202,124	0.2021	0.1423	MH-44	39, 51
MH-45	**28**	MDR	10.32	129	12.5	190	24,510	0.02451	49,020	0.0490	3.41	167,158	0.1672	0.1181	MH-45	44
MH-46	**36**	HDR	7.55	113	15.0	130	14,690	0.01469	29,380	0.0294	3.50	102,830	0.1028	0.0735	MH-46	45, 55
MH-47	**52**	CC-CV	13.06	18	1.4	2300	30,038	0.03004	60,076	0.0601	3.38	203,057	0.2031	0.1430	MH-47	46, 60
MH-48	**66**	P/R	3.04			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-48	47
MH-49	**51**	CC-CV	14.21	91	6.4	2300	32,683	0.03268	65,366	0.0654	3.34	218,322	0.2183	0.1530	MH-49	48
MH-50	**34**	LDR	3.86	19	4.9	190	3,610	0.00361	7,220	0.0072	3.58	25,848	0.0258	0.0186	MH-50	49
MH-51	**39**	MDR	7.35	54	7.3	190	10,260	0.01026	20,520	0.0205	3.54	72,641	0.0726	0.0521	MH-51	52
MH-52	**40**	LDR	13.51	71	5.3	190	13,490	0.01349	26,980	0.0270	3.50	94,430	0.0944	0.0675	MH-52	
MH-54	**67**	P/R	2.00			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000	MH-54	
MH-55	**42**	MDR	8.37	66	7.9	190	12,540	0.01254	25,080	0.0251	3.50	87,780	0.0878	0.0627	MH-55	54, 57
MH-56	**null**													0.0000	MH-56	
MH-57	**43**	LDR	13.64	78	5.7	190	14,820	0.01482	29,640	0.0296	3.50	103,740	0.1037	0.0741	MH-57	58
MH-58	**55**	P/QP	3.46			660	2,284	0.00228	4,567	0.0046	3.65	16,670	0.0167	0.0121	MH-58	
MH-59	**54**	P/QP	3.02			660	1,993	0.00199	3,986	0.0040	3.65	14,550	0.0146	0.0106	MH-59	
MH-60	**44**	HDR	6.03	150	24.9	130	19,500	0.01950	39,000	0.0390	3.46	134,940	0.1349	0.0959	MH-60	59
MH-61	**45**	MDR	8.24	94	11.4	190	17,860	0.01786	35,720	0.0357	3.46	123,591	0.1236	0.0879	MH-61	
MH-62	**37**	LDR	6.28	33	5.3	190	6,270	0.00627	12,540	0.0125	3.58	44,893	0.0449	0.0324	MH-62	61
MH-64	**32**	LDR	7.72	50	6.5	190	9,500	0.00950	19,000	0.0190	3.54	67,260	0.0673	0.0483	MH-64	70
MH-65	**24**	LDR	10.30	55	5.3	190	10,450	0.01045	20,900	0.0209	3.54	73,986	0.0740	0.0531	MH-65	64
MH-68	**56**	P/QP	0.28			660	185	0.00018	370	0.0004	3.65	1,349	0.0013	0.0010	MH-68	3,4
MH-69	**null**										3.65	0	0.0000	0.0000	MH-69	23, 65
MH-70	**110**	UR	20.00	1	0.05	190	190	0.00019	380	0.0004	3.65	1,387	0.0014	0.0010	MH-70	62
MH-72	**57**	P/QP	0.85			660	561	0.00056	1,122	0.0011	3.65	4,095	0.0041	0.0030	MH-72	20
MH-73	**null**										3.65	0	0.0000	0.0000	MH-73	69, 21
NPS											3.65	0	0.0000	0.0000	NPS	68
	70	Paseos	0.58			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	71	Paseos	0.32			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	72	Paseos	0.98			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	73	Paseos	0.98			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	74	Paseos	0.60			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	75	Paseos	0.76			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	76	Paseos	0.36			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	77	Paseos	0.85			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	78	Paseos	0.46			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	79	Paseos	0.39			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	80	Paseos	1.10			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	81	Paseos	1.15			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	90	OS	3.51			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	91	OS	4.15			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	92	OS	57.50			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	93	OS	5.99			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	94	OS	2.30			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	95	OS	2.73			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	96	OS	7.72			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	97	OS	40.08			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	98	OS	9.08			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	99	OS	0.48			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	100	OS	1.22			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	101	OS	0.95			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		
	102	OS	0.65			0					3.65	0	0.0000	0.0000		
	103	OS	0.65			0					3.65	0	0.0000	0.0000		
	104	OS	0.88			0					3.65	0	0.0000	0.0000		
		ROW	51.99			0	0	0.00000	0	0.0000	3.65	0	0.0000	0.0000		

Average Dry Weather Manhole Report
Scenario: Average Dry Weather Flow Report: Static Loading Manhole

ID	Rim Elevation (ft)	Base Flow (mgd)	Total Flow (mgd)	Grade (ft)	Status
MH-01	89.78	0.01520	0.01520	77.86	Not Full
MH-02	92.02	0.01292	0.01292	73.31	Not Full
MH-03	91.52	0.00000	0.00000	72.08	Not Full
MH-04	92.79	0.05206	0.05206	82.21	Not Full
MH-05	94.22	0.01843	0.01843	86.27	Not Full
MH-06	94.95	0.00760	0.00760	83.00	Not Full
MH-07	96.42	0.02622	0.02622	88.50	Not Full
MH-08	95.55	0.00000	0.00000	84.60	Not Full
MH-09	92.68	0.00988	0.00988	84.76	Not Full
MH-10	91.07	0.00000	0.00000	81.26	Not Full
MH-11	89.42	0.00589	0.00589	77.57	Not Full
MH-12	89.35	0.00760	0.00760	75.29	Not Full
MH-13	87.92	0.00646	0.00646	74.41	Not Full
MH-14	86.7	0.00323	0.00323	72.71	Not Full
MH-15	85.08	0.00779	0.00779	72.02	Not Full
MH-16	86.28	0.01045	0.01045	69.73	Not Full
MH-17	86.7	0.00399	0.00399	69.24	Not Full
MH-18	87.24	0.00000	0.00000	68.54	Not Full
MH-19	87.22	0.00247	0.00247	67.54	Not Full
MH-20	86.51	0.00000	0.00000	66.85	Not Full
MH-21	85.61	0.00532	0.00532	65.79	Not Full
MH-23	88.82	0.01159	0.01159	66.37	Not Full
MH-24	92.9	0.00437	0.00437	71.20	Not Full
MH-25	93.42	0.01045	0.01045	73.34	Not Full
MH-26	92.42	0.00285	0.00285	74.35	Not Full
MH-27	91.49	0.00532	0.00532	78.46	Not Full
MH-28	90.02	0.00855	0.00855	82.06	Not Full
MH-29	99.09	0.00000	0.00000	85.50	Not Full
MH-30	97.93	0.00456	0.00456	83.74	Not Full
MH-31	95.03	0.00513	0.00513	80.55	Not Full
MH-33	94.42	0.00000	0.00000	75.24	Not Full
MH-34	93.49	0.01672	0.01672	85.56	Not Full
MH-35	96.77	0.00361	0.00361	77.64	Not Full
MH-36.	96.48	0.00164	0.00164	76.64	Not Full
MH-37	97.67	0.00456	0.00456	80.91	Not Full
MH-38	97.92	0.00589	0.00589	79.91	Not Full
MH-39	98.21	0.00010	0.00010	90.22	Not Full
MH-41	101.71	0.02027	0.02027	93.56	Not Full
MH-42	105.5	0.00000	0.00000	96.43	Not Full
MH-43	107.62	0.04940	0.04940	99.73	Not Full
MH-44	99.65	0.02990	0.02990	82.91	Not Full
MH-45	99.14	0.02451	0.02451	80.64	Not Full
MH-46	94.26	0.01469	0.01469	70.35	Not Full
MH-47	92.08	0.03004	0.03004	69.07	Not Full

Average Dry Weather Manhole Report
Scenario: Average Dry Weather Flow Report: Static Loading Manhole

ID	Rim Elevation (ft)	Base Flow (mgd)	Total Flow (mgd)	Grade (ft)	Status
MH-48	90.76	0.00000	0.00000	68.06	Not Full
MH-49	90.3	0.03268	0.03268	67.69	Not Full
MH-50	89.56	0.00361	0.00361	67.10	Not Full
MH-51	104.47	0.01026	0.01026	89.69	Not Full
MH-52	106.73	0.01349	0.01349	98.77	Not Full
MH-54	105.25	0.00000	0.00000	97.20	Not Full
MH-55	101.77	0.01254	0.01254	75.00	Not Full
MH-56	100.53	0.00000	0.00000	76.78	Not Full
MH-57	95.24	0.01482	0.01482	82.88	Not Full
MH-58	93.59	0.00228	0.00228	85.63	Not Full
MH-59	95.66	0.00199	0.00199	87.73	Not Full
MH-60	97.76	0.01950	0.01950	83.08	Not Full
MH-61	95.27	0.01786	0.01786	87.38	Not Full
MH-62	92.72	0.00627	0.00627	81.30	Not Full
MH-64	91.51	0.00950	0.00950	77.91	Not Full
MH-65	89.5	0.01045	0.01045	74.08	Not Full
MH-68	90.9	0.00018	0.00018	71.00	Not Full
MH-69	87.38	0.00000	0.00000	65.38	Not Full
MH-70	91.25	0.00019	0.00019	79.49	Not Full
MH-72	85.85	0.00056	0.00056	66.15	Not Full
MH-73	85.7	0.00000	0.00000	62.90	Not Full
MH-P2G-1	94.87	0.00000	0.00000	94.87	Full
MH-P2G-2	82	0.00000	0.00000	82	Full

Average Dry Weather Flow Pipe Report
Scenario: Average Dry Weather Flow Report: Static Gravity Main

ID	From ID	To ID	Diameter (in)	Length (ft)	Slope	Total Flow (cfs)	Flow Type	Velocity (ft/s)	d/D	Full Flow (cfs)
17	MH-01	MH-02	6	323.20	0.0139	0.0235	Free Surface	1.5897	0.1288	0.6638
19	MH-02	MH-03	6	237.57	0.0046	0.0435	Free Surface	1.2941	0.2276	0.3828
21	MH-03	MH-68	6	55.52	0.0180	0.0435	Free Surface	2.0902	0.1629	0.7550
25	MH-04	MH-68	8	434.61	0.0255	0.1091	Free Surface	2.9950	0.1611	1.9363
23	MH-05	MH-04	6	352.65	0.0113	0.0285	Free Surface	1.5671	0.1485	0.5992
67	MH-06	MH-37	12	502.40	0.0040	0.2052	Free Surface	1.7852	0.2039	2.2539
63	MH-07	MH-08	6	467.50	0.0081	0.0406	Free Surface	1.5471	0.1913	0.5072
65	MH-08	MH-06	8	269.60	0.0045	0.0406	Free Surface	1.2081	0.1523	0.8083
35	MH-09	MH-10	6	421.20	0.0081	0.0153	Free Surface	1.1544	0.1194	0.5055
37	MH-10	MH-11	6	448.40	0.0080	0.0153	Free Surface	1.1523	0.1195	0.5041
39	MH-11	MH-12	6	246.80	0.0081	0.0244	Free Surface	1.3294	0.1494	0.5064
41	MH-12	MH-13	8	153.80	0.0052	0.0362	Free Surface	1.2331	0.1388	0.8738
43	MH-13	MH-14	8	319.60	0.0050	0.0462	Free Surface	1.3083	0.1576	0.8573
45	MH-14	MH-15	8	116.80	0.0051	0.0512	Free Surface	1.3610	0.1647	0.8684
47	MH-15	MH-16	8	386.00	0.0052	0.0632	Free Surface	1.4534	0.1822	0.8721
49	MH-16	MH-17	10	96.10	0.0042	0.0794	Free Surface	1.4005	0.1607	1.4173
51	MH-17	MH-18	10	138.80	0.0043	0.0856	Free Surface	1.4513	0.1651	1.4443
53	MH-18	MH-19	10	225.70	0.0040	0.0856	Free Surface	1.4107	0.1684	1.3872
55	MH-19	MH-20	10	156.80	0.0038	0.0894	Free Surface	1.4085	0.1738	1.3589
57	MH-20	MH-72	10	159.45	0.0038	0.0894	Free Surface	1.4001	0.1745	1.3476
61	MH-21	MH-73	10	49.30	0.0345	0.0985	Free Surface	3.1341	0.1072	4.0793
139	MH-23	MH-69	18	284.80	0.0032	0.7704	Free Surface	2.3128	0.2436	5.9207
97	MH-24	MH-23	12	416.30	0.0103	0.3191	Free Surface	2.8461	0.2004	3.6305
89	MH-25	MH-24	12	468.00	0.0043	0.2974	Free Surface	2.0398	0.2410	2.3352
87	MH-26	MH-25	12	251.90	0.0036	0.2812	Free Surface	1.8834	0.2451	2.1352
85	MH-27	MH-26	6	256.62	0.0144	0.0215	Free Surface	1.5656	0.1222	0.6755
83	MH-28	MH-27	6	435.00	0.0081	0.0132	Free Surface	1.1041	0.1115	0.5046
91	MH-29	MH-30	6	222.00	0.0077	0.0000	Free Surface	0.0000	0.0000	0.4923
93	MH-30	MH-31	6	388.10	0.0080	0.0071	Free Surface	0.9110	0.0828	0.5028
95	MH-31	MH-24	6	364.10	0.0225	0.0150	Free Surface	1.6426	0.0926	0.8443
81	MH-33	MH-26	12	260.60	0.0031	0.2553	Free Surface	1.7354	0.2426	1.9792
73	MH-34	MH-35	6	283.50	0.0265	0.0259	Free Surface	2.0478	0.1156	0.9150
75	MH-35	MH-36.	12	303.20	0.0030	0.2528	Free Surface	1.7097	0.2434	1.9462
77	MH-36.	MH-33	12	428.80	0.0030	0.2553	Free Surface	1.7277	0.2433	1.9669
69	MH-37	MH-38	12	224.60	0.0040	0.2122	Free Surface	1.8072	0.2070	2.2613
71	MH-38	MH-35	12	491.70	0.0041	0.2214	Free Surface	1.8393	0.2105	2.2783
109	MH-39	MH-44	10	649.70	0.0109	0.1080	Free Surface	2.1543	0.1476	2.2965
103	MH-41	MH-39	10	797.90	0.0040	0.1078	Free Surface	1.5134	0.1883	1.3912
101	MH-42	MH-41	10	699.60	0.0040	0.0764	Free Surface	1.3661	0.1593	1.3898
99	MH-43	MH-42	8	475.40	0.0063	0.0764	Free Surface	1.6479	0.1906	0.9625
111	MH-44	MH-45	12	703.70	0.0030	0.1910	Free Surface	1.5787	0.2113	1.9514
123	MH-45	MH-46	12	482.50	0.0207	0.2289	Free Surface	3.2959	0.1437	5.1427
125	MH-46	MH-47	15	407.40	0.0030	0.2975	Free Surface	1.7441	0.1967	3.5152
131	MH-47	MH-48	15	285.10	0.0032	0.3772	Free Surface	1.9162	0.2174	3.6391
133	MH-48	MH-49	15	83.20	0.0036	0.3772	Free Surface	2.0085	0.2104	3.8893
135	MH-49	MH-50	15	160.80	0.0031	0.4278	Free Surface	1.9769	0.2324	3.6117
137	MH-50	MH-23	15	142.10	0.0028	0.4334	Free Surface	1.9156	0.2398	3.4364
107	MH-51	MH-44	6	800.60	0.0079	0.0368	Free Surface	1.4855	0.1836	0.4991
105	MH-52	MH-51	6	1121.70	0.0080	0.0209	Free Surface	1.2645	0.1388	0.5039
113	MH-54	MH-55	6	451.80	0.0487	0.0000	Free Surface	0.0000	0.0000	1.2414
121	MH-55	MH-46	8	806.60	0.0051	0.0459	Free Surface	1.3128	0.1566	0.8638
119	MH-56	MH-55	6	187.90	0.0080	0.0265	Free Surface	1.3547	0.1559	0.5027
117	MH-57	MH-56	6	742.76	0.0081	0.0265	Free Surface	1.3602	0.1555	0.5056
115	MH-58	MH-57	6	269.02	0.0100	0.0035	Free Surface	0.7993	0.0566	0.5636
127	MH-59	MH-60	6	580.50	0.0079	0.0031	Free Surface	0.7064	0.0561	0.5008
129	MH-60	MH-47	6	1109.50	0.0121	0.0333	Free Surface	1.6770	0.1575	0.6183
141	MH-61	MH-62	6	728.63	0.0080	0.0276	Free Surface	1.3710	0.1593	0.5019
143	MH-62	MH-70	8	343.60	0.0050	0.0373	Free Surface	1.2232	0.1426	0.8522
147	MH-64	MH-65	8	679.90	0.0052	0.0523	Free Surface	1.3714	0.1664	0.8693
149	MH-65	MH-69	8	187.40	0.0438	0.0685	Free Surface	3.1479	0.1131	2.5344
27	MH-68	WET_WELL_NPS	8	240.91	0.0706	0.1529	Free Surface	4.7321	0.1483	3.2185

Average Dry Weather Flow Pipe Report
Scenario: Average Dry Weather Flow Report: Static Gravity Main

ID	From ID	To ID	Diameter (in)	Length (ft)	Slope	Total Flow (cfs)	Flow Type	Velocity (ft/s)	d/D	Full Flow (cfs)
151	MH-69	MH-73	18	541.74	0.0031	0.8389	Free Surface	2.3645	0.2548	5.9000
145	MH-70	MH-64	8	291.80	0.0051	0.0376	Free Surface	1.2427	0.1419	0.8687
59	MH-72	MH-21	10	52.36	0.0038	0.0902	Free Surface	1.4116	0.1747	1.3576
153	MH-73	WET_WELL_CPS	24	231.90	0.0375	0.9374	Free Surface	5.6468	0.1010	43.9347
159	MH-P2G-1	MH-06	8	45.78	0.0786	0.1529	Free Surface	4.9153	0.1445	3.3976
165	MH-P2G-2	OTL-100	18	127.97	0.0070	0.9374	Free Surface	3.2518	0.2200	8.8326

Peak Wet Weather Flow Manhole Report
Scenario: Peak Wet Weather Flow Report: Static Loading Manhole

ID	Rim Elevation (ft)	Base Flow (mgd)	Total Flow (mgd)	Grade (ft)	Status
MH-01	89.78	0.03040	0.10640	77.97	Not Full
MH-02	92.02	0.02580	0.09040	73.54	Not Full
MH-03	91.52	0.00000	0.00000	72.22	Not Full
MH-04	92.79	0.10410	0.33520	82.39	Not Full
MH-05	94.22	0.03690	0.12760	86.40	Not Full
MH-06	94.95	0.01520	0.05380	83.37	Not Full
MH-07	96.42	0.05240	0.17880	88.67	Not Full
MH-08	95.55	0.00000	0.00000	84.77	Not Full
MH-09	92.68	0.01980	0.07000	84.86	Not Full
MH-10	91.07	0.00000	0.00000	81.36	Not Full
MH-11	89.42	0.01180	0.04220	77.70	Not Full
MH-12	89.35	0.01520	0.05380	75.45	Not Full
MH-13	87.92	0.01290	0.04620	74.59	Not Full
MH-14	86.7	0.00650	0.02320	72.90	Not Full
MH-15	85.08	0.01560	0.05520	72.24	Not Full
MH-16	86.28	0.02090	0.07400	69.97	Not Full
MH-17	86.7	0.00800	0.02860	69.48	Not Full
MH-18	87.24	0.00000	0.00000	68.79	Not Full
MH-19	87.22	0.00490	0.01800	67.80	Not Full
MH-20	86.51	0.00000	0.00000	67.11	Not Full
MH-21	85.61	0.01060	0.03810	65.94	Not Full
MH-23	88.82	0.02320	0.08210	67.11	Not Full
MH-24	92.9	0.00870	0.03120	71.57	Not Full
MH-25	93.42	0.02090	0.07400	73.83	Not Full
MH-26	92.42	0.00570	0.02040	74.85	Not Full
MH-27	91.49	0.01060	0.03810	78.56	Not Full
MH-28	90.02	0.01710	0.06050	82.15	Not Full
MH-29	99.09	0.00000	0.00000	85.50	Not Full
MH-30	97.93	0.00910	0.03260	83.81	Not Full
MH-31	95.03	0.01030	0.03680	80.62	Not Full
MH-33	94.42	0.00000	0.00000	75.73	Not Full
MH-34	93.49	0.03340	0.11700	85.65	Not Full
MH-35	96.77	0.00720	0.02580	78.14	Not Full
MH-36.	96.48	0.00330	0.01200	77.14	Not Full
MH-37	97.67	0.00910	0.03260	81.28	Not Full
MH-38	97.92	0.01180	0.04220	80.30	Not Full
MH-39	98.21	0.00020	0.00070	90.42	Not Full
MH-41	101.71	0.04050	0.14020	93.82	Not Full
MH-42	105.5	0.00000	0.00000	96.64	Not Full
MH-43	107.62	0.09880	0.31810	99.94	Not Full
MH-44	99.65	0.05980	0.20210	83.30	Not Full
MH-45	99.14	0.04900	0.16710	80.88	Not Full
MH-46	94.26	0.02940	0.10290	70.78	Not Full
MH-47	92.08	0.06010	0.20310	69.58	Not Full

Peak Wet Weather Flow Manhole Report
Scenario: Peak Wet Weather Flow Report: Static Loading Manhole

ID	Rim Elevation (ft)	Base Flow (mgd)	Total Flow (mgd)	Grade (ft)	Status
MH-48	90.76	0.00000	0.00000	68.55	Not Full
MH-49	90.3	0.06540	0.21840	68.26	Not Full
MH-50	89.56	0.00720	0.02580	67.70	Not Full
MH-51	104.47	0.02050	0.07260	89.86	Not Full
MH-52	106.73	0.02700	0.09450	98.89	Not Full
MH-54	105.25	0.00000	0.00000	97.20	Not Full
MH-55	101.77	0.02510	0.08780	75.18	Not Full
MH-56	100.53	0.00000	0.00000	76.91	Not Full
MH-57	95.24	0.02960	0.10370	83.01	Not Full
MH-58	93.59	0.00460	0.01670	85.67	Not Full
MH-59	95.66	0.00400	0.01460	87.77	Not Full
MH-60	97.76	0.03900	0.13490	83.21	Not Full
MH-61	95.27	0.03570	0.12360	87.52	Not Full
MH-62	92.72	0.01250	0.04490	81.45	Not Full
MH-64	91.51	0.01900	0.06730	78.10	Not Full
MH-65	89.5	0.02090	0.07400	74.20	Not Full
MH-68	90.9	0.00040	0.00140	71.17	Not Full
MH-69	87.38	0.00000	0.00000	66.21	Not Full
MH-70	91.25	0.00040	0.00140	79.65	Not Full
MH-72	85.85	0.00110	0.00410	66.40565	Not Full
MH-73	85.7	0.00000	0.00000	63.22424	Not Full
MH-P2G-1	94.87	0.00000	0.00000	94.87	Full
MH-P2G-2	82	0.00000	0.00000	82	Full

Peak Wet Weather Flow Pipe Report
Scenario: Peak Wet Weather Flow Report: Static Gravity Main

ID	From ID	To ID	Diameter (in)	Length (ft)	Slope	Total Flow (cfs)	Flow Type	Velocity (ft/s)	d/D	Full Flow (cfs)
17	MH-01	MH-02	6	323.20	0.0139	0.1646	Free Surface	2.8041	0.3393	0.6638
19	MH-02	MH-03	6	237.57	0.0046	0.3045	Free Surface	2.1640	0.6737	0.3828
21	MH-03	MH-68	6	55.52	0.0180	0.3045	Free Surface	3.6387	0.4419	0.7550
25	MH-04	MH-68	8	434.61	0.0255	0.7161	Free Surface	5.1306	0.4210	1.9363
23	MH-05	MH-04	6	352.65	0.0113	0.1974	Free Surface	2.7362	0.3951	0.5992
67	MH-06	MH-37	12	502.40	0.0040	1.3826	Free Surface	3.0152	0.5660	2.2539
63	MH-07	MH-08	6	467.50	0.0081	0.2766	Free Surface	2.6391	0.5266	0.5072
65	MH-08	MH-06	8	269.60	0.0045	0.2766	Free Surface	2.0980	0.4034	0.8083
35	MH-09	MH-10	6	421.20	0.0081	0.1083	Free Surface	2.0494	0.3143	0.5055
37	MH-10	MH-11	6	448.40	0.0080	0.1083	Free Surface	2.0455	0.3148	0.5041
39	MH-11	MH-12	6	246.80	0.0081	0.1736	Free Surface	2.3377	0.4038	0.5064
41	MH-12	MH-13	8	153.80	0.0052	0.2568	Free Surface	2.1761	0.3714	0.8738
43	MH-13	MH-14	8	319.60	0.0050	0.3283	Free Surface	2.2927	0.4293	0.8573
45	MH-14	MH-15	8	116.80	0.0051	0.3642	Free Surface	2.3784	0.4518	0.8684
47	MH-15	MH-16	8	386.00	0.0052	0.4496	Free Surface	2.5174	0.5092	0.8721
49	MH-16	MH-17	10	96.10	0.0042	0.5641	Free Surface	2.4508	0.4386	1.4173
51	MH-17	MH-18	10	138.80	0.0043	0.6084	Free Surface	2.5347	0.4529	1.4443
53	MH-18	MH-19	10	225.70	0.0040	0.6084	Free Surface	2.4600	0.4634	1.3872
55	MH-19	MH-20	10	156.80	0.0038	0.6362	Free Surface	2.4506	0.4811	1.3589
57	MH-20	MH-72	10	159.45	0.0038	0.6362	Free Surface	2.4351	0.4835	1.3476
61	MH-21	MH-73	10	49.30	0.0345	0.7015	Free Surface	5.5944	0.2806	4.0793
139	MH-23	MH-69	18	284.80	0.0032	5.2638	Free Surface	3.7857	0.7341	5.9207
97	MH-24	MH-23	12	416.30	0.0103	2.1921	Free Surface	4.8387	0.5605	3.6305
89	MH-25	MH-24	12	468.00	0.0043	2.0365	Free Surface	3.3507	0.7227	2.3352
87	MH-26	MH-25	12	251.90	0.0036	1.9220	Free Surface	3.0770	0.7417	2.1352
85	MH-27	MH-26	6	256.62	0.0144	0.1526	Free Surface	2.7797	0.3231	0.6755
83	MH-28	MH-27	6	435.00	0.0081	0.0936	Free Surface	1.9644	0.2917	0.5046
91	MH-29	MH-30	6	222.00	0.0077	0.0000	Free Surface	0.0000	0.0000	0.4923
93	MH-30	MH-31	6	388.10	0.0080	0.0504	Free Surface	1.6388	0.2139	0.5028
95	MH-31	MH-24	6	364.10	0.0225	0.1074	Free Surface	2.9488	0.2408	0.8443
81	MH-33	MH-26	12	260.60	0.0031	1.7378	Free Surface	2.8426	0.7267	1.9792
73	MH-34	MH-35	6	283.50	0.0265	0.1810	Free Surface	3.6275	0.3016	0.9150
75	MH-35	MH-36.	12	303.20	0.0030	1.7193	Free Surface	2.7973	0.7304	1.9462
77	MH-36.	MH-33	12	428.80	0.0030	1.7378	Free Surface	2.8275	0.7304	1.9669
69	MH-37	MH-38	12	224.60	0.0040	1.4330	Free Surface	3.0477	0.5778	2.2613
71	MH-38	MH-35	12	491.70	0.0041	1.4983	Free Surface	3.0962	0.5917	2.2783
109	MH-39	MH-44	10	649.70	0.0109	0.7102	Free Surface	3.7112	0.3817	2.2965
103	MH-41	MH-39	10	797.90	0.0040	0.7091	Free Surface	2.5631	0.5057	1.3912
101	MH-42	MH-41	10	699.60	0.0040	0.4922	Free Surface	2.3297	0.4110	1.3898
99	MH-43	MH-42	8	475.40	0.0063	0.4922	Free Surface	2.7729	0.5067	0.9625
111	MH-44	MH-45	12	703.70	0.0030	1.2814	Free Surface	2.6513	0.5911	1.9514
123	MH-45	MH-46	12	482.50	0.0207	1.5400	Free Surface	5.7206	0.3752	5.1427
125	MH-46	MH-47	15	407.40	0.0030	2.0213	Free Surface	2.9638	0.5438	3.5152
131	MH-47	MH-48	15	285.10	0.0032	2.5668	Free Surface	3.2137	0.6196	3.6391
133	MH-48	MH-49	15	83.20	0.0036	2.5668	Free Surface	3.3855	0.5931	3.8893
135	MH-49	MH-50	15	160.80	0.0031	2.9048	Free Surface	3.2730	0.6792	3.6117
137	MH-50	MH-23	15	142.10	0.0028	2.9447	Free Surface	3.1472	0.7127	3.4364
107	MH-51	MH-44	6	800.60	0.0079	0.2585	Free Surface	2.5641	0.5106	0.4991
105	MH-52	MH-51	6	1121.70	0.0080	0.1462	Free Surface	2.2230	0.3689	0.5039
113	MH-54	MH-55	6	451.80	0.0487	0.0000	Free Surface	0.0000	0.0000	1.2414
121	MH-55	MH-46	8	806.60	0.0051	0.3221	Free Surface	2.2938	0.4230	0.8638
119	MH-56	MH-55	6	187.90	0.0080	0.1863	Free Surface	2.3690	0.4215	0.5027
117	MH-57	MH-56	6	742.76	0.0081	0.1863	Free Surface	2.3795	0.4201	0.5056
115	MH-58	MH-57	6	269.02	0.0100	0.0258	Free Surface	1.4577	0.1458	0.5636
127	MH-59	MH-60	6	580.50	0.0079	0.0226	Free Surface	1.2890	0.1447	0.5008
129	MH-60	MH-47	6	1109.50	0.0121	0.2313	Free Surface	2.9214	0.4237	0.6183
141	MH-61	MH-62	6	728.63	0.0080	0.1912	Free Surface	2.3831	0.4280	0.5019
143	MH-62	MH-70	8	343.60	0.0050	0.2607	Free Surface	2.1456	0.3795	0.8522
147	MH-64	MH-65	8	679.90	0.0052	0.3670	Free Surface	2.3852	0.4534	0.8693
149	MH-65	MH-69	8	187.40	0.0438	0.4815	Free Surface	5.5867	0.2954	2.5344
27	MH-68	WET_WELL_NPS	8	240.91	0.0706	1.0227	Free Surface	8.1875	0.3874	3.2185

Peak Wet Weather Flow Pipe Report
Scenario: Peak Wet Weather Flow Report: Static Gravity Main

ID	From ID	To ID	Diameter (in)	Length (ft)	Slope	Total Flow (cfs)	Flow Type	Velocity (ft/s)	d/D	Full Flow (cfs)
151	MH-69	MH-73	18	541.74	0.0031	5.7453	Free Surface	3.8051	0.7969	5.9000
145	MH-70	MH-64	8	291.80	0.0051	0.2629	Free Surface	2.1804	0.3773	0.8687
59	MH-72	MH-21	10	52.36	0.0038	0.6426	Free Surface	2.4550	0.4842	1.3576
153	MH-73	WET_WELL_CPS	24	231.90	0.0375	6.4468	Free Surface	9.9946	0.2589	43.9347
159	MH-P2G-1	MH-06	8	45.78	0.0786	1.0227	Free Surface	8.5163	0.3762	3.3976
165	MH-P2G-2	OTL-100	18	127.97	0.0070	6.4468	Pressurized	5.4552	0.6342	8.8326

Amoruso Ranch Specific Plan Area

Wastewater Master Plan

Appendix B

Force Main Alignment Through Creekview Letter

Kimley»Horn

July 22, 2014

Ms. Kathy Pease
City of Roseville
311 Vernon Street
Roseville, CA 95678

RE: ***Amoruso Ranch Specific Plan – Wastewater Conveyance Through Creekview SPA***

Brookfield Residential is currently proposing development of the Amoruso Ranch Specific Plan (ARSP) Area within the City of Roseville. The ARSP Area consists of approximately 694.4-acres located in the northwest edge of the City of Roseville. The ARSP Area is bounded on the west by the Al Johnson Wildlife Area, to the south by the Creekview Specific Plan Area, to the east by the future Sunset Industrial/Placer Ranch Specific Plan Area and to the north by the existing Amoruso Estates (Toad Hill) area.

The ARSP Area provides for a mix of land uses to achieve the desired community form and objectives. These land use designations include low-, medium- and high density residential uses; commercial and office uses; which in some cases are sited with one another and/or with residential uses; public and quasi-public uses for the schools and civic activities such as a fire station; parks and open space uses; and an urban reserve.

At buildout, the ARSP Area will provide for approximately 3,000 dwelling units which would accommodate roughly 7,900 residents, it adds approximately 51 acres of commercial retail and office land uses, and provides approximately 26-acres of parks and 135-acres of open space.

We have reviewed the conveyance and routing of wastewater from the Amoruso Ranch Specific Plan (ARSP) Area through the Creekview Specific Plan (Creekview) Area. It should be noted that Creekview currently proposes a wastewater lift station within their development on the south side of Pleasant Grove Creek. This lift station will pump flows from the Creekview development into a discharge manhole located just north of Blue Oaks Boulevard.

The wastewater flows generated within the ARSP Area will need to be pumped through a wastewater lift station located within the ARSP development. Once flows pass from the ARSP Area to Creekview there are three feasible alternatives for the conveyance of wastewater.

In general, the three wastewater conveyance alternatives for the ARSP Area can be described as follows and are shown on the attached exhibits:

- **Alternative A - Dual Pumping**: The flows from the ARSP Area can be discharged into the Creekview system prior to their wastewater lift station. This point of interconnect could occur either at a gravity sewer main prior to the lift station or at the lift station wet well.

- **Alternative B - Combined Force Main**: The flows from the ARSP Area can be discharged into a combined force main on the outlet side of the Creekview lift station.

- **Alternative C - Parallel Force Mains**: The wastewater flows from the ARSP Area can be discharged into a common discharge manhole just north of Blue Oaks Boulevard.

We have reviewed the three alternatives for conveyance of wastewater flows from the ARSP Area through Creekview and recommend "Alternative C – Parallel Force Mains" for the following reasons:

1. Alternative C eliminates the need to double pump flows from the ARSP Area through Creekview's lift station. Double pumping of flows would greatly increase the construction and capital costs of the Creekview lift station.

2. Alternative C, by not increasing the capacity of the Creekview lift station, results in reduced operations and maintenance costs than would occur over the life of the facility if the ARSP Area flows are pumped a second time through the Creekview lift station.

3. Alternative C eliminates the complexities of hydraulics and operations when pumping into a combined force main.

4. Alternatives B and C have similar capital cost estimates. While Alternative C has an additional length of force main (approximately 1,000 feet), the system operations and valving scenarios for the interconnected force mains for Alternative B are more complex, rendering the projected capital cost estimates equivalent at this preliminary level of analysis.

5. Based on review of the Creekview Development Agreement (DA) it appears that Alternative B was the basis for the DA. Alternative A would add complexities to the DA to address significant upsizing of the Creekview lift station; while Alternative C can be readily addressed as part of the DA.

We have coordinated with GBD Communities regarding the alternatives for conveying wastewater flows from the ARSP Area through Creekview and we have mutually agreed that Alternative C is the preferred option. As a result of the significant savings to the City of Roseville over the operational life of the facilities from reduced operations and maintenance costs and reduced operational

complexities, not to mention a significant savings in the capital cost of the lift station, we recommend "Alternative C - Parallel Force Mains" and will be proceeding with development of the ARSP Wastewater Master Plan based on this recommendation.

Please contact me at (916) 571-1005 or paul.klein@kimley-horn.com should you have any questions related to the information presented within this letter on the preliminary analysis for conveyance of wastewater flows from the ARSP Area through Creekview.

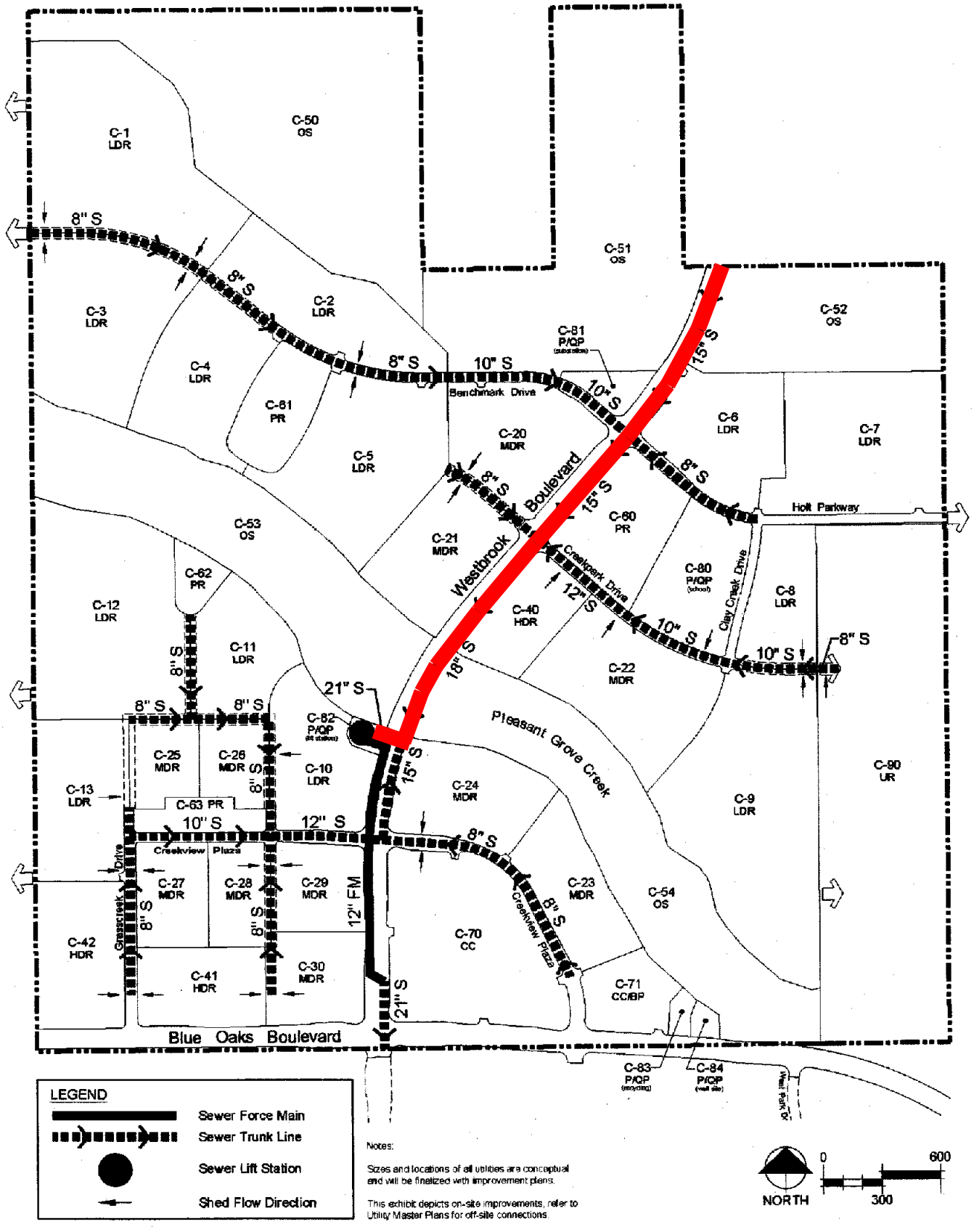
Sincerelv.

Paul A. Klein

Paul A. Klein, P.E.
Regional Vice President

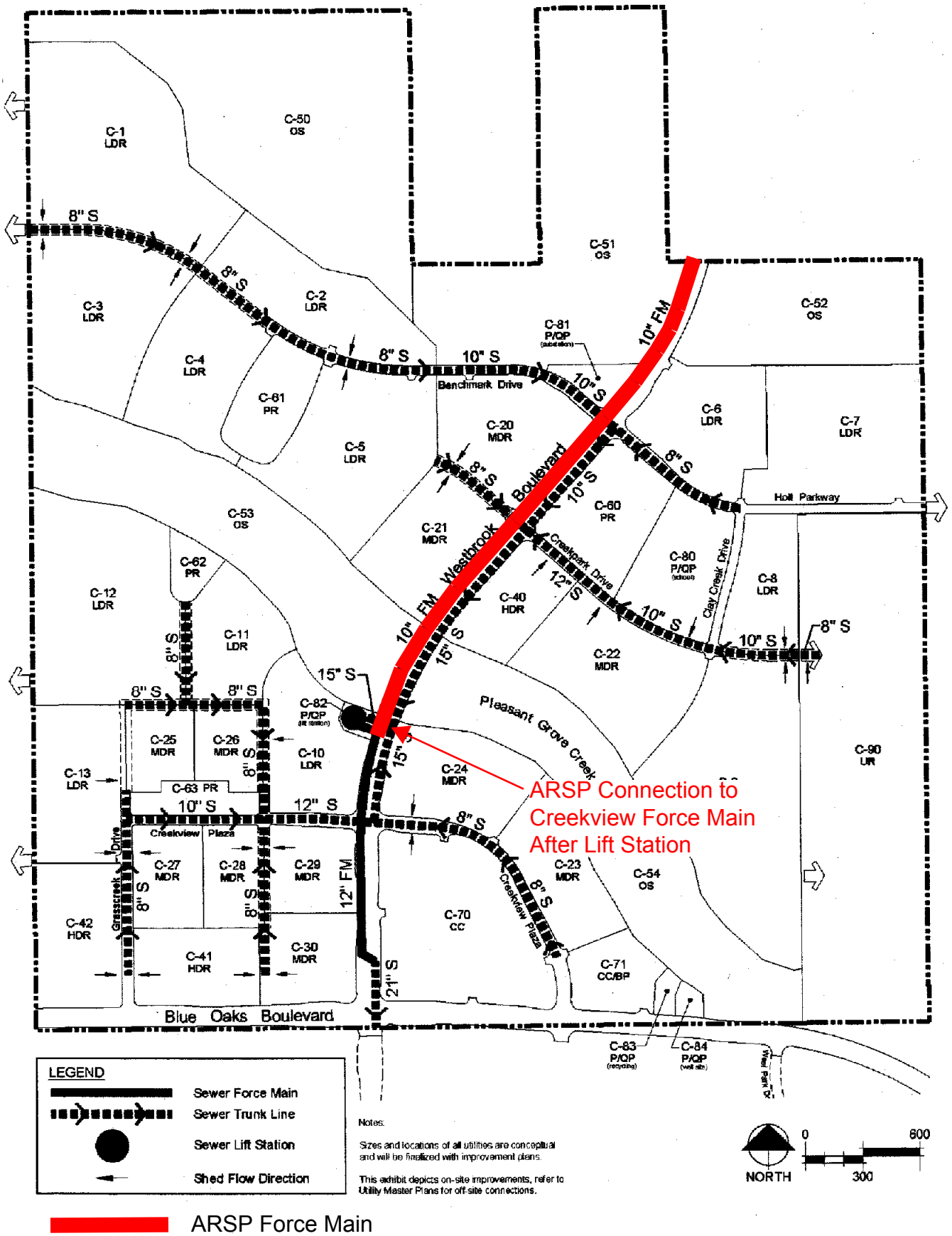
cc: Brookfield Residential

Alternative A: Dual Pumping

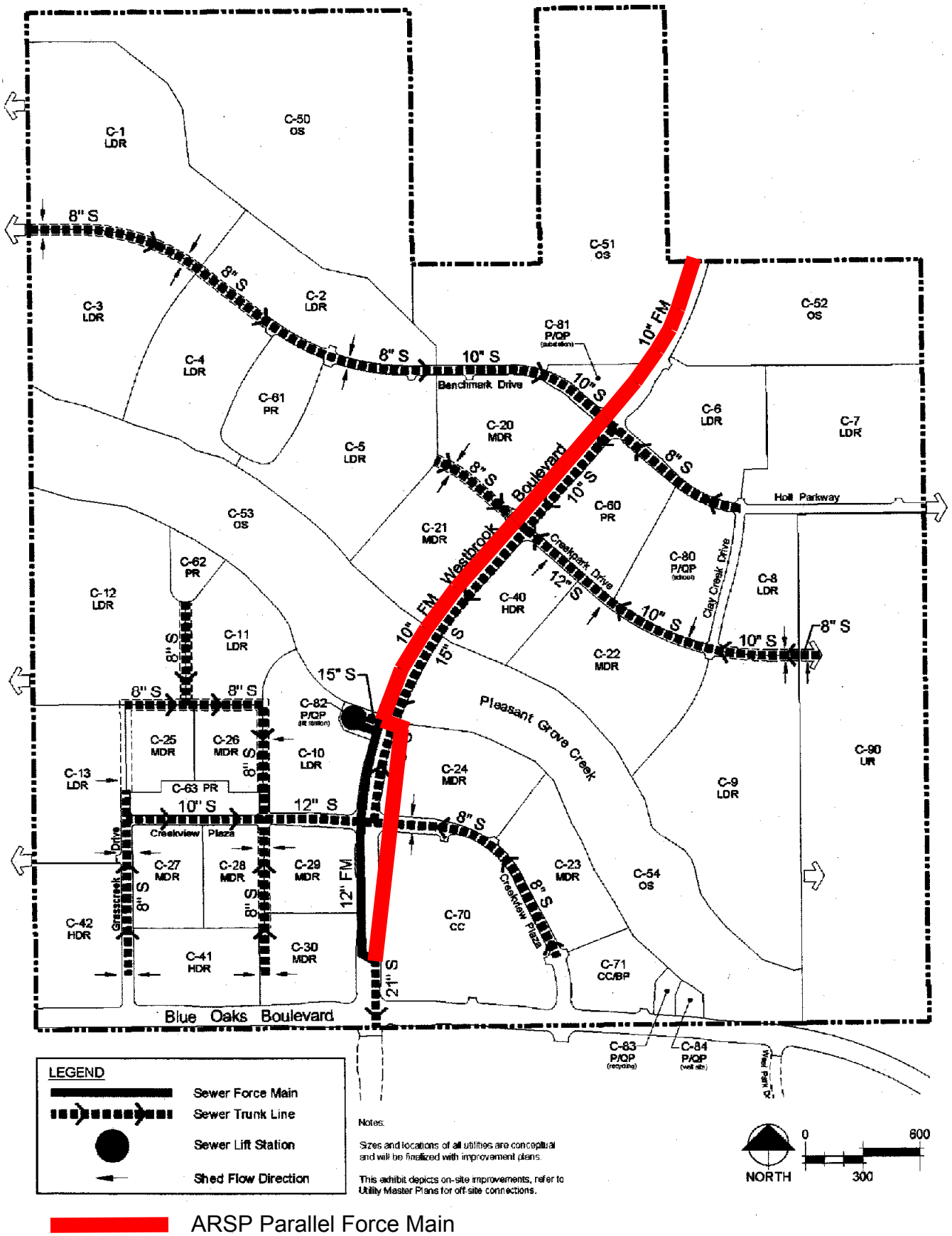


ARSP Gravity Sewer or Force Main to Interconnect with Creekview Sewer System Prior to Lift Station

Alternative B: Combined Force Main



Alternative C: Parallel Force Main



ARSP Parallel Force Main

Amoruso Ranch Specific Plan Area

Wastewater Master Plan

Appendix C

Creekview Sewer Modeling – Trunk Sewer Model for Creekview (2010 Final Technical Memorandum by RMC)

Final Technical Memorandum

Creekview Sewer Modeling

Subject:	**Trunk Sewer Model for Creekview**
Prepared For:	Mike Smith, MacKay and Somps
Prepared by:	Chris van Lienden, RMC
Reviewed by:	Glenn Hermanson, RMC
Date:	August 10, 2010
Reference:	0201-004

1 Introduction

The purpose of this technical memorandum (TM) is to describe the sanitary sewer hydraulic modeling conducted for the Creekview urban growth area (UGA) near the City of Roseville in Placer County. This TM was prepared for MacKay and Somps Civil Engineers, Inc (MacKay and Somps).

The Creekview UGA is within the ultimate service area of the South Placer Wastewater Authority (SPWA). As such, MacKay and Somps was asked by SPWA to add portions of the planned Creekview sanitary sewer system to an existing hydraulic model of the SPWA trunk sewer system. Prior to the preparation of this TM, a Sanitary Sewer Master Plan had been prepared by MacKay and Somps for the Creekview UGA. The Sanitary Sewer Master Plan provides the basis for the modeling described in this TM.

As part of the South Placer Regional Wastewater and Recycled Water Systems Evaluation (Systems Evaluation), a TM titled *Unit Flow Factor Sets and Sewer Design Criteria* (TM 3a) was prepared by SPWA to provide criteria for the sizing of sewers for new developments. TM 3a states that for the sizing of future infrastructure facilities, the hydraulic model of the trunk sewer system should be used for pipes 15 to 18 inches in diameter and larger. TM 3a is attached to this TM (Attachment B).

Three alternatives were evaluated corresponding to three different potential loading scenarios: Base, Base plus Urban Reserve, Base plus Urban Reserve plus Brookfield UGA. Loading and pipeline invert information for these scenarios was provided by Mackay and Somps.

1.1 Information Source

The alignments, diameters, inverts, and slopes of modeled sewers, as well as the locations, rim elevations, tributary areas and wastewater flow information associated with the modeled manholes for the proposed infrastructure were provided by MacKay and Somps. A summary of this information is provided in Attachment A.

2 Hydraulic Model

Pipes 18 inches in diameter and larger in the Creekview UGA sanitary sewer system were added to an existing SPWA trunk sewer model. The SPWA trunk sewer model was designed to function as an extended period simulation, and features land use-specific diurnal curves, a design storm, and unit hydrographs for the purpose of simulating time-varying wastewater flows in the trunk sewer system during a design storm event. These same features were applied to the modeled Creekview trunk sewers. For more information on the development of the SPWA trunk sewer model, refer to the SPWA TM titled

Trunk Sewer Hydraulic Analysis (TM 3b). Since the publication of TM 3b, the city of Roseville has constructed a number of pipes in West Roseville, including a 24 inch pipe on Phillip Road which would serve Creekview, a portion of West Roseville, and potentially Brookfield. These newly constructed pipes have been added to the SPWA trunk sewer model for the current analysis. This analysis uses the Buildout PWWF model described in TM 3b. The RDI/I and GWI rate parameters used were the same as surrounding UGAs (GWI: 100 gpad for the Pleasant Grove basin).

The pipe segment from Node 310 to Node 320 (Lift Station C-43) was not modeled as proposed inverts were not available and will depend on pump station design. Predicted flow through this pipe segment is expected to be the same as between Node 320 and Node 340. The design of Lift Station C-43 and the lift station in Brookfield should ensure that the instantaneous pumping rate is less than the capacity of the downstream sewers. Three nodes between 350 and 370 were not assigned node IDs in the Sanitary Sewer Master Plan. For the purposes of this study, they have been assigned IDs 350A, 350B and 350C.

2.1 Model Software

The software used to model the Creekview trunk sewers was H2OMap Sewer Professional Suite 9.0 (H2OMap Sewer), a product of MWH Soft, Inc. This software is widely used for hydraulic analysis of collection systems.

2.2 Model Results

Model results for the three scenarios are described below. The modeled Creekview trunk sewers were evaluated using the same criteria used by SPWA (and presented in TM 3b) to evaluate other existing and planned trunk sewers in the SPWA service area. The surcharge criterion used for this analysis requires that under design flow conditions, trunk sewers shall not be allowed to surcharge.

2.2.1 Base

This alternative includes only the base Creekview development. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 1 summarizes the modeled pipes and PWWF using the pipe sizes.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.29, including flow from Creekview.

Table 1: Base Modeled Pipe Summary

U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330[a]	340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320[b]	340	10	50	N/A	0.85	2.4	N/A	N/A	2.7
340[b]	350	10	1250	N/A	0.85	2.4	N/A	N/A	2.7
350	350A	15	400	0.0015	0.85	2.1	0.51	0.53	N/A
350A	350B	15	500	0.0015	0.83	2.1	0.51	0.51	N/A
350B	350C	15	400	0.0015	0.81	2.0	0.50	0.50	N/A
350C	370	15	400	0.0015	0.81	2.0	0.50	0.50	N/A
370	380	18	525	0.0012	1.19	2.1	0.50	0.51	N/A
380	390	18	275	0.0012	1.18	2.1	0.50	0.50	N/A

Footnotes:

a. Force Main from Brookfield not included in this model.
b. Force main.

2.2.2 Base + Urban Reserve

This alternative includes the Urban Reserve in addition to base Creekview. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 2 summarizes the modeled pipes and PWWF using the pipe sizes.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base plus Urban Reserve buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.32, including flow from Creekview.

Table 2: Base + Urban Reserve Modeled Pipe Summary

U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330[a]	340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320[b]	340	10	50	N/A	0.98	4.4	N/A	N/A	3.5
340[b]	350	10	1250	N/A	0.98	2.8	N/A	N/A	3.5
350	350A	15	400	0.0015	0.98	2.1	0.56	0.61	N/A
350A	350B	15	500	0.0015	0.96	2.1	0.55	0.59	N/A
350B	350C	15	400	0.0015	0.94	2.1	0.55	0.58	N/A
350C	370	15	400	0.0015	0.94	2.1	0.55	0.58	N/A
370	380	18	525	0.0012	1.31	2.1	0.53	0.55	N/A
380	390	18	275	0.0012	1.31	2.1	0.53	0.55	N/A

Footnotes:

a. Force Main from Brookfield not included in this model.

b. Force main.

2.2.3 Base + Urban Reserve + Brookfield

This alternative includes the Brookfield UGA in addition to base Creekview and the Urban Reserve. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 3 summarizes the modeled pipes and PWWF.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base plus Urban Reserve plus Brookfield buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.59, including flow from Creekview.

Table 3: Base + Urban Reserve + Brookfield Modeled Pipe Summary

U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330[a]	340	10	3000	N/A	1.19	3.4	N/A	N/A	5.0
320[a]	340	10	50	N/A	0.98	4.4	N/A	N/A	3.5
340[a]	350	12	1250	N/A	2.17	4.3	N/A	N/A	6.3
350	350A	21	400	0.001	2.16	2.2	0.60	0.67	N/A
350A	350B	21	500	0.001	2.14	2.2	0.59	0.66	N/A
350B	350C	21	400	0.001	2.11	2.2	0.59	0.65	N/A
350C	370	21	400	0.001	2.08	2.2	0.58	0.64	N/A
370	380	24	525	0.0008	2.46	2.1	0.55	0.58	N/A
380	390	24	275	0.0008	2.46	2.1	0.55	0.58	N/A

Footnotes:

a. Force Main.

Attachment A

LEGEND

- MAJOR SHED BOUNDARY
- MAJOR SHED LINE
- MINOR SHED LINE
- FM — SEWER FORCE MAIN
- SS — SEWER TRUNK LINE
- FUT FM — FUTURE SEWER FORCE MAIN
- EX SS — EXISTING SEWER LINE
- FD-10 LDR — PARCEL ID AND LAND USE DESIGNATION
- NODE POINT
- SHED FLOW DIRECTION

NODE
Q_A = AVERAGE DRY WEATHER FLOW, (MGD)
Q_F = FACTORED FLOW, (MGD)
P_F = PEAKING FACTOR
Q_D = PEAK WET WEATHER FLOW, (MGD)

C-1 LDR-3.8 13.1 ± AC.
C-2 LDR-4.5 7.1 ± AC.
C-3 LDR-5.0 20.8 ± AC.
C-4 LDR-4.5 10.2 ± AC.
C-5 LDR-6.5 6.4 ± AC.
C-6 LDR-6.5 11.5 ± AC.
C-7 MDR-8.5 11.3 ± AC.
C-8 MDR-10.5 6.5 ± AC.
C-9 LDR-6.5 11.5 ± AC.
C-10 LDR-4.5 11.0 ± AC.
C-11 HDR-25.0 4.6 ± AC.
C-12 MDR-8.5 10.5 ± AC.
C-13 LDR-5.5 4.3 ± AC.
C-14 LDR-5.5 23.7 ± AC.
C-15 MDR-12.9 8.4 ± AC.
C-16 MDR-8.5 7.0 ± AC.
C-17 LDR-5.5 3.9 ± AC.
C-18 LDR-5.5 16.8 ± AC.
C-19 LDR-6.9 7.6 ± AC.
C-20 LDR-6.9 5.6 ± AC.
C-21 LDR-6.9 5.6 ± AC.
C-22 HDR-25.0 4.2 ± AC.
C-23 MDR-10.5 3.9 ± AC.
C-24 MDR-10.5 3.9 ± AC.
C-25 MDR-12.9 5.1 ± AC.
C-26 HDR-25.0 4.3 ± AC.
C-27 HDR-25.0 6.4 ± AC.
C-28 HDR-25.0 3.6 ± AC.
C-40 CC (CMU) 27.4 ± AC.
C-41 P/QP WELL SITE 0.5 ± AC.
C-42 P/QP RECYCLING CENTER 0.5 ± AC.
C-43 LIFT STATION 0.4 ± AC.
C-44 SUB-STATION 1.1 ± AC.
C-50 OS 34.7 ± AC.
C-51 OS 35.8 ± AC.
C-52 OS 14.8 ± AC.
C-53 OS 24.7 ± AC.
C-54 OS 23.7 ± AC.
C-70 PR 8.0 ± AC.
C-71 PR 4.9 ± AC.
C-72 PR 1.5 ± AC.
C-73 PR 1.5 ± AC.
C-80 P/QP SCHOOL 7.0 ± AC.
C-90 UR 39.9 ± AC.
N.A.P.
N.A.P.
PARKWAY ONE
PARKWAY ONE
BLUE OAKS BLVD.
BLUE OAKS BLVD.
WESTBROOK BOULEVARD
WESTBROOK BOULEVARD
PLEASANT GROVE CREEK
PLEASANT GROVE CREEK
CREEKVIEW CIRCLE
CREEKVIEW CIRCLE
NOBO DRIVE
WEST PARK DRIVE
EXISTING PHILLIP ROAD
ROSEVILLE ENERGY PARK
ROSEVILLE WWTP
WESTPARK
FIDDYMENT RANCH

NODE DATA			
PARCEL	AREA	PROJECTED DU	TRIBUTARY TO NODE
C-1 (LDR)	13.1	50	140
C-2 (LDR)	7.1	32	140, 150
C-3 (LDR)	20.8	104	170, 180
C-4 (LDR)	10.2	46	150, 160
C-5 (LDR)	6.4	42	170
C-6 (LDR)	11.5	75	180
C-7 (MDR)	11.3	96	200
C-8 (MDR)	6.5	68	200
C-9 (LDR)	11.5	75	230
C-10 (LDR)	11.0	50	220
C-11 (HDR)	4.6	115	290
C-12 (MDR)	10.5	89	280
C-13 (LDR)	4.3	24	260
C-14 (LDR)	23.7	130	260
C-15 (MDR)	8.4	108	120
C-16 (MDR)	7.0	60	100
C-17 (LDR)	3.9	21	90
C-18 (LDR)	16.8	92	80
C-19 (LDR)	7.6	52	30, 70
C-20 (LDR)	5.6	39	70
C-21 (LDR)	5.6	39	90
C-22 (HDR)	4.2	105	60
C-23 (MDR)	3.9	41	60
C-24 (MDR)	3.9	41	20
C-25 (MDR)	5.1	66	20
C-26 (HDR)	4.3	108	10
C-27 (HDR)	6.4	160	10, 50
C-28 (HDR)	3.6	90	50
C-40 (CMU)	27.4	80	120
C-41 (PUB)	0.5		120
C-42 (PUB)	0.5		120
C-43 (PUB)	0.4		
C-44 (PUB)	1.1		210
C-71 (PARK)	4.9		
C-72 (PARK)	1.5		
C-73 (PARK)	1.5		
C-90 (UR)	39.9	405	250
BROOKFIELD	1	1	330
WRSP	1	1	360
PARCEL A	9.6		380

TABLE 1 - PIPELINE CAPACITY SUMMARY			
PIPE DIAMETER	MINIMUM SLOPE	0.7 FULL mgd	1.0 FULL mgd
6"	0.005	0.21	0.25
8"	0.0035	0.38	0.46
10"	0.0025	0.59	0.70
12"	0.002	0.86	1.02
15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
24"	0.0008	3.46	4.13

= USED FOR PRELIMINARY DESIGN

NOTES:

1. COVER FROM TOP OF PIPE TO FLOW LINE OF CREEK CROSSINGS IS 3.0' MIN.
2. PEAK WET WEATHER FLOWS AT NODES 310, 320, 330, 340, 350, 370. 380, AND 390 HAVE BEEN CALCULATED BASED ON HYDRAULIC MODELING.
3. PIPES DOWN STREAM FROM NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN SIZED BASED ON HYDRAULIC MODELING.
4. THE 167 UNITS OF MEDIUM DENSITY RESIDENTIAL AND 238 UNITS OF HIGH DENSITY RESIDENTIAL FUTURE LAND USE ON C-90 (URBAN RESERVE) ARE INCLUDED IN THE HYDRAULIC MODELING.
5. MINOR WASTEWATER SHED BOUNDARY ADJUSTMENTS WILL BE ALLOWED DURING FINAL UTILITY AND GRADING DESIGN, SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.

NORTH
0 200 400 800
SCALE:1"=400'

CREEKVIEW SPECIFIC PLAN

SANITARY SEWER MASTER PLAN

CVSP BASE + URBAN RESERVE CONDITION

SCALE: 1"=200' AUGUST 9, 2010

MacKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1189

EXHIBIT 2
SHEET 1 OF 1

7-22-2010 15:19:03 mjones P:\1845\1\master plans\MS Sewer\Master_SS_ExhO2.dwg
[1] P:\1845\1\master plans\Overview_Land_Use.dwg

LEGEND

- MAJOR SHED BOUNDARY
- MAJOR SHED LINE
- MINOR SHED LINE
- SEWER FORCE MAIN (FM)
- SEWER TRUNK LINE (SS)
- FUTURE SEWER FORCE MAIN (FUT FM)
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- PARCEL ID AND LAND USE DESIGNATION (FD-10 LDR)
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C-24 MDR-10.5 3.9 ± AC.
C-25 MDR-12.9 5.1 ± AC.
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C-51 OS 35.8 ± AC.
C-52 OS 14.8 ± AC.
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C-54 OS 23.7 ± AC.
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C-71 PR 4.9 ± AC.
C-72 PR 1.5 ± AC.
C-73 PR 1.5 ± AC.
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N.A.P.
N.A.P.

NODE DATA			
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C-21 (LDR)	5.6	39	90
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C-23 (MDR)	3.9	41	60
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C-25 (MDR)	5.1	66	20
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C-27 (HDR)	6.4	160	10, 50
C-28 (HDR)	3.6	90	50
C-40 (CMU)	27.4	80	120
C-41 (PUB)	0.5		120
C-42 (PUB)	0.5		120
C-43 (PUB)	0.4		
C-44 (PUB)	1.1		210
C-71 (PARK)	4.9		
C-72 (PARK)	1.5		
C-73 (PARK)	1.5		
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BROOKFIELD	1	1	330
WRSP	1	1	360
PARCEL A	9.6		380

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NORTH
0 200 400 800
SCALE:1" =400'

CREEKVIEW SPECIFIC PLAN

SANITARY SEWER MASTER PLAN

CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION

SCALE: 1"=200' AUGUST 9, 2010

MacKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1189

EXHIBIT 3
SHEET 1 OF 1

7-22-2010 15:19:00 mjones P:\18451\master plans\MS Sewer\Master_SS_Exh03.dwg
[1]P:\18451\master plans\Obsolete_Land_Use.dwg

TABLE 8
WASTEWATER FLOWS BY NODE
BASE CONDITION
CREEKVIEW SPECIFIC PLAN

REFERENCE	CONTRIBUTING	LDR / MDR			HDR			CMU					SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL	FACTORED	PEAKING	TOTAL	PIPE	PIPE	% FULL
NODE	NODE	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA		AREA	CUM AREA	Q(ADWF)	Q(ADWF)	FLOW	FACTOR	Q(PWWF)	SIZE	SLOPE	Q(PWWF)
#	#		#	MGD		#	MGD		#	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	AREA	MGD	ACRE	ACRE	MGD	MGD	MGD		MGD	IN.	FT/FT	(d/D)
10					188	188	0.024																		0.024	0.049	3.42	0.167	8	0.0035	31
20	10	107	107	0.020		188	0.024																		0.045	0.090	3.26	0.292	8	0.0035	54
30		26	26	0.005																					0.005	0.010	3.59	0.035	8	0.0035	7
40	20, 30		133	0.025		188	0.024																		0.050	0.099	3.23	0.321	8	0.0035	59
50					170	170	0.022																		0.022	0.044	3.44	0.152	8	0.0035	28
60	50	41	41	0.008	105	275	0.036																		0.044	0.087	3.27	0.285	8	0.0035	52
70		65	65	0.012																					0.012	0.025	3.52	0.087	8	0.0035	16
80	70	92	157	0.030																					0.030	0.060	3.38	0.202	8	0.0035	37
90	80	60	217	0.041																					0.041	0.082	3.29	0.271	8	0.0035	50
100	90	60	277	0.053																					0.053	0.105	3.20	0.337	8	0.0035	62
110	40, 60, 100		451	0.086		463	0.060																		0.146	0.292	2.70	0.788	12	0.0020	79
120		108	108	0.021				80	80	27.4	27.4	0.063							1.0	1.0	0.001				0.084	0.168	3.00	0.505	10	0.0025	61
130	110, 120		559	0.106		463	0.060		80		27.4	0.063								1.0	0.001				0.230	0.460	2.49	1.146	15	0.0015	72
140		66	66	0.013																					0.013	0.025	3.52	0.088	8	0.0035	16
150		39	39	0.007																					0.007	0.015	3.56	0.053	8	0.0035	10
160	140, 150	23	128	0.024																					0.024	0.049	3.42	0.166	8	0.0035	31
170	160	94	222	0.042																					0.042	0.084	3.28	0.277	8	0.0035	51
180	170	127	349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
190	180		349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
200	190	164	513	0.097																					0.097	0.195	2.93	0.571	10	0.0025	69
210																			1.1	1.1	0.001				0.001	0.001	3.65	0.005	8	0.0035	1
220		50	50	0.010																					0.010	0.019	3.55	0.067	8	0.0035	12
230	220	75	125	0.024																					0.024	0.048	3.43	0.163	8	0.0035	30
240	210, 240		125	0.024																1.1	0.001				0.024	0.049	3.42	0.167	8	0.0035	31
250	Urban Reserve																								0.000	0.000		0.000			0
260	250	154	154	0.029																					0.029	0.059	3.39	0.198	8	0.0035	37
270	260		154	0.029									7.0	7.0	0.001										0.030	0.061	3.37	0.205	8	0.0035	38
280	270	89	243	0.046										7.0	0.001										0.047	0.095	3.25	0.308	8	0.0035	57
290	280		243	0.046	115	115	0.015							7.0	0.001										0.062	0.125	3.14	0.391	10	0.0025	47
300	200, 240, 290		881	0.167		115	0.015							7	0.001					1.1	0.001				0.184	0.369	2.58	0.951	12	0.0020	95
310	130, 300		1440	0.274		578	0.075		80		27.4	0.063		7	0.001					2.1	0.001				0.414	0.829	2.35	1.947	18	0.0012	83
320	310		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001					2.1	0.001				0.414	0.829	2.35	1.947	FM		
330	Brookfield																								0.000	0.000		0.000	FM		
340	320, 330		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001		0.0	0.000		2.1	0.001		0.0	0.000	0.414	0.829	2.35	1.947	FM		
350	340		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001		0.0	0.000		2.1	0.001		0.0	0.000	0.414	0.829	2.35	1.947	18	0.0012	
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063							0.175	0.349	2.60	0.907	15	0.0015	57
370	350, 360		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		74.6	0.063		2.1	0.001		0.0	0.000	0.589	1.178	2.35	2.768	21	0.0010	
380	370		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003	9.6	84.2	0.072		2.1	0.001		0.0	0.000	0.597	1.194	2.35	2.806	21	0.0010	
390	380		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.0	0.000	0.597	1.194	2.35	2.806	21	0.0010	
TOTAL			1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.0	0.000	0.597	1.194	2.35	2.806	21	0.0001	

NOTES:

1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)

2 The 167 units of medium density residential and 238 units of high density rersidential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.

3 Land use unit counts and aceages based on June 10, 2010 Creekview Specifc Plan Land Use Plan.

TABLE 9
WASTEWATER FLOWS BY NODE
INCLUDES URBAN RESERVE AREA
CREEKVIEW SPECIFIC PLAN

REFERENCE	CONTRIBUTING	LDR / MDR			HDR			CMU					SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL	FACTORED	PEAKING	TOTAL	PIPE	PIPE	% FULL
NODE	NODE	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA		AREA	CUM AREA	Q(ADWF)	Q(ADWF)	FLOW	FACTOR	Q(PWWF)	SIZE	SLOPE	Q(PWWF)
#	#		#	MGD		#	MGD		#	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	AREA	MGD	ACRE	ACRE	MGD	MGD	MGD		MGD	IN.	FT/FT	(d/D)
10					188	188	0.024																		0.024	0.049	3.42	0.167	8	0.0035	31
20	10	107	107	0.020		188	0.024																		0.045	0.090	3.26	0.292	8	0.0035	54
30		26	26	0.005																					0.005	0.010	3.59	0.035	8	0.0035	7
40	20, 30		133	0.025		188	0.024																		0.050	0.099	3.23	0.321	8	0.0035	59
50					170	170	0.022																		0.022	0.044	3.44	0.152	8	0.0035	28
60	50	41	41	0.008	105	275	0.036																		0.044	0.087	3.27	0.285	8	0.0035	52
70		65	65	0.012																					0.012	0.025	3.52	0.087	8	0.0035	16
80	70	92	157	0.030																					0.030	0.060	3.38	0.202	8	0.0035	37
90	80	60	217	0.041																					0.041	0.082	3.29	0.271	8	0.0035	50
100	90	60	277	0.053																					0.053	0.105	3.20	0.337	8	0.0035	62
110	40, 60, 100		451	0.086		463	0.060																		0.146	0.292	2.70	0.788	12	0.0020	79
120		108	108	0.021				80	80	27.4	27.4	0.063							1.0	1.0	0.001				0.084	0.168	3.00	0.505	10	0.0025	61
130	110, 120		559	0.106		463	0.060		80		27.4	0.063								1.0	0.001				0.230	0.460	2.49	1.146	15	0.0015	72
140		66	66	0.013																					0.013	0.025	3.52	0.088	8	0.0035	16
150		39	39	0.007																					0.007	0.015	3.56	0.053	8	0.0035	10
160	140, 150	23	128	0.024																					0.024	0.049	3.42	0.166	8	0.0035	31
170	160	94	222	0.042																					0.042	0.084	3.28	0.277	8	0.0035	51
180	170	127	349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
190	180		349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
200	190	164	513	0.097																					0.097	0.195	2.93	0.571	10	0.0025	69
210																			1.1	1.1	0.001				0.001	0.001	3.65	0.005	8	0.0035	1
220		50	50	0.010																					0.010	0.019	3.55	0.067	8	0.0035	12
230	220	75	125	0.024																					0.024	0.048	3.43	0.163	8	0.0035	30
240	210, 240		125	0.024																1.1	0.001				0.024	0.049	3.42	0.167	8	0.0035	31
250	Urban Reserve	167	167	0.032	238	238	0.031																		0.063	0.125	3.13	0.392	8	0.0035	72
260	250	154	321	0.061		238	0.031																		0.092	0.184	2.97	0.546	10	0.0025	66
270	260		321	0.061		238	0.031						7.0	7.0	0.001										0.093	0.186	2.96	0.551	10	0.0025	67
280	270	89	410	0.078		238	0.031							7.0	0.001										0.110	0.220	2.87	0.632	12	0.0020	63
290	280		410	0.078	115	353	0.046							7.0	0.001										0.125	0.250	2.79	0.697	12	0.0025	70
300	200, 240, 290		1048	0.199		353	0.046							7.0	0.001					1.1	0.001				0.247	0.494	2.46	1.215	15	0.0015	76
310	130, 300		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001					2.1	0.001				0.477	0.954	2.35	2.242	18	0.0012	
320	310		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001					2.1	0.001				0.477	0.954	2.35	2.242	FM		
330	Brookfield																								0.000	0.000		0.000	FM		
340	320, 330		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001		0.0	0.000		2.1	0.001		0.0	0.000	0.477	0.954	2.35	2.242	FM		
350	340		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001		0.0	0.000		2.1	0.001		0.0	0.000	0.477	0.954	2.35	2.242	18	0.0012	
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063							0.175	0.349	2.60	0.907	15	0.0015	57
370	350, 360		2012	0.382		1068	0.139		80		27.4	0.063		15.2	0.003		74.6	0.063		2.1	0.001		0.0	0.000	0.652	1.303	2.35	3.062	21	0.0010	
380	370		2012	0.382		1068	0.139		80		27.4	0.063		15.2	0.003	9.6	84.2	0.072		2.1	0.001		0.0	0.000	0.660	1.319	2.35	3.100	21	0.0010	
390	380		2012	0.382		1068	0.139		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.0	0.000	0.660	1.319	2.35	3.100	21	0.0010	
TOTAL			2012	0.382		1068	0.139		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.0	0.000	0.660	1.319	2.35	3.100	21	0.0010	

NOTES:

1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)

2 The 167 units of medium density residential and 238 units of high density rersidential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.

3 Land use unit counts and aceages based on June 10, 2010 Creekview Specifc Plan Land Use Plan.

TABLE 10
WASTEWATER FLOWS BY NODE
INCLUDES URBAN RESERVE AREA AND BROOKFIELD
CREEKVIEW SPECIFIC PLAN

REFERENCE	CONTRIBUTING	LDR / MDR			HDR			CMU					SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL	FACTORED	PEAKING	TOTAL	PIPE	PIPE	% FULL
NODE	NODE	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA		AREA	CUM AREA	Q(ADWF)	Q(ADWF)	FLOW	FACTOR	Q(PWWF)	SIZE	SLOPE	Q(PWWF)
#	#		#	MGD		#	MGD		#	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	AREA	MGD	ACRE	ACRE	MGD	MGD	MGD		MGD	IN.	FT/FT	(d/D)
10					188	188	0.024																		0.024	0.049	3.42	0.167	8	0.0035	31
20	10	107	107	0.020		188	0.024																		0.045	0.090	3.26	0.292	8	0.0035	54
30		26	26	0.005																					0.005	0.010	3.59	0.035	8	0.0035	7
40	20, 30		133	0.025		188	0.024																		0.050	0.099	3.23	0.321	8	0.0035	59
50					170	170	0.022																		0.022	0.044	3.44	0.152	8	0.0035	28
60	50	41	41	0.008	105	275	0.036																		0.044	0.087	3.27	0.285	8	0.0035	52
70		65	65	0.012																					0.012	0.025	3.52	0.087	8	0.0035	16
80	70	92	157	0.030																					0.030	0.060	3.38	0.202	8	0.0035	37
90	80	60	217	0.041																					0.041	0.082	3.29	0.271	8	0.0035	50
100	90	60	277	0.053																					0.053	0.105	3.20	0.337	8	0.0035	62
110	40, 60, 100		451	0.086		463	0.060																		0.146	0.292	2.70	0.788	12	0.0020	79
120		108	108	0.021				80	80	27.4	27.4	0.063							1.0	1.0	0.001				0.084	0.168	3.00	0.505	10	0.0025	61
130	110, 120		559	0.106		463	0.060		80		27.4	0.063								1.0	0.001				0.230	0.460	2.49	1.146	15	0.0015	72
140		66	66	0.013																					0.013	0.025	3.52	0.088	8	0.0035	16
150		39	39	0.007																					0.007	0.015	3.56	0.053	8	0.0035	10
160	140, 150	23	128	0.024																					0.024	0.049	3.42	0.166	8	0.0035	31
170	160	94	222	0.042																					0.042	0.084	3.28	0.277	8	0.0035	51
180	170	127	349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
190	180		349	0.066																					0.066	0.133	3.12	0.414	10	0.0025	50
200	190	164	513	0.097																					0.097	0.195	2.93	0.571	10	0.0025	69
210																			1.1	1.1	0.001				0.001	0.001	3.65	0.005	8	0.0035	1
220		50	50	0.010																					0.010	0.019	3.55	0.067	8	0.0035	12
230	220	75	125	0.024																					0.024	0.048	3.43	0.163	8	0.0035	30
240	210, 240		125	0.024																1.1	0.001				0.024	0.049	3.42	0.167	8	0.0035	31
250	Urban Reserve	167	167	0.032	238	238	0.031																		0.063	0.125	3.13	0.392	8	0.0035	72
260	250	154	321	0.061		238	0.031																		0.092	0.184	2.97	0.546	10	0.0025	66
270	260		321	0.061		238	0.031						7.0	7.0	0.001										0.093	0.186	2.96	0.551	10	0.0025	67
280	270	89	410	0.078		238	0.031							7.0	0.001										0.110	0.220	2.87	0.632	12	0.0020	63
290	280		410	0.078	115	353	0.046							7.0	0.001										0.125	0.250	2.79	0.697	12	0.0025	70
300	200, 240, 290		1048	0.199		353	0.046							7.0	0.001					1.1	0.001				0.247	0.494	2.46	1.215	15	0.0015	76
310	130, 300		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001					2.1	0.001				0.477	0.954	2.35	2.242	18	0.0012	95
320	310		1607	0.305		816	0.106		80		27.4	0.063		7.0	0.001					2.1	0.001				0.477	0.954	2.35	2.242	FM		
330	Brookfield	2176	2176	0.413	577	577	0.075	32	32	55.2	55.2	0.127	7.0	7.0	0.001				6.7	6.7	0.004				0.621	1.242	2.35	2.919	FM		
340	320, 330		3783	0.719		1393	0.181		112		82.6	0.190		14.0	0.002					8.8	0.006		0.0	0.000	1.098	2.196	2.35	5.161	FM		
350	340		3783	0.719		1393	0.181		112		82.6	0.190		14.0	0.002					8.8	0.006		0.0	0.000	1.098	2.196	2.35	5.161			
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063							0.175	0.349	2.60	0.907	15	0.0015	57
370	350, 360		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		74.6	0.063		8.8	0.006		0.0	0.000	1.273	2.545	2.35	5.981			
380	370		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004	9.6	84.2	0.072		8.8	0.006		0.0	0.000	1.281	2.561	2.35	6.019			
390	380		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		84.2	0.072		8.8	0.006		0.0	0.000	1.281	2.561	2.35	6.019			
TOTAL			4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		84.2	0.072		8.8	0.006		0.0	0.000	1.281	2.561	2.35	6.019			

NOTES:

1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)

2 The 167 units of medium density residential and 238 units of high density rersidential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.

3 Land use unit counts and aceages based on June 10, 2010 Creekview Specifc Plan Land Use Plan.

Attachment B

Technical Memorandum

South Placer Regional Wastewater & Recycled Water Systems Evaluation Project

Subject: Unit Flow Factor Sets and Sewer Design Criteria –TM No. 3a (FINAL)

Prepared For: Art O'Brien – City of Roseville

Prepared By: Mai-Tram Le - RMC; revised by Gisa Ju - RMC

Reviewed By: Dave Richardson - RMC
Pete Bellows – BC

Date: May 25, 2005; Final revision October 3, 2006

Reference: 0091-4.02

This technical memorandum (TM) provides a definition of the unit flow factors that have been developed and used in analyses of treatment and trunk sewer facilities as part of the South Placer Regional Wastewater and Recycled Water Systems Evaluation Project (Project). The TM also proposes criteria to be used by developers for design of new sewer facilities.

The various analyses and their associated application are as follows:

1. **Treatment Plant Analyses** – A set of average dry weather unit flow factors has been developed for the entire South Placer Wastewater Authority (SPWA) service area. These factors include the average flow coming from various areas based on specific land use designations, along with a base dry weather groundwater infiltration (GWI) component across the service area. The average unit flow factors were developed using water use and flow monitoring data, as presented in TM 2a, "Dry Weather Flow Projection for 2005 Service Area." For example, the unit flow factor for single-family residential dwelling units, regardless of density, is 190 gpd, of which 10 gpd represents the dry weather GWI component. The unit flow factors used for treatment plant analyses are presented in **Table 1**.

2. **Hydraulic Model Calibration and Trunk Sewer Analyses** – The dry weather flows used for model calibration and analyses of trunk sewers consists of base sanitary flows (BSF) which have been developed using the same unit flow factor concept as for the treatment plant analyses discussed above. However, the dry weather GWI component of the unit flow factors has been included on an areal basis based on actual measured flows, rather than having been considered as a uniform base dry weather GWI load across the service area.

   Trunk Sewer analyses also include additional components of wet weather GWI and rainfall-dependent infiltration and inflow (RDI/I) that vary across the SPWA service area to reflect actual conditions as verified by the wet weather flow monitoring data. The wet weather GWI factors are specific to each wastewater treatment plant (WWTP) service area and were determined from analysis of WWTP flows to be 200 gpd/acre in the Dry Creek WWTP basin and 100 gpd/acre in the Pleasant Grove WWTP basin. The GWI rates and RDI/I parameters used in the trunk sewer model are documented in TM 2c, "Wet Weather Flow Projection for the Ultimate SPWA Service Area."

Table 1 – Average Dry Weather Unit Flow Factors Used for Treatment Plant Analyses

Land Use Designation	Units	Flow Factor (gpd/unit)[1]
Commercial	gpd per acre	850
Heavy Industrial	gpd per acre	850
Light Industrial	gpd per acre	850
Mixed Use	gpd per acre	2,300
Public/Quasi-Public	gpd per acre	660
Schools	gpd per acre	170
Residential 1 DU	gpd per DU	190
Residential 2 DU	gpd per DU	190
Residential 3 DU	gpd per DU	190
Residential Multiple DU[2]	gpd per acre or gpd per DU	2,040 or 130
Open Space	gpd per acre	0
Parks > 10 Acres	gpd per acre	10
Vacant	gpd per acre	0

[1] Includes allowance for dry season GWI.
[2] Future development projects should use the factor that results in the highest flow .

3. **Design Flow Standards (Criteria) for Sizing Infrastructure** – For sizing future infrastructure facilities, the hydraulic model of the trunk sewer system should be used for pipes 18 inches in diameter and larger. For smaller facilities, the average dry weather unit flow factors for the treatment plant analyses can be used along with a safety factor of 2.0 and appropriate peaking factors. The safety factor of 2.0 will be used to factor the average dry weather unit flow factor in order to:
    1. Account for changes that may occur over time in the behavior of residential and nonresidential contributors to the sewer systems, such as increased indoor water use;
    2. Account for changes in environmental conditions (higher groundwater table and consequent higher GWI) and changes in infrastructure (aging pipes, etc.);
    3. Provide for safety to adequately size the infrastructure to avoid any sanitary sewer overflows due to under-sizing;
    4. Account for the increasing friction losses (increase in the roughness coefficient) due to pipe aging; and,
    5. Account for nominal pipe diameter decreases due to accumulation of material adhering to the walls of the sewer piping and restricting capacity.

    Peak wet weather flows will be accounted for using a system-wide peaking factor. A peaking factor curve was developed based on the following assumptions:
    - Single family residential development at 4 DU/acre
    - Design average dry weather flow (ADWF) based on a unit flow rate of 190 gpd/DU times a safety factor of 2.0

- Diurnal peaking factor ranging from 1.8 to 3.0 depending on area size (reflects the attenuation of peak flows through the sewer system as the tributary area increases – refer to Footnote 4 in Table 2))
- GWI at 150 gpd/acre
- RDI/I at 700 gpd/acre, estimated based on model parameters used for new development UGAs (Note: New development RDI/I parameters were assumed to be similar to those determined by flow monitoring and model calibration for relatively new areas of the system; see TM 2c for discussion.)
- Peak diurnal flow concurrent with peak RDI/I flow

The resultant peaking factor curve is presented in **Figure 1**. **Table 2** below shows the derivation of the peaking factor curve for areas ranging from 10 to 750 acres. (NOTE: the values in Table 2 are meant to support the derivation of the peaking factor curve, rather than to be published as design standards).

Table 2 - Derivation of Proposed Roseville/SPWA Design Peaking Factor Curve[1]

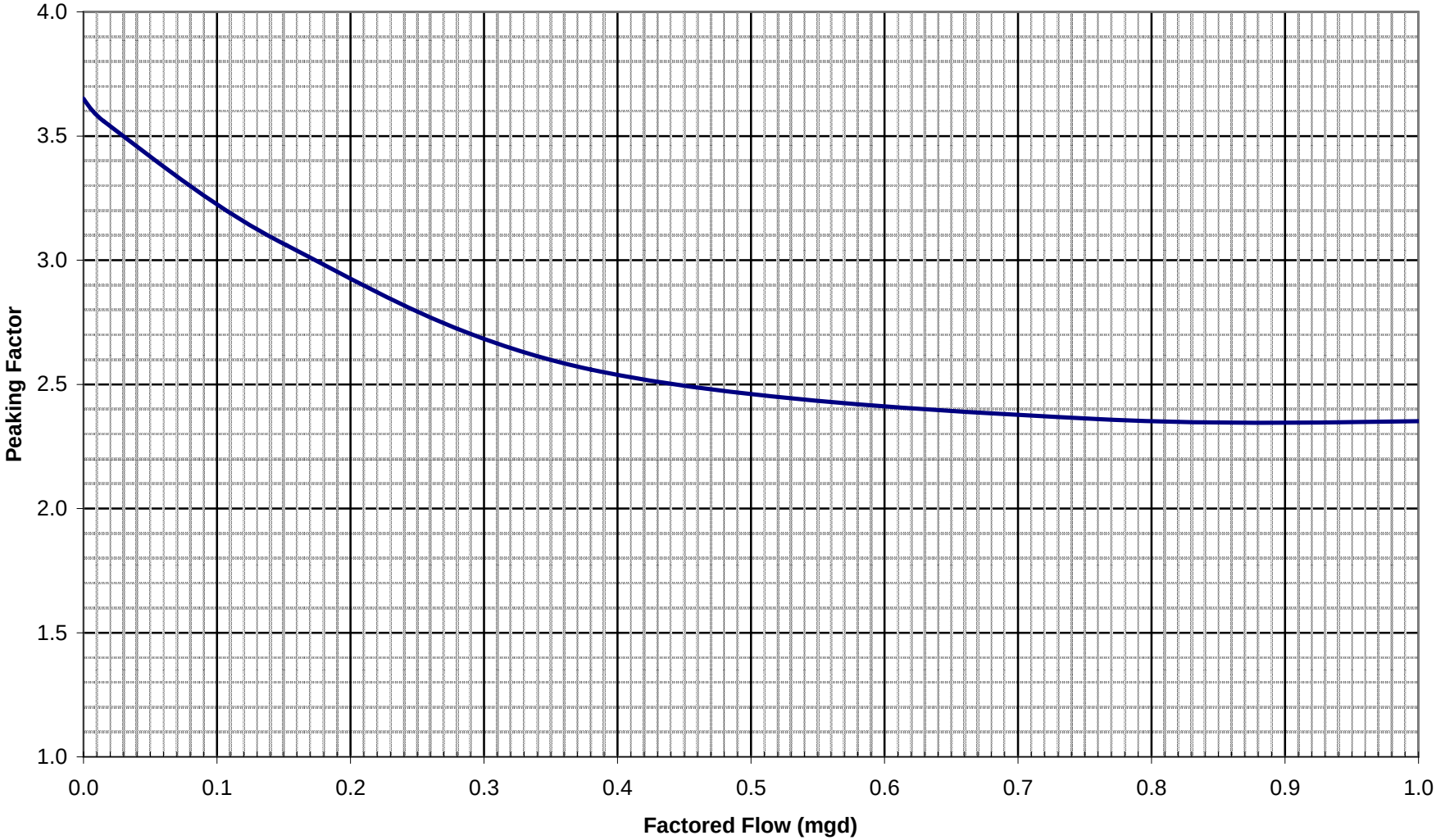
Area (acres)	No. of DUs[1]	ADWF (mgd)[2]	Factored Flow (mgd)[3]	Diurnal PF[4]	Wet GWI (mgd)[5]	Peak RDI/I (mgd)[6]	PWWF (mgd)[7]	Peaking Factor	PF Curve
0			0						3.65
10	40	0.0076	0.0152	3.0	0.0015	0.0070	0.054	3.56	3.56
100	400	0.076	0.152	2.5	0.015	0.070	0.47	3.06	3.06
250	1,000	0.19	0.38	2.0	0.038	0.175	0.97	2.56	2.56
500	2,000	0.38	0.76	1.8	0.075	0.350	1.79	2.36	2.36
750	3,000	0.57	1.14	1.8	0.11	0.53	2.69	2.36	2.36

[1] Based on single-family residential development at 4 DUs/acre. 4 DUs/acre is considered to be a typical density for single family residences, and is not intended to be used as a design criterion.
[2] Based on 190 gpd/DU
[3] Based on safety factor of 2.0
[4] The diurnal PF values in this analysis are based on the peaking factor used for residential flows (PF = 1.8) in the hydraulic model, which was derived from dry weather flow monitoring data. Since that derivation was based on a large area, the PF value is increased progressively as the area decreases in order to account for decreased attenuation of peak flows. Selection of the upper limit of that range is based on engineering judgment and experience with similar analyses.
[5] Based on 150 gpd/acre
[6] Based on 700 gpd/acre
[7] Assumes peak RDI/I coincides with peak diurnal

Attachment A includes an example calculation illustrating the application of the peaking factor curve.

At the direction of SPWA member agencies, several planning-level criteria were developed to aid developers in the sizing and configuration of pump station and force main facilities. These criteria are presented in **Attachment B**.

Figure 1
SPWA Design Peaking Factor Curve



ATTACHMENT A:
Example Design Flow Analysis for Sewers Smaller than 18-inches

Example calculation for application of peaking factor curve for 400-unit single family subdivision:

ADWF [a]:

(400 DUs)*(190 gpd/DU) = **76,000 gpd = ADWF**

Factored Flow:

(ADWF)*(2.0) = (76,000 gpd)*(2.0) = **152,000 gpd = Factored Flow**

PWWF:

(Factored flow)*(3.05 [b]) = (152,000)*(3.05) = **464,000 gpd = PWWF**

Per City of Roseville Improvement Standards, page SS-5, a 10-inch sewer at minimum slope is adequate for this PWWF.

[a] Based on ADWF unit flow factors (as opposed to base sanitary flow unit flow factors, which do not allow for dry season GWI)

[b] From Figure 1: SPWA Design Peaking Factor Curve

ATTACHMENT B:
Recommended Planning Level Criteria for Pump Stations and Force Mains

Table B-1 presents planning-level criteria for the design of pump stations and force mains within the SPWA service area; these criteria should be confirmed during design.

Table B-1: Recommended Planning Level Criteria for Pump Stations and Force Mains

Pump Stations	
Capacity	PWWF (hydraulic modeling required for pipes 18 inches and larger)
Storage	24 hours, or 8 hours with an emergency generator
Operation	Lead/lag for duty pump(s), plus 1 standby pump
Maximum Pump Cycles	6 cycles/hour
Force Mains	
Headloss	Hazen-Williams roughness coefficient (C-factor) of 120
Maximum Velocity	7-10 feet per second
Minimum Velocity	3.0 feet per second

NOTE: Hydraulic transient, surge, and odor control analyses will need to be performed during final design.

Amoruso Ranch Specific Plan Area

Wastewater Master Plan

Appendix D

South Placer Regional Wastewater and Recycled Water System Evaluation Average Dry Weather Flow Projection for the Ultimate SPWA Service Area (Including Urban Growth Areas) – (TM No. 2b)

Technical Memorandum

South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject:	**Average Dry Weather Flow Projection for the Ultimate SPWA Service Area (Including Urban Growth Areas) -- (TM No. 2b)**
Prepared For:	Art O'Brien – City of Roseville
Prepared by:	Pete Bellows/Chris Peters – Brown and Caldwell Andy Smith – RMC
Reviewed by:	Dave Richardson/Gisa Ju – RMC
Date:	November 4, 2005; updated October 31, 2006, January 24, 2008 & September 3, 2009
Reference:	0091-004 Task 2

0 Previous TM Publication and Updates

Since the initial publication of technical memorandum (TM) 2b on November 4, 2005, changes in information available for the South Placer Wastewater and Recycled Water Systems Evaluation (Systems Evaluation), as well as changes in the data, have resulted in the need to identify and update out-of-date information. As part of the June 2007 publication of the Systems Evaluation, an Update Sheet was prepared for this TM, and is included in **Attachment B**. Subsequent changes have resulted in the need for further updates of the TM. The newest version of the TM is consistent with the updates summarized in the 2009 Update Sheet which is included in **Attachment C**.

1 Introduction

This TM summarizes the average dry weather wastewater flow (ADWF) projections for buildout conditions within the Ultimate SPWA service area. This includes flows generated within the 2005 Regional Service Area boundary and flows generated within the Urban Growth Areas (UGAs) located outside the 2005 Regional Service Area boundary. ADWF projections are used to project flows for the analysis of the SPWA wastewater treatment plants.

This TM is a supplement to the *Dry Weather Flow Projection for the 2005 Regional Service Area TM* (TM No. 2a) which summarized flow projections within the 2005 Regional Service Area. Further discussion of wastewater flow components, flow monitoring, development of the base sanitary flow (BSF) unit factors, and groundwater infiltration (GWI) is presented in TM No. 2a.

2 Buildout Land Use

Development of the buildout land use map (including UGAs), land use code designations, and connected land use is documented in the *June 2004 and Buildout Land Use TM* (TM No. 1b). Buildout land use is based on buildout within the Ultimate Service Area as shown in **Figure 1**. For the buildout condition, all parcels are considered to be connected to the wastewater collection system even though some land uses in the "Open Space" category do not generate wastewater. Buildout land use acreages for connected parcels within the Ultimate Service Area are summarized in **Table 1** and **Table 2**. Detailed land use summaries for each UGA are provided in **Attachment A** and TM No. 1b.

The total buildout acreage within the SPWA Ultimate Service Area is 74,522 acres. This includes 30,637 acres in the Pleasant Grove watershed and 43,253 acres in the Dry Creek watershed.

Table 1: Buildout Land Use Summary within the 2005 Regional Service Area

Land Use Designation	Buildout Connected Area (Acres)		Total Buildout Connected Area (Acres[1,2])
	Pleasant Grove Watershed[1]	Dry Creek Watershed[2]	
Commercial	2,151	2,915	5,066
Heavy Industrial	1,715	263	1,979
Light Industrial	1,599	637	2,236
Mixed Use	13	12	25
Open Space	7,318	3,502	10,820
Parks > 10 Acres	303	361	664
Public/Quasi-Public	327	878	1,206
Residential 1 DU	7,629	18,859	26,488
Residential 2 DU	0	839	839
Residential 3 DU	9	366	375
Residential Multiple DU	789	635	1,424
Schools	377	540	917
Total Acreage	**22,231**	**29,808**	**52,039**

[1] Includes portion of Placer Ranch UGA within the 2005 Regional Service Area.
[2] Includes portion of Placer Vineyards UGA within the 2005 Regional Service Area.

Table 2: Buildout Land Use Summary within Urban Growth Areas

Urban Growth Area (UGA)	Buildout Connected Area (Acres)		Total Buildout Connected Area (Acres)
	Pleasant Grove Watershed	Dry Creek Watershed	
Curry Creek UGA	3,212	--	3,212
Regional University UGA	1,140	--	1,140
Inviro Tech UGA	5	--	5
Placer UGA	--	630	630
Orchard Creek	25	--	25
Placer Ranch [1]	807	--	807
Placer Vineyards [1]	--	4,806	4,806
SMD-3	--	2,231	2,231
SPMUD UGA	--	6,410	6,410
Creekview UGA [2]	749		749
Sierra Vista UGA	1,785		1,785
Brookfield UGA	683		683
Total Acreage	**8,406**	**14,077**	**22,483**

[1] Does not include portions of Placer Ranch or Placer Vineyards UGAs within the 2005 Regional Service Area.
[2] "Panhandle" refers to a 238-acre portion of the Reason Farms planning area that is adjacent to the western boundary of the 511-acre Creekview UGA. Though not considered a UGA, the panhandle area is assumed to contribute wastewater flow to the Creekview UGA.

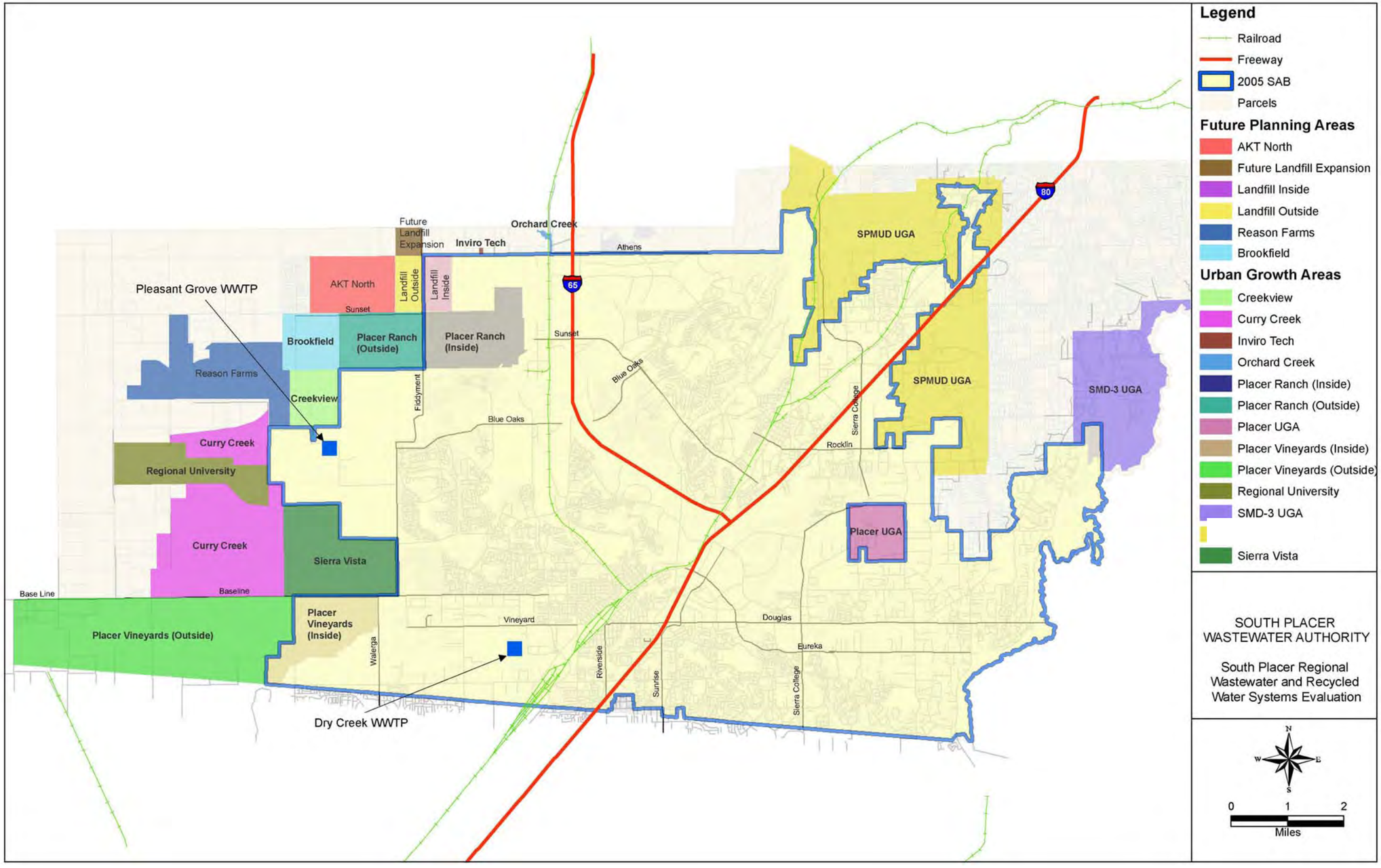


Figure 1 – Buildout Land Use Map Including UGAs

3 Point Sources

Seven existing point sources were identified within the 2005 Regional Service Area based on discussions with SPWA member agencies. Information about point sources is summarized in **Table 3**. There are also three point sources located within UGAs. These point source flows are included with the UGA flow projections presented later in this TM and the UGA flow projection worksheets provided in **Attachment A**. Existing point sources in the 2005 Regional Service Area were identified from flow monitoring and water billing information. The Placer County Landfill was also identified as a point source because it generates very little wastewater flow in comparison to its land area. Buildout flow projections from NEC and HP were provided by the City of Roseville and are based on buildout conditions for each development.

Table 3: June 2004 and Buildout ADWF from Point Sources in the June 2004 Service Area

Point Source	Location	Current Flow Data Source	Current ADWF (gpd)	Projected Buildout ADWF (gpd)
Union Pacific Railroad	Roseville	City of Roseville	85,000	85,000
Landfill	Placer County	City of Roseville	5,000	5,000
NEC	Roseville	Flow Monitor Data	700,000	2,000,000
HP	Roseville	City of Roseville	150,000	484,000
Kaiser Hospital	Roseville	Water Use Data	50,000	50,000
Formica	Placer County	Placer County	60,000	60,000
Rio Bravo Power Plant	Placer County	Placer County	15,000	15,000

Notes: Flow projections are based upon existing land use and existing land use designations current as of June 2004, and will provide the estimated flows for baseline modeling scenario for SPWA. Rezoning of HP and Kaiser Hospital properties are now better known than in June 2004, and are documented in TM No. 9b, and are included in a "Land Use intensification Scenario".

4 Unit Flow Factors

Information about the development of unit flow factors used for the WWTP expansion analysis is discussed in the Dry Weather Flow Projection for the 2005 Regional Service Area TM (TM No. 2a). The 2005 unit flow factors for the buildout scenario are presented in **Table 4**. Unit flow factors for single family residential are applied on a per dwelling unit (du) basis while unit flow factors for other land uses are applied on an acreage basis.

Table 4: 2005 Average Dry Weather Flow (ADWF) Factors

Land Use Designation	Units	2005 Unit Flow Factors WWTP Analysis[1]	1996 Master Plan Unit Flow Factor
Commercial	gpd per acre	850	1,040
Heavy Industrial	gpd per acre	850	1,560
Light Industrial	gpd per acre	850	1,040
Mixed Use	gpd per acre	2,300	N/A
Public/Quasi-Public	gpd per acre	660	1,040
Schools	gpd per acre	170	N/A
Residential 1 DU	gpd per du	190	260
Residential 2 DU	gpd per du	190	260
Residential 3 DU	gpd per du	190	260
Residential Mult. DU	gpd per acre	2,040[2]	4,160
Open Space	gpd per acre	0	0
Parks > 10 Acres	gpd per acre	10	N/A
Vacant	gpd per acre	0	0

[1] Includes allowance for dry season GWI.
[2] The 2005 Residential Multiple DU unit flow factor can also be represented as 130 gpd per du

5 Buildout Flow Projections

Buildout ADWF projections within the Ultimate SPWA Service Area are based on the unit ADWF factors developed for the WWTP analysis above (includes dry season GWI). These flow projections include the results of proposed redevelopment/intensification within Roseville and Rocklin, which were analyzed as a separate scenario and are presented in detail in the *Intensification Land Use TM* (TM No. 9c). Buildout ADWF projections within the 2005 Regional Service Area are presented in **Table 5**. Buildout average dry weather flow projections within the Ultimate SPWA Service Area (including UGAs) are presented in **Table 6**. Detailed flow projections for each UGA are presented in **Attachment A** at the end of this TM.

Table 5: Buildout ADWF Projections within 2005 Regional Service Area

Land Use	Unit Flow Factor	PG WWTP[3]		DC WWTP[4]		2005 Regional Service Area	
		Buildout Units (ac or du)	Buildout ADWF (mgd)	Buildout Units (ac or du)	Buildout ADWF (mgd)	Buildout Units (ac or du)	Buildout ADWF (mgd)
Commercial	850 gpd/ac	1,728	1.47	2,890	2.46	4,618	3.92
Heavy Industrial[1]	850 gpd/ac	1,680	1.43	263	0.22	1,943	1.65
Light Industrial[1]	850 gpd/ac	1,221	1.04	637	0.54	1,858	1.58
Mixed Use	2,300 gpd/ac	-	-	7	0.02	7	0.02
Public/Quasi-Public[1]	660 gpd/ac	282	0.19	851	0.56	1,133	0.75
Schools	170 gpd/ac	258	0.04	540	0.09	798	0.14
Residential 1 DU	190 gpd/du	26,893	5.11	42,866	8.14	69,759	13.25
Residential 2 DU	190 gpd/du	2	0.0004	2,122	0.40	2,124	0.40
Residential 3 DU	190 gpd/du	12	0.002	720	0.14	732	0.14
Residential Multiple DU	2,040 gpd/ac	594	1.21	606	1.24	1,200	2.45
Open Space	0 gpd/ac	6,034	-	3,171	-	9,205	-
Parks > 10 Acres	10 gpd/ac	270	0.003	361	0.004	631	0.01
Point Sources	Varies gpd/ac	1,043	2.56	91	0.14	1,134	2.70
Placer Ranch[2]	Varies gpd/ac	1,027	0.90	-	-	1,027	0.90
West Roseville[2]	Varies gpd/ac	3,162	2.07	-	-	3,162	1.70
Placer Vineyards[2]	Varies gpd/ac	-	-	1,062	0.58	1,062	0.58
Rezones	Varies gpd/ac	-	0.50	-	0.17	-	0.67
Intensification	Varies gpd/ac	-	-	-	1.64	-	1.64
	Total (mgd)		**16.52**		**16.34**		**32.86**

[1] Land use category does not include area of parcels associated with point sources identified in **Table 3**.
[2] Includes portion of development located within the 2005 Regional Service Area.
[3] Pleasant Grove WWTP Service Area
[4] Dry Creek WWTP Service Area
[5] Includes all of WRSP, located entirely inside of the 2005 Regional Service Area boundary

Table 6: Buildout ADWF Projections within Ultimate SPWA Service Area

Description of Area	Buildout ADWF (mgd)		Total Buildout ADWF (mgd)
	PGWWTP[3]	DCWWTP[4]	
2005 Regional Service Area	16.52	16.34	32.86
Curry Creek UGA	2.72	-	2.72
Regional University UGA	1.17	-	1.17
Inviro Tech UGA	0.08	-	0.08
Placer UGA	-	0.01	0.01
Orchard Creek UGA	0.02	-	0.02
Placer Ranch UGA	1.27	-	1.27
Placer Vineyards UGA	-	2.23	2.23
SMD-3 UGA	-	0.29	0.29
SPMUD UGA	-	1.11	1.11
Creekview UGA and Panhandle[5]	1.06	-	1.06
Sierra Vista UGA	2.10	-	2.10
Brookfield UGA	0.73	-	0.73
Total ADWF (mgd)	**25.67**	**19.99**	**45.64**

[1] Includes portion of Placer Ranch UGA within the 2005 Regional Service Area.
[2] Includes portion of Placer Vineyards UGA within the 2005 Regional Service Area.
[3] Pleasant Grove WWTP Service Area
[4] Dry Creek WWTP Service Area
[5] "Panhandle" refers to a 238-acre portion of the Reason Farms planning area that is adjacent to the western boundary of the 511-acre Creekview UGA. The panhandle area is assumed to contribute wastewater flow to the Creekview UGA.

Attachment A

Urban Growth Area Flow Projections

CURRY CREEK UGA

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	931	-	-
COMMERCIAL	Acres	161	850	136,850
HEAVY INDUSTRIAL	Acres	64	850	54,400
LIGHT INDUSTRIAL	Acres	161	850	136,850
MIXED USE	Acres	64	2,300	147,200
PUBLIC/QUASI-PUBLIC	Acres	161	660	106,260
SCHOOLS	Acres	96	170	16,320
RESIDENTIAL 1 DU	DU	8,988	190	1,707,720
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	3,210	130	417,300
Total				2,722,900
Total (mgd)				**2.72**

REGIONAL UNIVERSITY UGA

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	149	-	-
COMMERCIAL	Acres	22	850	18,870
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	10	660	6,864
SCHOOLS	Acres	31	170	5,270
RESIDENTIAL 1 DU	DU	2,226	190	422,940
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	1,006	130	130,780
Point Sources				
UNIVERSITY				582,600
Total				1,167,324
Total (mgd)				**1.17**

INVIRO TECH UGA

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	0	0	0
COMMERCIAL	Acres	0	850	0
HEAVY INDUSTRIAL	Acres	0	850	0
LIGHT INDUSTRIAL	Acres	0	850	0
MIXED USE	Acres	0	2,300	0
PUBLIC/QUASI-PUBLIC	Acres	0	660	0
SCHOOLS	Acres	0	170	0
RESIDENTIAL 1 DU	DU	0	190	0
RESIDENTIAL 2 DU	DU	0	190	0
RESIDENTIAL 3 DU	DU	0	190	0
RESIDENTIAL MULTIPLE DU	DU	0	130	0
Point Sources				
INVIRO TECH				80,000
Total				80,000
Total (mgd)				**0.08**

PLACER RANCH UGA (OUTSIDE 2005 REGIONAL SERVICE AREA)

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	74	-	-
COMMERCIAL	Acres	67	850	56,610
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	29	850	24,650
MIXED USE	Acres	20	2,300	46,460
PUBLIC/QUASI-PUBLIC	Acres	21	660	14,058
SCHOOLS	Acres	30	170	5,100
RESIDENTIAL 1 DU	DU	2,046	190	388,683
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,281	130	296,582
Point Sources				
UNIVERSITY [a]				440,000
Total				1,272,143
Total [b] (mgd)				**1.27**

Footnotes:
(a) Does not include faculty housing, which is included in the Residential categories above.
(b) 1.27 mgd does not include flows from "offsite" areas.

CREEKVIEW UGA & PANHANDLE [a]

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	248	-	-
COMMERCIAL	Acres	11	850	9,435
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	9	850	7,225
MIXED USE	Acres	12	2,300	27,600
PUBLIC/QUASI-PUBLIC	Acres	3	660	2,046
SCHOOLS	Acres	11	170	1,785
RESIDENTIAL 1 DU	DU	1,593	190	302,670
RESIDENTIAL 2 DU	DU		190	-
RESIDENTIAL 3 DU	DU		190	-
RESIDENTIAL MULTIPLE DU	DU	1,170	130	152,100
Total				502,861
Point Sources *(From Panhandle Area)*				
From North Panhandle Area [a,b]				
MDH (Faculty Housing)	DU	96	190	18,240
Commercial (Hotel)	DU	150	190	28,500
Commercial (Athletic Club)	acres	1	850	850
From South Panhandle Area [c]				
University [d]	acres	221	2,304	509,184
Total (mgd)				**1.06**

Footnotes:

(a) "North Panhandle" refers to the portion of the Reason Farms panhandle that is north of Pleasant Grove Creek; this area is adjacent to the western boundary of the Creekview UGA. This area is assumed to contribute wastewater flow to the Creekview UGA.

(b) As of July 2007, several development scenarios were under consideration for the North Panhandle area. The scenarios associated with the highest flow estimates are included here.

(c) The entire "Panhandle" area comprises approximately 238 acres. Subtracting 17 acres (Wood Rodgers) for the North Panhandle area yields 221 acres remaining for a proposed private university in the "South Panhandle" area.

(d) The unit flow factor for the university was derived by dividing the total flow projection for the university in the Placer Ranch UGA (0.68 mgd) by its corresponding acreage (295 acres), yielding 2,304 gpad.

SIERRA VISTA UGA

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE [a]	Acres	412	-	-
COMMERCIAL	Acres	220	850	187,000
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE [b]	Acres	43	2,300	98,900
PUBLIC/QUASI-PUBLIC	Acres	10	660	6,600
SCHOOLS	Acres	68	170	11,492
RESIDENTIAL 1 DU	DU	7,799	190	1,481,810
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,399	130	311,870
Total				2,097,672
Total (mgd)				**2.10**

Footnotes:
(a) Estimated area. At zero gpd/acre, however, this estimate does not impact flow projections

(b) Differs from 78,900 gpd calculated in the Sierra Vista Sanitary Sewer Master Plan (MSCE, July 2007).

BROOKFIELD UGA

PLEASANT GROVE WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	208	-	-
COMMERCIAL	Acres	14	850	11,560
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	2	660	1,320
SCHOOLS	Acres	22	170	3,740
RESIDENTIAL 1 DU	DU	835	190	158,650
RESIDENTIAL 2 DU	DU	2,087	190	396,530
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	1,252	130	162,760
Total				734,560
Total[1] (mgd)				**0.73**

Footnotes:
[1]Brookfield developers supplied several sets of preliminary land use data during this project, resulting in a range of projected ADWF from 0.69 (the most recent) to 0.73 mgd. The largest of these projections, 0.73 mgd, was used for this analysis.

PLACER UGA

DRY CREEK WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	-	-	-
COMMERCIAL	Acres	-	850	-
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	-	660	-
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU	DU	27	190	5,130
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	-	130	-
Total				5,130
Total (mgd)				**0.01**

PLACER VINEYARDS UGA (OUTSIDE 2005 REGIONAL SERVICE AREA [a,b])

DRY CREEK WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE [c]	Acres	729	-	-
COMMERCIAL	Acres	236	850	200,600
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	63	2,300	143,750
PUBLIC/QUASI-PUBLIC	Acres	119	660	78,540
SCHOOLS	Acres	140	170	23,800
RESIDENTIAL 1 DU	DU	7,649	190	1,453,310
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,542	130	330,460
Total				2,230,460
Total (mgd)				**2.23**

Footnotes:
(a) There is an area of approximately 150 acres inside Placer Vineyards Shed A, but within the 2005 Regional Service Area Boundary. Mike Smith of MSCE provided land use information for this area in September 2007. Flow projections for this area were therefore subtracted from Shed A and added to the Shed B flows to represent the total flow from within the 2005 Regional Service Area Boundary.

(b) For convenience, the boundary for Shed A is henceforth assumed to be contiguous with the 2005 SAB and the area represented by the ADWF presented above.
(c) Estimated area. At zero gpd/acre, however, this estimate does not impact flow projections

SMD-3 UGA

DRY CREEK WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	-	-	-
COMMERCIAL	Acres	3	850	2,550
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	11	660	7,260
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU	DU	1,268	190	240,920
RESIDENTIAL 2 DU	DU	14	190	2,660
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	250	130	32,500
Total				285,890
Total (mgd)				**0.29**

SPMUD UGA

DRY CREEK WATERSHED

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	97	-	-
COMMERCIAL	Acres	99	850	84,150
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	-	660	-
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU - by 2050 [a]	DU	1,200	190	228,000
RESIDENTIAL 1 DU - after 2050 [a]	DU	4,180	190	794,200
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	-	130	-
Total				1,106,350
Total - by 2050 [a] (mgd)				**0.23**
Total - after 2050 [a] (mgd)				**1.11**

Footnotes:
a) Based on information provided by SPMUD, a total of 5,380 DUs are expected in the SPMUD UGA at ultimate buildout. However, SPMUD projects that only 1,200 of these DUs will be built within the planning horizon (2050) of this study, leaving 4,180 DUs for later buildout.

Attachment B

June 2007 TM Update Sheet

Update Sheet

South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject: **Update for TM 2b**

Prepared For: Art O'Brien, City of Roseville

Prepared by: Andy Smith, RMC

Reviewed by: Dave Richardson, RMC

Date: October 31, 2006

Reference: 0091-04

1 Summary of Update for TM 2b

Since the completion of TM 2b on November 4, 2005, changes in the scope of the South Placer Wastewater and Recycled Water Systems Evaluation, as well as changes in the data available, have resulted in the need to identify out-of-date information, to summarize the updated information, and provide justification as to the need for the update. **Table 1** presents a summary of the updates for TM 2b.

Table 1: Summary of Update for TM 2b

Page	Location	Summary of Outdated Information	Summary of Updated Information	Reason for Update
1	Paragraph 4	Total Ultimate Service Area acreage = 29,724 (PG); 36,070 (DC); 65,794 (Total)	Total Ultimate Service Area acreage = 30,407 (PG); 40,161 (DC); 70,568 (Total)	Expanded SPMUD boundary and Brookfield
2	Table 2	SPMUD UGA = 2,319 acres	SPMUD UGA = 6,410	SPMUD provided an expanded UGA boundary
2	Table 2	Brookfield not included	Brookfield: Pleasant Grove Watershed, 683 acres	Brookfield added as a UGA
2	Table 2	Total UGA acreage = 7,549 (PG); 6,242 (DC); 13,791 (Total)	Total UGA acreage = 8,232 (PG); 10,333 (DC); 18,565 (Total)	Expanded SPMUD boundary and Brookfield
3	Figure 1	SPMUD UGA included, but does not reflect expanded boundary	Expanded boundary shown in Figure 2-5 of Systems Evaluation report	SPMUD provided an expanded UGA boundary
3	Figure 1	Brookfield included, but not shown as a UGA	Brookfield is considered as a UGA	Brookfield added as a UGA
7	Table 6	Brookfield not included	Brookfield: 0.73 mgd (PG)	Brookfield added as a UGA
n/a	Attachment A	Brookfield not included	Refer to TM 11a for land use summary	Brookfield added as a UGA

Attachment C

2009 Update Sheet

Update Sheet

South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject:	**2009 Update Sheet for TM 2b**
Prepared For:	Art O'Brien, City of Roseville
Prepared by:	Chris van Lienden, RMC
Reviewed by:	Dave Richardson, RMC
Date:	September 3, 2009
Reference:	0091-04

The TM has been modified since it was originally developed in 2005 based on the following updates.

1 2006 Updates

The TM was updated in 2006 to reflect changes in the SPMUD UGA boundary and land use, and to add Brookfield as an additional UGA.

2 2008 Updates

The TM was further updated in 2008 to reflect changes in the land uses and flow projections of the UGAs.

3 2009 Updates

An additional update was prepared in 2009 to reflect the following changes.

3.1 Updates to the H2Omap Sewer Model

Since the 2008 update, the H2Omap Sewer software has been updated which resulted changes to the build-out flow estimates. The flow estimates in the TM has been updated to reflect the most recent model results.

3.2 Changes to the Development Timeline

Flow projections have been updated to reflect reduced rates of residential development due to the economic slowdown beginning in 2008.

3.3 West Roseville Specific Plan Rezone

Buildout flow estimates have been updated to reflect additional inflow from a proposed rezone in the West Roseville Specific Plan (May, 2009). The new land uses and associated average dry weather flow (ADWF) are summarized in Table 1.

Table 1 – West Roseville Specific Plan Rezone Comparison

Connected Land Use Description	Original Developer Agreements		2009 Proposed Update	
	DU or Area (DU or ac)	Flow (mgd)	DU or Area (DU or ac)	Flow (mgd)
1 Residential				
1.1 Low Density Residential	4842 DU	0.92	5963 DU	1.13
1.2 LDR (age restricted)	710 DU	0.13	0 DU	0.00
1.3 Medium Density Residential	1064 DU	0.20	1746 DU	0.33
1.4 High Density Residential	1774 DU	0.23	3229 DU	0.42
2 Open Space	670 ac		696 ac	0.00
2.1 Paseo	15 ac		0 ac	0.00
2.2 Park	251 ac		284 ac	0.00
2.3 Pocket Parks	19 ac		0 ac	0.00
3. Public/Quasi-Public				
3.1 Schools	108 ac	0.02	109 ac	0.02
3.2 Public/Quasi-Public	41 ac	0.02	15 ac	0.01
4 Community Commercial				
4.1 Commercial	34 ac	0.03	56 ac	0.05
4.2 Mixed Use	14 ac	0.03	0 ac	0.00
4.3 Church	0 ac	0.01	0 ac	0.00
5. Business Professional				
5.1 Commercial	20 ac	0.02	18 ac	0.02
6. Light Industrial	74 ac	0.06	75 ac	0.06
7. Industrial	34 ac	0.03	35 ac	0.03
Total		**1.71**		**2.07**

Amoruso Ranch Specific Plan Area

Wastewater Master Plan

Appendix E

Cumulative Analysis of UGA Impacts on Water Quality and Aquatic Resources in Pleasant Grove Creek, Roseville, California

MERRITT SMITH
CONSULTING
ENVIRONMENTAL SCIENCE AND COMMUNICATION

TECHNICAL MEMORANDUM

TO: Steve Dalrymple, West Yost Associates

FROM: David W. Smith, PhD.

DATE: January 15, 2006

SUBJECT: Cumulative Analysis of UGA Impacts on Water Quality and Aquatic Resources in Pleasant Grove Creek, Roseville, California

INTRODUCTION

BACKGROUND AND NEED FOR ASSESSMENT

As part of the South Placer Wastewater Authority's (SPWA) Regional Wastewater and Recycled Water Systems Evaluation Project, the City of Roseville (City) has been reviewing information for planned developments seeking wastewater services for particular urban growth areas (UGAs) that are outside the geographical area currently covered by CEQA documents that were the basis of NDPES permits to discharge from the City's two regional wastewater treatment plants, Pleasant Grove Wastewater Treatment Plant (PGWWTP) and Dry Creek Wastewater Treatment Plant (DCWWTP). The County of Placer (County), as the local land use authority, will serve as the Lead Agency for California Environmental Quality Act (CEQA) compliance for each UGA project located in the unincorporated area. SPWA will be a Responsible Agency under CEQA for purposes of financing regional wastewater/recycled water infrastructure. As a Responsible Agency, the SPWA will rely on the UGA CEQA documentation prepared by local lead agencies when taking discretionary actions related to funding or financing such infrastructure.

As agreed upon in Operations Agreement among the Regional Partners, the City owns and operates the regional wastewater treatment plants on behalf of the partners. In this capacity, the City approves plant expansion/upgrade designs, construction documents, and bid authorizations, awards construction contracts, and obtains the necessary National Pollutant Discharge Elimination System (NPDES) permits for the facilities. In this role, the City functions as a CEQA Lead Agency. When taking discretionary actions related to regional wastewater facilities to accommodate treatment and discharge of UGA flows, however, the City, serving as staff to SPWA which is a Responsible Agency, intends to rely on UGA project-specific CEQA documentation for all UGA-related environmental issues not addressed by the City's own existing CEQA documents. To be in a position to do so, the City needs to assure the adequacy of each UGA CEQA document. Of particular interest to the City in this regard is the adequacy of the discussion, in EIRs for

UGA projects, of future cumulative impacts associated with treatment and discharge of all of the foreseeable wastewater flows from pending UGA projects.

The scope and analytical requirements that the SPWA and the City require of future UGA CEQA documentation is outlined in the City's letter to Mr. Durfee dated April 26, 2005.The City expects that the County, as Lead Agency for the UGA CEQA documents, will rely on the City's 1996 Master Plan and Master Plan Environmental Impact Report (EIR) (Roseville, City of, 1996) and its West Roseville Specific Plan EIR (Roseville, City of, 2004) as baseline documents and examples of the appropriate level of analysis that is required for UGA CEQA documentation, particularly cumulative impact assessments. The 1996 Master Plan EIR addressed planned wastewater conveyance and treatment improvements to serve a regional service area through the year 2015. In looking at impacts that would result from actions to be taken over a 20 year planning horizon, its impacts assessments are "inherently cumulative" in nature. The service area for the regional system would cover approximately 95 square miles in southwestern Placer County, extending from the town of Newcastle westward to the City of Roseville, and from the City of Lincoln southward to the Placer County/Sacramento County line. The UGA CEQA documents will identify and adequately assess actions not addressed, or not sufficiently addressed, by the City's previously certified CEQA documents. The City's 1996 Master Plan EIR and its West Roseville Specific Plan EIR collectively evaluated, for CEQA purposes, impacts of future flows that will be generated from development within the "2005 service area." The 2005 service area includes the 1996 service area and any subsequent formal modifications thereto. Impacts from portions of UGAs located outside the 2005 service area, and appropriate mitigation, would need to be identified in the CEQA documents associated with each UGA. The 2005 service area and UGAs located outside this service area are shown in Figure 1.

PURPOSE AND USE OF THIS MEMORANDUM

The purpose of this technical memorandum (TM) is to evaluate future anticipated compliance with water quality regulations in Pleasant Grove Creek, and to assess future cumulative impacts to water quality and aquatic biological resources of Pleasant Grove Creek in light of the prospect of treating and discharging increasingly more wastewater from the PGWWTP, some of which is expected from particular UGAs planned for development located outside the geographical area currently covered by CEQA documents that were the basis of NDPES permits to discharge from PGWWTP. More specifically, this TM acknowledges the future cumulative assessments included in the City's two certified EIR's (cited above) and the environmental documentation for the other areas included in the "2005 Service Area" (Reference the "Proposed 2005 Regional Service Area Boundary Tech Memo dated January 13, 2005"), which address wastewater flows from within the 2005 service area, and determines whether discharge of the

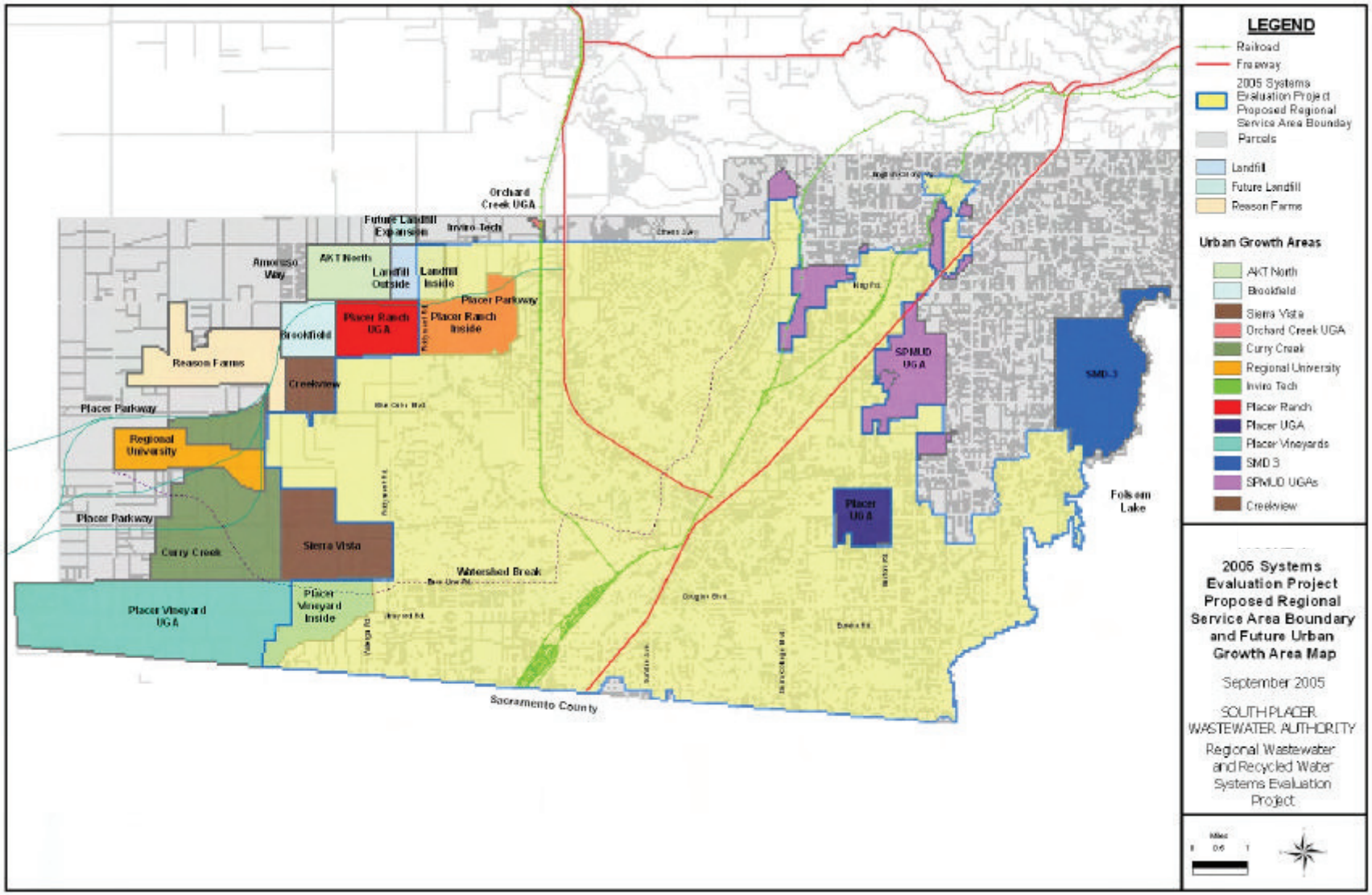


Figure 1. Location of UGAs (courtesy of RMC Water and Environment)

additional treated UGA flows (that are outside the 2005 service area) will result in any new significant cumulative impacts, not previously identified, or more severe cumulative impacts relative to those previously identified by the City's CEQA documents. Measures for mitigating future cumulative impacts are also discussed.

The assessment of water quality and aquatic biological resource impacts described in this TM is intended to contribute to a common basis for the cumulative impacts section of the project-specific CEQA documentation being prepared for each of the UGAs.

The future UGAs that are planned to be served by PGWWTP and considered in this assessment include:

- Curry Creek
- Regional University
- Orchard Creek
- Placer Ranch
- Invirotech
- Sierra Vista and Creekview Specific Plan Areas (formerly called West Roseville remainder area).

In addition, flows from the following future UGAs that are planned to be served by DCWWTP are provided in this assessment:

- Placer Vineyards
- Placer County Sewer Maintenance District No. 3
- Areas in the South Placer Municipal Utility District not currently within the 2005 SPWA boundary (i.e., flows for which discharge impacts have not already been addressed in a CEQA document).

Analysis of potential cumulative Pleasant Grove Creek impacts resulting from the future treatment and discharge of flow from all the UGAs tributary to the PGWWTP respectively, and identification of appropriate mitigation measures for any significant or potentially significant cumulative impacts, has been requested by the City to help assure adequate CEQA basis for approving annexation of the UGAs to the WWTP service areas, and eventual permitting of the future PGWWTP flows. This TM addresses impacts of flow incremental to that from the 2005 service area (i.e., flow from the UGAs) to Pleasant Grove Creek. Impacts to Dry Creek are not addressed in this TM. They have been addressed in a separate memorandum dated October 27, 2005.

For any future cumulative condition deemed (from this assessment) to have significant effects, a determination will be made as to whether the incremental increase in flow from

the UGAs would contribute considerably to that significant cumulative condition. For all assessments that find the future cumulative condition to be less-than-significant and, thus, not requiring mitigation, determination of whether the UGA's increment contributes considerably to the future cumulative condition becomes unnecessary under CEQA and, therefore, will not be addressed.

BASIS OF ANALYSIS

Table 1 shows the allocation of estimated flows from each of the UGAs to the DC and PGWWTPs and the allocation of flows from within and outside of the 2005 service area. Land uses for most of these UGAs are currently undergoing revisions and further analysis. Projected flow from any UGA may change slightly in the future, but minor changes in flow would not change the analysis herein.

ASSESSMENT APPROACH

This cumulative assessment builds upon the cumulative assessments included in the City's 1996 Master Plan EIR (which are inherently "cumulative" in nature) and West Roseville Specific Plan EIR (Roseville, City of, 1996; Roseville, City of, 2004). The following sections discuss whether new or more significant impacts to Pleasant Gove Creek water quality or aquatic biological resources would occur with the annexation of the UGAs into the SPWA service area and the resulting discharge of treated effluent from the PGWWTP into Pleasant Grove Creek.

REGULATORY ENVIRONMENT

Water Quality

Discharges from wastewater treatment plants are regulated by National Pollutant Discharge Elimination System (NPDES) permits. The Central Valley Regional Water Quality Control Board (RWQCB) issued a NPDES permit regulating discharges from the PGWWTP in 2000 (NPDES No. CA0084573, Order No. 5-00-075). The permitted capacity of the PGWWTP is 12.0 mgd (ADWF). NPDES permits expire and must be renewed every five years. Through its development and adoption of NPDES permits every five years, the RWQCB stipulates effluent and receiving water limitations that must be met, thereby assuring compliance with receiving water quality criteria/objectives and protection of beneficial uses.

Table 1 indicates the total estimated future flow from the PGWWTP, plus flow from UGAs located outside the 2005 service area, is 23.4 mgd. This is 13.4 mgd greater than the current permitted capacity of the DCWWTP, but 6.1 mgd *less than* the 29.5 mgd

Table 1. Estimated Future Wastewater Flows
(All flows million gallons per day average dry weather flow. "Inside" refers to areas within the 2005 service area and "outside" refers to areas located outside the 2005 service area)

	DCWWTP			PGWWTP		
	Inside	Outside	Total	Inside	Outside	Total
2005 Service Area	14.05		14.05	14.8		14.8
Placer Vineyards	0.85	3.04	3.89			
SMD-3		0.29	0.29			
SPMUD		1.09	1.09			
Placer		0.01	0.01			
Placer Ranch				0.90	1.29	2.19
Curry Creek					2.72	2.72
Regional University					1.16	1.16
Orchard Creek					0.02	0.02
Sierra Vista & Creekview					2.51	2.51
Total	14.9	4.4	19.3	15.7	7.6	23.4
Current Permitted Capacity			18.0			12.0
Data from Dry Weather Flow Projection for the Ultimate SPWA Service Area (including Urban Growth Areas) Tech Memo, RMC, November 4, 2005						

future flow projected for PGWWTP under one of the alternatives in the 1996 Master Plan EIR (see Master Plan EIR Table 2-4). Impacts for the 29.5 mgd alternative were evaluated in the 1996 Master Plan EIR at an equivalent level of detail to that of PGWWTP flow alternatives with lower flow (including the selected alternative with a flow of 20.7 mgd). In this regard, the approach used to evaluate impacts in this TM is conservative.

Aquatic Biological Resources

Because aquatic biological resources are an identified beneficial use of Pleasant Grove Creek, certain limitations included in the NPDES permit act to assure compliance with receiving water criteria/objectives adopted for the protection of aquatic life. By complying with aquatic life water quality criteria/objectives in the receiving waters downstream of the PGWWTP discharge, these resources are protected and maintained. As part of the permit renewal process, State (i.e., California Department of Fish and Game) and federal (i.e., NOAA Fisheries and the U.S. Fish and Wildlife Service) agencies charged with management of fisheries and aquatic resources receive a copy of the Tentative NPDES permit for review and comment. This further assures that the limitations included in the NPDES permit, when met, will protect fish and aquatic resources in the receiving water, downstream of the discharge.

EVALUATION OF IMPACTS

The 1996 Master Plan EIR (Roseville, City of 1996) identified the following significant/potentially significant impacts to water quality and aquatic biological resources associated with treatment and discharge of anticipated future PGWWTP discharges in Pleasant Grove Creek (i.e., operational impacts, not temporary construction-related impacts):

- Degradation of water quality in Pleasant Grove Creek (Impact 7-3);
- Erosion and sedimentation (Impact 5-2); and
- Loss of oak trees along Pleasant Grove Creek resulting from effluent discharge (Impact 4-2).

The 1996 EIR introduced mitigation that would reduce each of these impacts to a less-than-significant level. The first impact listed above attempted to address overall degradation of water quality due to increased effluent discharge. The latter two impacts identified in the 1996 EIR derive wholly, or in part, from the hydraulic effects of greater discharge rates. Consistent with the organization of the 1996 EIR, the two main impact categories discussed below are: 1) water quality degradation due to increased discharge of treated effluent, and 2) flow-related effects on riparian habitat and aquatic life. With regard to the water quality degradation category of assessment, this TM evaluates not only constituents specifically discussed in the City's 1996 EIR, but also evaluates additional constituents of potential concern under the future cumulative condition.

The West Roseville Specific Plan EIR (Roseville, City of 2004) found project-specific impacts to hydrology (with implementation of mitigation), water quality, groundwater, and biological resources to be less than significant. The West Roseville Specific Plan

EIR found cumulative impacts to hydrology, water quality, groundwater, and biological resources to be less than significant.

Several factors indicate the analysis of impacts in this TM is conservative:

- The total estimated future flow of 23.4 mgd from the PGWWTP is 6.1 mgd *less than* the 29.5 mgd future flow projected and evaluated in the 1996 Master Plan EIR.

- This analysis assumes all of the dry weather flow will be discharged. However, dry season discharge to Pleasant Grove Creek will be less than average dry weather flow generated because a portion of the flow will be returned to the UGAs as recycled water for irrigation instead of being discharged to Pleasant Grove Creek.

- The West Roseville Specific Plan EIR includes mitigation Measure 4.11-5, which conditions issuance of building permits on obtaining all the necessary permits to treat, discharge and reuse flows from the specific plan area. SPWA, as a Responsible CEQA agency, will require a similar mitigation measure for the UGAs that are the subject of this TM.

WATER QUALITY DEGRADATION DUE TO INCREASED DISCHARGE

The 1996 Master Plan EIR identified significant impacts to Pleasant Grove Creek water quality resulting from increase water temperature and elevated levels of trace metals and organic pollutants. The impact of the UGAs with respect to these constituents is discussed below. Other constituents of potential concern (i.e., toxicity, mercury, pH, biostimulatory substances, dissolved oxygen, and taste and odors) are also evaluated.

Temperature

The 1996 Master Plan EIR identified elevated temperature as an element of the significant impact to the water quality in Pleasant Grove Creek. The 1996 Master Plan EIR included the following to mitigate for this impact:

- Install cooling towers if necessary (Mitigation Measure 7-4)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

Consistent with this mitigation measure, the City installed temperature cooling units at the DCWWTP, and began operating them in 2004. The City monitors receiving water temperature under the NPDES Permit Monitoring and Reporting Program. The City has not installed cooling units at PGWWTP because salmonid fish are not present there (due to lack of habitat), which is reflected in the less-stringent receiving water temperature limit in the PGWWTP NPDES permit relative to that in the DCWWTP NPDES permit.

During those periods when flow is present in Pleasant Grove Creek (Pleasant Grove Creek is naturally a seasonal stream), additional flows from the UGAs to the PGWWTP service area would cause additional temperature increases in Pleasant Grove Creek, downstream of the PGWWTP outfall. The amount of additional thermal load added to Pleasant Grove Creek would be directly related to the incremental increase in wastewater flow from the UGAs being treated and discharged at the PGWWTP. During those periods when flow (other than effluent from PGWWTP) is not present in Pleasant Grove Creek, incremental UGA flows will not affect water quality in Pleasant Grove Creek. Because the 2015 condition assessed in the City's 1996 Master Plan EIR was determined to be significant, the future cumulative condition with the UGA flows added also would be significant, and the UGA contribution to the future cumulative condition would be considerable.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, cooling units would be added, if necessary, to address the increased wastewater flow needing cooling, thereby assuring continued compliance with the temperature objectives in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) and thermal protection of aquatic resources. The treatment and discharge of UGA flows from the PGWWTP into Pleasant Grove Creek would not result in any new thermal impacts not identified in the 1996 Master Plan EIR. Implementation of the already-identified mitigation will reduce the future cumulative Pleasant Grove Creek thermal impact to a less-than-significant level. No new mitigation measures are required in light of the additional UGA flows; rather, Mitigation Measure 7-4, already identified by the City, may simply need to be implemented sooner, or to a greater or expanded level as needed to address the UGA flows in addition to the flows evaluated in the 1996 Master Plan EIR. Implementation of Mitigation Measure 7-4, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Trace Metals and Organic Pollutants

The 1996 Master Plan EIR identified the introduction of elevated levels of trace metals and organic pollutants as an element of the significant impact to the water quality in Pleasant Grove Creek. The 1996 Master Plan EIR identified the following mitigation for this impact:

- install advanced treatment facilities (Mitigation Measure 7-2)
- institute metals source controls/pre-treatment (Mitigation Measure 7-3)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

During those periods with flow is present in Pleasant Grove Creek, additional flows from the UGAs to the PGWWTP service area would cause the percentage of water in the Pleasant Grove Creek channel composed of treated effluent, downstream of the PGWWTP outfall, to be higher, all other factors (e.g., creek hydrology) remaining the same. Consequently, instream concentrations of trace metals and organic pollutants downstream of the outfall would increase in proportion to the incremental increase in wastewater flow from the UGAs being treated and discharged at the PGWWTP. During those periods when flow (other than effluent from PGWWTP) is not present in Pleasant Grove Creek, incremental UGA flows will not affect water quality in Pleasant Grove Creek. Because the 2015 condition assessed in the City's 1996 Master Plan EIR was determined to be significant, the future cumulative condition with the UGA flows added also would be significant, and the UGA contribution to the future cumulative condition would be considerable.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, any advanced treatment facilities that the City constructs and operates to comply with its NPDES permit would be expanded (or initially constructed for an expanded capacity) to address the increased wastewater flow from the UGAs, thereby assuring continued compliance with all Basin Plan pollutant objectives and California Toxic Rule criteria. The treatment and discharge of UGA flows from the PGWWTP into Pleasant Grove Creek would not result in any pollutant impacts that would not occur in the absence of the UGA flows. Implementation of the mitigation measures identified in the 1996 EIR, to the degree necessary, to comply with water quality standards under future cumulative flows will reduce the future cumulative Pleasant Grove Creek pollutant impact to a less-than-significant level. No new mitigation measures are required in light of the additional UGA flows; rather, Mitigation Measures 7-2 and 7-3, already identified by the City, may simply need to be implemented sooner, or to a greater or expanded level. Implementation of Mitigation Measures 7-2 and 7-3, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Aquatic Life Toxicity

The PGWWTP currently performs chronic three-species bioassay testing of its effluent quarterly. These bioassays determine a No Observable Effect Concentration (NOEC) and an Inhibition Concentration for a set percentage effect (IC_{25}). For example, the IC_{25} is the concentration of toxicant that would cause a 25 percent reduction in mean young per female in the *Ceriodaphnia dubia* reproduction test or a 25 percent reduction in growth for the test population. The IC_{25} is used because it is a very sensitive, non-lethal endpoint, which attempts to be indicative of the "first signs" of an effect on the test population. LC_{50}s, the lethal concentration to 50 percent of the test population, is a test endpoint showing a much greater level of toxic effect. The NOEC is the lowest dilution ratio (i.e., the largest proportion of effluent) at which no toxic effect is observed. The IC_{25} is a point estimate that approximates the highest dilution ratio (i.e., the smallest

proportion of effluent) at which a specified level (25 percent) of effect is observed. These results are reported in toxicity units (TU), which are defined as:

$$TU_c = \frac{100}{NOEC}$$

For example, 8 TUc represents a test result where the NOEC was observed at 12.5 percent effluent, or a dilution ratio of 1 part effluent to 7 parts dilution water. Similarly, 16 TUc represents a test result where the NOEC was observed at 6.25 percent effluent, or a dilution ratio of 1 part effluent to 15 parts dilution water. As TUc increases, more dilution water is required to have no effect on the test organisms. A TUc of <1 indicates that no effect was observed in undiluted (100 percent) effluent, relative to control tests.

The three-species bioassay results for the PGWWTP for all four quarterly tests performed since discharge and bioassay testing began in 2004, have a result of <1 TUc for all tests. These results show that the undiluted effluent is non-toxic to aquatic life.

PGWWTP effluent quality under the future cumulative condition would be maintained at essentially equivalent or possibly higher quality levels (if additional or more restrictive NPDES limits are permitted by the RWQCB), relative to current effluent quality. Therefore, no aquatic life toxicity would be expected in the future, once the PGWWTP is adequately expanded/upgraded, as necessary, and permitted to treat the incremental flows, including UGA flows. This would be a less-than-significant cumulative impact.

Mercury

The current NPDES permit contains a mercury (Hg) mass-loading limit of 1.71 pounds per year for the combined discharge of the DCWWTP and the PGWWTP. Based on Finding 25f in the DCWWTP NPDES permit, this limit is performance-based and is based on a flow-weighted average mercury concentration plus 20 percent using effluent quality data from January 1996 through September 1999. The average Hg concentration (based on detectable values during this period and upon which the mass loading limit was based) is 0.058 µg/L (see Table 2). Finding 25f indicates the Hg concentration data are questionable because "clean technique" was not used. This means that the actual concentration would likely be less than 0.058 µg/L. Indeed, the average concentration in DCWWTP effluent (based on detectable values) in 2004 through 2005 was 0.012 µg/L, a period during which clean techniques were used (see Table 2). Thus, actual flow could be as much as 0.058/0.012 or 4.9 times greater than the flow upon which the mass loading limit is based without causing the limit to be exceeded. The current NPDES permits have a combined permitted flow of 30 mgd, and the total incremental UGA flow (from areas outside the 1996 EIR area) is 12 mgd, for a total flow of 42 mgd or a 1.4-fold increase. This flow increase factor is less than 4.9, indicating that the combined incremental flow of all UGAs will not cause the Hg mass loading limit to be exceeded. Therefore, the

cumulative impact of the discharge from DCWWTP and PGWWTP on mercury loading is considered to be less than significant.

pH

The NPDES permit for the PGWWTP has an effluent limitation that requires discharges to have a pH between 6.5 and 8.5 units. Based on the current science regarding pH requirements of freshwater aquatic life, the beneficial use most sensitive to creek pH, the Central Valley RWQCB is processing a Basin Plan amendment that will remove the 0.5-unit change requirement of the current pH objective, leaving the component that requires controllable factors affecting water quality to maintain receiving water pH between 6.5 and 8.5 units (RWQCB 2002). Because the permit requires effluent discharged to Pleasant Grove Creek to have a pH between 6.5 and 8.5 and incremental UGA flows will not affect the pH of effluent, future discharges, regardless of volume, would not cause Pleasant Grove Creek pH to fall outside this range. Once the PGWWTP is expanded to accommodate future cumulative flows, the higher rate of discharge will not cause Pleasant Grove Creek pH to fall below a pH of 6.5 or be raised above 8.5. Based on these facts, the future cumulative condition for pH in Pleasant Grove Creek will have a less-than-significant impact on the creek's beneficial uses, including aquatic life uses, which are the uses most sensitive to creek pH.

Biostimulatory Substances (Nutrients)

The 1996 Master Plan EIR indicted that algal growth in Pleasant Grove Creek is limited by factors other than nutrient availability. This indicates that nutrients in effluent would not stimulate algal growth in the creek. In addition, PGWWTP bioassay data indicate that current undiluted PGWWTP effluent does not contain sufficient biostimulatory substances (i.e., nitrogen and phosphorus) to cause a significant increase in cell production in the *S. capricornutum* (algae) bioassay. Consequently, nuisance level plant or algae communities are not expected to develop in Pleasant Grove Creek, downstream of the PGWWTP outfall, under the future cumulative condition when higher rates of effluent discharge, including UGA flows, result in a greater proportion of creek water being constituted by treated effluent. Consequently, nutrient loading from the PGWWTP under the future cumulative condition constitutes a less-than-significant impact to nutrient water quality.

Dissolved Oxygen

The 1996 Master Plan EIR mitigation measures to address receiving water quality degradation impacts are as follows:

- Install advanced treatment facilities (Mitigation Measure 7-2, which is assumed to include mitigation for oxygen-related impacts since dissolved

oxygen impacts were not addressed in particular in the 1996 Master Plan EIR)

- Institute metals source controls/pre-treatment (Mitigation Measure 7-3)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

Table 2. Total Recoverable Mercury Concentrations in the City of Roseville's Wastewater Treatment Plant Effluent

Analysis Period	Sample Date	Concentration (µg/L)
Basis for NPDES Permit Mass Limit	2/6/96	0.04
	5/6/96	0.12
	8/13/96	0.007
	11/13/96	< 0.013
	3/10/97	< 0.02
	5/13/97	< 0.02
	9/10/97	< 0.02
	11/4/97	0.098
	2/27/98	< 0.02
	6/23/98	< 0.02
	9/21/98	0.041
	3/30/99	< 0.02
	5/26/99	< 0.02
	7/20/99	0.041
	12/5/99	< 0.02
	Period Average (Detected Concentrations Only)	**0.058**
Clean Sampling Techniques Implemented	1/26/04	< 0.00024
	5/18/04	0.0061
	8/3/04	0.0051
	11/9/04	0.0023
	2/6/05	0.0028
	4/19/05	0.043
	Period Average (Detected Concentrations Only)	**0.012**

The PGWWTP produces Title 22 quality, tertiary-treated effluent characterized by low BOD (typically less than 3 mg/L) and ammonia (typically less than 0.3 mg-N/L). As

such, its biochemical oxygen demand is relatively low. Re-aeration of downstream waters due to physical processes and photosynthesis tends to largely offset the oxygen demand of the effluent as it flows downstream, thereby resulting in small, if any, downstream dissolved oxygen (DO) sags (i.e., reductions in instream DO levels relative to background levels). This is shown by the DO data summarized in Table 3 that reflects the period since discharge from PGWWTP began in July 2004. In particular, the minimum monthly DO concentration is typically greater below the discharge than above it.

Table 3. Dissolved Oxygen in Pleasant Grove Creek

	2004						*2005*			
	Jul	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*
Avg R1	*8.9*	*9.2*	*8.4*	*10.3*	*9.6*	*9.0*	*9.1*	*6.1*	*7.9*	*7.3*
Avg R2	*7.4*	*7.5*	*7.5*	*8.3*	*9.1*	*9.9*	*10.7*	*10.1*	*9.2*	*8.8*
Min R1	*3.1*	*0.0*	*4.8*	*7.4*	*0.0*	*0.0*	*3.7*	*2.6*	*3.6*	*0.0*
Min R2	*2.0*	*4.1*	*5.7*	*7.4*	*8.4*	*9.4*	*9.4*	*9.1*	*8.8*	*7.9*
Max R1	*20.6*	*25.0*	*11.5*	*14.1*	*12.7*	*13.9*	*14.6*	*10.7*	*14.9*	*17.3*
Max R2	*9.8*	*13.1*	*9.7*	*9.2*	*10.2*	*10.5*	*13.5*	*11.1*	*9.9*	*10.1*

Notes:
R1 = 200 feet upstream of the PGWWTP discharge
R2 = 200 feet downstream of the PGWWTP discharge

As discharge rates increase in the future, the proportion of creek water constituted by effluent also will increase, as will the total oxygen demand of the discharged effluent. As such, a possibility exists that receiving water DO limitations (which derive directly from Basin Plan DO objectives) would not be met even if NPDES effluent BOD and ammonia limits are met. Available data are insufficient to conclusively establish whether the future cumulative discharge rates from the PGWWTP will result in DO sags downstream that will cause Pleasant Grove Creek DO levels to fall below applicable Basin Plan DO objectives. Because future discharges could potentially cause Pleasant Grove Creek DO concentrations to fall below the applicable DO objective, the future cumulative DO condition in Pleasant Grove Creek is considered to be potentially significant. The contribution of the UGA flows would be cumulatively considerable.

Although DO levels in Pleasant Grove creek were not specifically addressed in the 1996 EIR, this EIR's Mitigation Measure 7-2 (install advanced treatment facilities) is the same measure that would be implemented to address a DO issue. The type of advanced treatment facility would, of course, be tailored to the constituent of concern.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, any advanced treatment facilities that the City constructs and operates to comply with its NPDES DO limitations would be expanded (or initially constructed for an expanded

capacity) to address the increased wastewater flow from the UGAs, thereby assuring continued compliance with all Basin Plan DO objectives. Based on available information, the UGA flows are not expected to create a DO impact where, in the absence of the UGA flows, one would not exist. More likely, the UGA flows would simply further contribute to a cumulative DO impact, should one occur in the future. Consequently, no new mitigation measure(s) would be required in light of the additional UGA flows; rather, the advanced treatment facilities that the City would already have identified to address the potential DO impact may simply need to be implemented sooner, or to a greater or expanded level. Implementation of Mitigation Measure 7-2, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Tastes and Odors

The Basin Plan states that "*Waters shall not contain taste or odor producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.*" No history of taste and odor problems exists in Pleasant Grove Creek at locations downstream of the PGWWTP discharge. Municipal water supply taste and odor problems are often associated with algae production in source waters. The biostimulatory substance assessment presented above concludes that problematic levels of bio-stimulation and associated increased algal production is not expected to occur in Pleasant Grove Creek under the future cumulative condition.

Effluent quality under the future cumulative condition will be maintained at essentially equivalent or possibly higher quality levels (if additional or more restrictive NPDES limits are permitted by the RWQCB), relative to current effluent quality. Therefore, no taste and odor problems would be expected in the future, once the PGWWTP is adequately expanded/upgraded, as necessary, and permitted to treat the incremental flows, including UGA flows. This would be a less-than-significant cumulative impact.

FLOW-RELATED EFFECTS

Flow can affect habitat and result in flooding. Each type of effect is addressed below.

Flooding Effects

Appendix A describes an analysis of the effects of discharge from PGWWTP on water surface elevation in Pleasant Grove Creek under 100-year flow conditions. The analysis indicates that water surface elevation would be increased 0.07 feet or less in the reach upstream of Reason Farm as a result of incremental UGA wastewater flows as a result of the incremental the PGWWTP discharge. Downstream of Reason Farms, the impact of

the incremental UGA discharge would be immeasurable, partially as a result of 207 acre-feet of storage that is being constructed at Reason Farms for the purpose of mitigating impacts of the PGWWTP discharge. The size of this storage was established to exceed that needed to mitigate the effect PGWWTP adwf of 24 mgd, and the analysis in Appendix A shows no more 165 acre-feet would be needed to mitigate for effects of PGWWTP adwf of 23.3 mgd (which includes the incremental UGA wastewater flows) downstream of Reason Farms. This impact is considered less than significant.

Effects on Aquatic Life

Increasing the flows in Pleasant Grove Creek through the discharge of additional treated effluent will result in channel conveyance of higher flow volumes with associated higher water velocities which could cause additional bed scour and bank erosion. Bed scour and bank erosion, if it occurs as a result of the incremental flows, would increase water column turbidity and alter substrate composition downstream of the PGWWTP outfall.

Sedimentation/Turbidity

Due to the constraints of the NPDES permit's effluent limits, the only mechanism for the discharge to cause sedimentation and higher turbidities within Pleasant Grove Creek under future cumulative conditions would be via the hydraulic effects of the higher flows re-suspending creek bed sediments and eroding creek banks near the outfall, and in downstream reaches. The effluent discharged from the PGWWTP under the future cumulative condition will have very low turbidity (i.e., average < 2 NTU) and suspended matter.

Appendix A describes the velocity (in the column entitled "vel chnl") of water in Pleasant Grove Creek under high and low streamflow conditions with and without the incremental UGA flows. The velocity of water indicates the amount of energy available to scour sediment from the bed and bank of the stream. Under high flow conditions, which is the channel forming condition, Appendix A indicates water velocity is not affected to a measurable extent by the incremental UGA flows. Under low flow conditions, the overall stream velocity regime is much lower than at high flow conditions, indicating much less bed and bank erosion would generally be expected under low flow conditions relative to the high flow condition evaluated in the study described in Appendix A. Therefore, the impact of the incremental UGA flows on sedimentation and turbidity is considered to be less than significant.

Water Quality Degradation (Temperature)

The temperature impact has been discussed previously (see Water Quality Degradation due to Increased Discharge section above).

Water Quality Degradation (Contaminant Levels)

The contaminant impact has been discussed previously (see Water Quality Degradation due to Increased Discharge section above).

Riparian Habitat Effects

The 1996 Master Plan EIR identified loss of oak trees along Pleasant Grove Creek resulting from effluent discharge as a significant impact. The 1996 Master Plan EIR included the following to mitigate for this impact:

- Conduct monitoring for oak mortality along Pleasant Grove Creek (Mitigation Measure 4-13)

Following mitigation, this impact is considered significant in the 1996 Master Plan EIR. This impact results from conversion of Pleasant Grove Creek from a seasonal stream to a perennial stream.

Appendix A describes the effect of the proposed incremental UGA flows on Pleasant Grove Creek water surface elevation under typical dry season conditions. The impact of the incremental UGA flows is estimated to be 0.44 feet or less depending on location. Pleasant Grove Creek riparian vegetation was not adapted to saturated soils during the dry season in or near the root zone prior to 2004 when discharge from PGWWTP commenced. The incremental UGA flows could further contribute to the significant impact identified in the 1996 Master Plan EIR. Assuming all feasible and effective mitigation was included in the 1996 Master Plan EIR, no new mitigation measure(s) would be required under CEQA to mitigate for the impact of additional UGA flows. Thus, the incremental impact of UGA flows on riparian vegetation would be considered significant.

REFERENCES

Roseville, City of. 1996. Roseville Regional Wastewater Treatment Service Area Master Plan Final Environmental Impact Report. Prepared for the City of Roseville by Montgomery Watson and ESA Associates. State Clearinghouse No. 93092079. October 25, 1996.

Roseville, City of. 2004. Final Environmental Impact Report for the West Roseville Specific Plan and Sphere of Influence Amendment, Volume I: Chapters 1, 2, 3, and 4 (sections 4.1 through 4.10). Prepared for the City of Roseville by EIP Associates, State Clearinghouse No. 2002082057, January 9, 2004.

Roseville, City of. 2004. Final Environmental Impact Report for the West Roseville Specific Plan and Sphere of Influence Amendment, Volume II: Chapter 4 (4.11

through 4.13 and Chapters 5-10. Prepared for the City of Roseville by EIP Associates, State Clearinghouse No. 2002082057, January 9, 2004.

RWQCB. 2002. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for pH and Turbidity at Deer Creek, El Dorado & Sacramento Counties, Staff Report And Functional Equivalent Document. Central Valley Regional Water Quality Control Board. February.

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MEMORANDUM

To: David Smith

Of: Merritt Smith Consulting

From: Thomas S. Plummer

Job Number: 2003.24

Re: Pleasant Grove Wastewater Treatment Plant (PGWWTP) impacts at Pleasant Grove Creek

Date: January 12, 2006

Dear David:

Per your request, we have reviewed your Draft summary table entitled "Table 1. Estimated Future Wastewater Flows". In quantifying the hydraulic impacts to Pleasant Grove Creek, the increased releases from the treatment plan would have the potential to increase peak discharges, above the existing estimated conditions, by an average flow rate of 7.6 MGD which is equivalent to 11.76 cubic feet per second (cfs). However, to determine the potential impact to peak flow rates you have advised that a peaking factor of 2.5 should be applied which results in a peak flow impact of 29.4 cfs. Secondly, Art O'Brien of the City of Roseville has advised that we also should review the impacts associated with the transfer of the storage from the PGWWTP site to the Reason Farms site.

Hydraulic Modeling Basis:

There are two historical hydraulic models of significance to this study. We have used a composite model of the two studies for this analysis.

In 1999 Carollo Engineers prepared a study ":Hydrological Analysis of Pleasant Grove Creek – Pleasant Grove Wastewater Treatment Plan Project". The study indicates that cross sections were surveyed for the included hydraulic analysis. The study includes analysis of Pleasant Grove Creek from the Pleasant Grove Canal at the downstream end, to reaches of Pleasant Grove creek well upstream of the PGWWTP. Research for the Carollo study did not find the original hydraulic analysis files. Civil Solutions used the cross sections, the river stations and section map included in the study to create a replica version of the analysis.

In 2003, Wood Rodgers prepared a hydraulic analysis of Pleasant Grove Creek for the West Roseville Specific Plan area. The analysis includes all upper reaches of the Creek, and the downstream reach which flows past the treatment plant. The study terminates at the downstream end, upstream of Brewer Road at a location which is similar to River Mile (RM) Section 4.5 of the Carollo Study. Hydraulic analysis HEC-RAS files were obtained for the WRSP hydraulic analysis directly from Wood Rodgers.

In order to use the best information available for this analysis, we assembled a composite study, which includes all of the information from the WRSP hydraulic analysis, and added to it our replicated section information from the Carollo study for the sections downstream of RM 4.5. We joined Section 0.0189 of the WRSP to RM 4.5 of the Carollo study.

The WRSP hydrology study is the most recent study of Pleasant Grove Creek that we are aware of. We have used the flow rate estimates from the WRSP hydrology as a basis for the 2-year, 10-year, 25-year and 100-year peak storm events. For this study, we will compare the "Existing Conditions" flowrates from the WRSP analysis to the impacted flowrates determined in this study. Downstream starting water surface elevations were read from the Carollo report and specified in the composite model.

An exhibit is provided at the end of this letter which shows the river stationing for the combined study.

Peak Flow Impacts:

We have run the above described hydraulic model for the WRSP peak estimated "existing" flow rates, and for those same rates with 29.4 cfs added. 29.4 cfs being the 7.6 MGD average increase in discharge rates with a 2.5 peaking factor applied for the peak flow event. Flow discharges from the PGWWTP would enter the creek at WRSP station 3.451.

From WRSP station 3.648 (+/- 0.2 miles upstream of the PGWWTP discharge) to WRSP station 2.398 (+/- 1 mile downstream of the PGWWTP discharge) a 0.01 feet increase in 100-year water surface elevations is reported. From WRSP station 2.244 to WRSP station 1.879 (+/- 1.5 miles downstream of the PGWWTP discharge) a 0.02 feet increase in 100-year water surface elevations is reported. From WRSP station 1.825 to Carollo station 4.00 (roughly 1 mile upstream of the Sutter/Placer County line) a 0.01 feet increase in 100-year water surface elevations is reported. Downstream of this location to the Pleasant Grove Canal, no further increases in 100-year peak water surface elevations is reported. Overall, it is our opinion that the reported impacts would be less than measurable. We have attached the summary printout from the HEC-RAS model to this memo.

Low Flow Impacts:

Prior to the construction of the PGWWTP, Pleasant Grove Creek was documented in the PGWWTP EIR as an "intermittent stream". We interpret this to mean that at some times during the dry season, no base flow would be observed. Table 1 "Estimated Future Wastewater Flows" identifies the buildout wastewater flows from inside the 2005 planning area as 15.7 MGD (24.3 cfs), which is the baseline flow for this analysis. The best available information indicates Pleasant Grove Creek has

no other source of dry season flow. The dry weather average discharge rates with the buildout of the Urban Growth Areas are expected to increase 7.6 MGD to 23.4 MGD or 36.1 cfs.

We have performed a hydraulic evaluation using the composite model described above to determine the impacts to dry season water depths and velocities. We have included a comparison of the results of the current dry season flow rates (pre-project) to the proposed dry season flow rates (post-project)"Low Flow" analysis with this letter. The Maximum increase in water depths would be 0.55 feet between WRSP stations 1.116 (approximately 2.3 miles downstream of the discharge to Pleasant Grove Creek) and 0.829(approximately 2.6 miles downstream of the discharge to the creek). Increases in water surface elevations were computed between WRSP station 3.878 (upstream of Haden Parkway, and .4 miles upstream of the discharge point to the creek), and Carollo Station 1.40 (downstream of the railroad crossing). The average increase in water depth over that reach was 0.34 feet.

Surveys for the detailed geometry of the low flow channel for Pleasant Grove Creek are not available. The analysis included should be adequate to represent the relative changes in waters surface elevations due to the change in base flow rates. However, the results of this model should not be used to determine dry weather flood elevations at a point along the analysis reach.

Movement of Storage:

There are two potential issues which result from the movement of the peak flow storage component of the WWTP from the current WWTP site to the Reason Farms site.

First, *"What should the revised storage requirement be?":*

Currently, the 1999 Carollo study predicted that when flow rates in Pleasant Grove Creek exceed 1000 cfs a flooding potential exists at Fifield Road, which could be worsened by adding additional flows. The hydrographs for the 24-hour precipitation event indicate that the potential for flow rates within the creek to exceed 1000 cfs in a 100-year event would extend for a period of up to 22 hours 10 minutes. The Carollo Study identified a storage requirement of 147 acre feet for the previous design flow rates of the treatment plant.

The WRSP Hydrologic analysis updated the Pleasant grove Creek Hydrology for Storm centering issues and other factors identified in the Placer County Stormwater Management Manual. The results of that analysis, for the ultimate developed project, indicate the potential for flow rates in the 100-year event to exceed 1000 cfs would be for a period of 18 hours 5 minutes.

The proposed average discharge rate for the PGWWTP would be 23.3 MGD or 36.05 cfs. Applying a peaking factor of 2.5, the peak discharge rate for the plant to a storage facility would be 90.1 cfs. The required storage based on the Carollo and WRSP hydrology basis studies would be 165.1 acre feet and 134.6 acre feet respectively.

Second, *"What impact if any, would the release of the sustained peak discharge rates between the WWTP and the Reasons Farms site have on the 100-year peak flood elevations in the creek."*

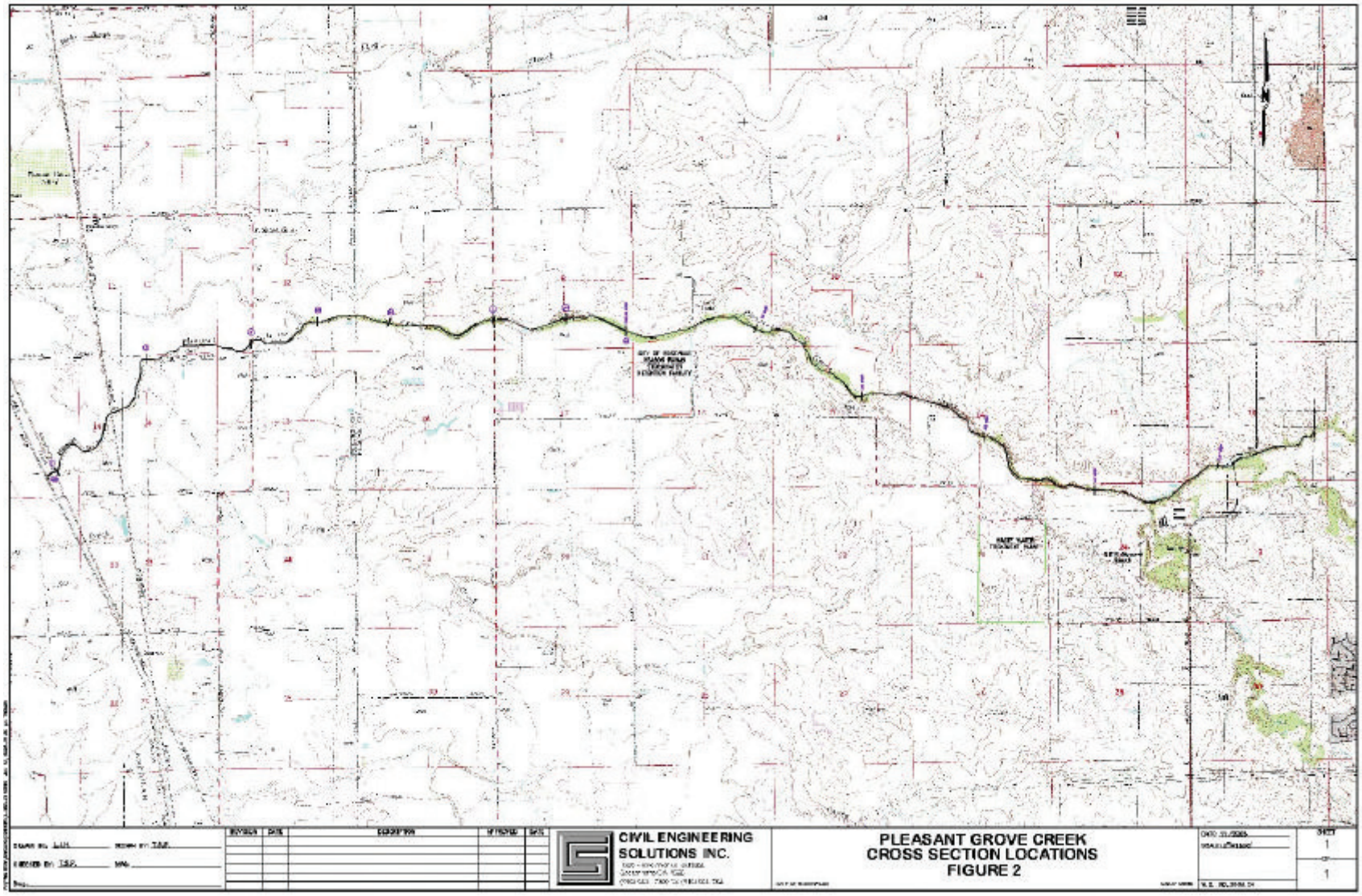
For this analysis, 90.1 cfs was added to the existing peak flow rates, from WRSP station 3.451 (near the PGWWTP), to WRSP station 1.825 (near the intake for the Reasons Farms project). Then 29.4 cfs was added to the remainder of the downstream reaches.

The results of the hydraulic analysis indicate that a 0.01 feet increase in 100-year water surface elevations would occur as far upstream as WRSP station 4.853 (upstream of Haden Parkway). The largest increase in water surface reported in the analysis was 0.07 feet at WRSP station 3.457, just upstream of the PGWWTP discharge location. 100-year water surface elevation increases average 0.04 feet from this location to the Reasons Farms site. Increases in 100-year water surface elevations gradually decrease from this point measuring 0.03 feet to no increase at Carollo Station 1.37 (downstream of the Railroad crossing, and upstream of the transition to the Pleasant Grove Canal). A copy of the HEC-RAS summary comparison is included at the end of this letter.

If you have any questions or comments please contact me at (916) 563-7300.

Sincerely,

Thomas S. Plummer P.E., CFM


CIVIL ENGINEERING
SOLUTIONS INC.
PLEASANT GROVE CREEK
CROSS SECTION LOCATIONS
FIGURE 2

PEAK FLOW COMPARISON +29.4cfs (HEC-RAS OUTPUT):

HEC-RAS Plan: PGC Existing

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Channel 3	4.314	100-yr (Exist) M	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.314	100-yr ex +29.4	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.279	100-yr (Exist) M	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.279	100-yr ex +29.4	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.164	100-yr (Exist) M	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.164	100-yr ex +29.4	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.016	100-yr (Exist) M	8173.00	69.00	85.95	79.77	86.12	3.31
Main Channel 3	4.016	100-yr ex +29.4	8173.00	69.00	85.95	79.77	86.12	3.31
Main Channel 3	3.878	100-yr (Exist) M	8173.00	67.32	85.40	78.55	85.54	3.05
Main Channel 3	3.878	100-yr ex +29.4	8173.00	67.32	85.40	78.55	85.55	3.04
Main Channel 3	3.800		Bridge					
Main Channel 3	3.762	100-yr (Exist) M	8173.00	67.00	84.92		85.07	3.19
Main Channel 3	3.762	100-yr ex +29.4	8173.00	67.00	84.92		85.08	3.18
Main Channel 3	3.648	100-yr (Exist) M	8173.00	66.15	84.42	78.49	84.59	3.46
Main Channel 3	3.648	100-yr ex +29.4	8173.00	66.15	84.43	78.49	84.60	3.45
Main Channel 3	3.532	100-yr (Exist) M	8173.00	65.82	84.16	77.19	84.24	2.49
Main Channel 3	3.532	100-yr ex +29.4	8173.00	65.82	84.17	77.19	84.25	2.49
Main Channel 3	3.467	100-yr (Exist) M	8173.00	65.80	83.24	77.42	83.86	6.44
Main Channel 3	3.467	100-yr ex +29.4	8173.00	65.80	83.25	77.42	83.87	6.43
Main Channel 3	3.465		Bridge					
Main Channel 3	3.461	100-yr (Exist) M	8159.00	65.80	82.60	77.41	83.39	7.11
Main Channel 3	3.461	100-yr ex +29.4	8188.40	65.80	82.61	77.43	83.40	7.13
Main Branch 2	3.356	100-yr (Exist) M	8159.00	65.30	82.52	75.58	82.63	3.35
Main Branch 2	3.356	100-yr ex +29.4	8188.40	65.30	82.53	75.58	82.64	3.36
Main Branch 2	3.270	100-yr (Exist) M	8159.00	64.65	82.31	77.80	82.40	3.51
Main Branch 2	3.270	100-yr ex +29.4	8188.40	64.65	82.32	77.81	82.41	3.51
Main Branch 2	3.132	100-yr (Exist) M	8159.00	64.35	81.93		82.03	3.41
Main Branch 2	3.132	100-yr ex +29.4	8188.40	64.35	81.94		82.04	3.42
Main Branch 2	3.041	100-yr (Exist) M	8159.00	63.99	81.77		81.81	1.70
Main Branch 2	3.041	100-yr ex +29.4	8188.40	63.99	81.78		81.82	1.71
Main Branch 2	2.932	100-yr (Exist) M	8159.00	63.76	81.51		81.59	2.13
Main Branch 2	2.932	100-yr ex +29.4	8188.40	63.76	81.52		81.59	2.13
Main Branch 2	2.863	100-yr (Exist) M	8159.00	63.50	81.37		81.45	2.42
Main Branch 2	2.863	100-yr ex +29.4	8188.40	63.50	81.38		81.46	2.42
Main Branch 2	2.782	100-yr (Exist) M	8159.00	63.30	81.27		81.34	2.28
Main Branch 2	2.782	100-yr ex +29.4	8188.40	63.30	81.28		81.35	2.28
Main Branch 2	2.723	100-yr (Exist) M	8159.00	62.89	81.11		81.22	3.08

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 2	2.723	100-yr ex +29.4	8188.40	62.89	81.12		81.23	3.08
Main Branch 2	2.598	100-yr (Exist) M	8159.00	62.62	80.56		80.71	3.46
Main Branch 2	2.598	100-yr ex +29.4	8188.40	62.62	80.57		80.72	3.46
Main Branch 2	2.517	100-yr (Exist) M	8159.00	62.39	80.26		80.35	2.64
Main Branch 2	2.517	100-yr ex +29.4	8188.40	62.39	80.27		80.36	2.64
Main Branch 2	2.448	100-yr (Exist) M	8159.00	62.23	80.00		80.12	3.02
Main Branch 2	2.448	100-yr ex +29.4	8188.40	62.23	80.01		80.13	3.03
Main Branch 2	2.398	100-yr (Exist) M	8159.00	61.72	79.88		79.87	4.43
Main Branch 2	2.398	100-yr ex +29.4	8188.40	61.72	79.89		79.88	4.42
Main Branch 2	2.244	100-yr (Exist) M	8159.00	61.59	78.59	73.87	78.76	4.41
Main Branch 2	2.244	100-yr ex +29.4	8188.40	61.59	78.61	73.89	78.78	4.39
Main Branch 2	2.205	100-yr (Exist) M	8159.00	61.47	76.52	73.16	78.09	10.13
Main Branch 2	2.205	100-yr ex +29.4	8188.40	61.47	76.54	73.18	78.11	10.13
Main Branch 2	2.167	100-yr (Exist) M	8159.00	61.28	76.01	71.08	76.81	7.61
Main Branch 2	2.167	100-yr ex +29.4	8188.40	61.28	76.03	71.10	76.84	7.63
Main Branch 2	2.111	100-yr (Exist) M	8159.00	61.08	74.67		75.69	8.10
Main Branch 2	2.111	100-yr ex +29.4	8188.40	61.08	74.69		75.71	8.12
Main Branch 2	2.051	100-yr (Exist) M	8159.00	60.87	73.61		74.33	6.78
Main Branch 2	2.051	100-yr ex +29.4	8188.40	60.87	73.63		74.34	6.80
Main Branch 2	1.987	100-yr (Exist) M	8159.00	60.70	73.55	68.46	73.66	2.68
Main Branch 2	1.987	100-yr ex +29.4	8188.40	60.70	73.57	68.47	73.68	2.68
Main Branch 2	1.935	100-yr (Exist) M	8159.00	60.52	73.40	66.93	73.49	2.39
Main Branch 2	1.935	100-yr ex +29.4	8188.40	60.52	73.41	66.94	73.50	2.39
Main Branch 2	1.879	100-yr (Exist) M	8159.00	60.34	73.27	66.54	73.36	2.31
Main Branch 2	1.879	100-yr ex +29.4	8188.40	60.34	73.29	66.55	73.37	2.31
Main Branch 2	1.825	100-yr (Exist) M	8159.00	60.13	72.83	67.39	73.15	4.55
Main Branch 2	1.825	100-yr ex +29.4	8188.40	60.13	72.84	67.40	73.17	4.56
Main Branch 2	1.763	100-yr (Exist) M	8159.00	60.05	72.59		72.74	3.16
Main Branch 2	1.763	100-yr ex +29.4	8188.40	60.05	72.60		72.76	3.16
Main Branch 2	1.738	100-yr (Exist) M	8159.00	59.92	72.50		72.64	3.03
Main Branch 2	1.738	100-yr ex +29.4	8188.40	59.92	72.51		72.66	3.03
Main Branch 2	1.699	100-yr (Exist) M	8159.00	59.71	72.25		72.46	3.71
Main Branch 2	1.699	100-yr ex +29.4	8188.40	59.71	72.26		72.48	3.71
Main Branch 2	1.634	100-yr (Exist) M	8159.00	59.60	71.68	66.48	71.86	4.38
Main Branch 2	1.634	100-yr ex +29.4	8188.40	59.60	71.70	66.49	72.00	4.39
Main Branch 2	1.602	100-yr (Exist) M	8159.00	59.31	71.63	65.17	71.78	3.10
Main Branch 2	1.602	100-yr ex +29.4	8188.40	59.31	71.64	65.18	71.79	3.11

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta.	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 2	1.512	100-yr (Exist) M	8159.00	59.20	71.29	65.43	71.44	3.14
Main Branch 2	1.512	100-yr ex +29.4	8188.40	59.20	71.30	65.43	71.45	3.15
Main Branch 2	1.480	100-yr (Exist) M	8159.00	59.05	71.25	63.75	71.34	2.37
Main Branch 2	1.480	100-yr ex +29.4	8188.40	59.05	71.26	63.76	71.35	2.37
Main Branch 2	1.435	100-yr (Exist) M	8159.00	59.05	71.20	63.85	71.26	2.05
Main Branch 2	1.435	100-yr ex +29.4	8188.40	59.05	71.21	63.86	71.27	2.05
Main Branch 2	1.386	100-yr (Exist) M	8159.00	58.68	71.00		71.16	3.17
Main Branch 2	1.386	100-yr ex +29.4	8188.40	58.68	71.02		71.17	3.17
Main Branch 1	1.322	100-yr (Exist) M	8797.00	58.57	70.88	63.28	70.99	2.59
Main Branch 1	1.322	100-yr ex +29.4	8826.40	58.57	70.90	63.30	71.00	2.60
Main Branch 1	1.289	100-yr (Exist) M	8797.00	58.43	70.77		70.91	3.00
Main Branch 1	1.289	100-yr ex +29.4	8826.40	58.43	70.78		70.92	3.01
Main Branch 1	1.248	100-yr (Exist) M	8797.00	58.30	70.60		70.77	3.35
Main Branch 1	1.248	100-yr ex +29.4	8826.40	58.30	70.61		70.78	3.36
Main Branch 1	1.206	100-yr (Exist) M	8797.00	58.23	70.47		70.62	3.15
Main Branch 1	1.206	100-yr ex +29.4	8826.40	58.23	70.48		70.63	3.15
Main Branch 1	1.187	100-yr (Exist) M	8797.00	58.13	70.37		70.55	3.40
Main Branch 1	1.187	100-yr ex +29.4	8826.40	58.13	70.38		70.56	3.41
Main Branch 1	1.157	100-yr (Exist) M	8797.00	58.00	70.27		70.44	3.38
Main Branch 1	1.157	100-yr ex +29.4	8826.40	58.00	70.28		70.45	3.38
Main Branch 1	1.116	100-yr (Exist) M	8797.00	57.88	70.00		70.24	4.02
Main Branch 1	1.116	100-yr ex +29.4	8826.40	57.88	70.01		70.25	4.03
Main Branch 1	1.079	100-yr (Exist) M	8797.00	57.68	69.91		70.06	3.10
Main Branch 1	1.079	100-yr ex +29.4	8826.40	57.68	69.92		70.07	3.10
Main Branch 1	1.020	100-yr (Exist) M	8797.00	57.55	69.73		69.87	3.03
Main Branch 1	1.020	100-yr ex +29.4	8826.40	57.55	69.74		69.88	3.03
Main Branch 1	.982	100-yr (Exist) M	8797.00	57.47	69.63		69.78	2.98
Main Branch 1	.982	100-yr ex +29.4	8826.40	57.47	69.63		69.77	2.97
Main Branch 1	.957	100-yr (Exist) M	8797.00	57.31	69.53		69.68	3.30
Main Branch 1	.957	100-yr ex +29.4	8826.40	57.31	69.53		69.68	3.31
Main Branch 1	.906	100-yr (Exist) M	8797.00	57.05	69.18		69.42	3.97
Main Branch 1	.906	100-yr ex +29.4	8826.40	57.05	69.19		69.42	3.98
Main Branch 1	.829	100-yr (Exist) M	8797.00	56.96	68.99		69.09	2.75
Main Branch 1	.829	100-yr ex +29.4	8826.40	56.96	69.00		69.10	2.75
Main Branch 1	.802	100-yr (Exist) M	8797.00	56.84	68.34		68.88	6.26
Main Branch 1	.802	100-yr ex +29.4	8826.40	56.84	68.35		68.89	6.24
Main Branch 1	.765	100-yr (Exist) M	8797.00	56.70	68.09		68.33	4.08
Main Branch 1	.765	100-yr ex +29.4	8826.40	56.70	68.10		68.34	4.08

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 1	.722	100-yr (Exist) M	8797.00	56.62	67.83		68.02	3.71
Main Branch 1	.722	100-yr ex +29.4	8826.40	56.62	67.84		68.03	3.72
Main Branch 1	.698	100-yr (Exist) M	8797.00	56.57	67.72		67.84	3.01
Main Branch 1	.698	100-yr ex +29.4	8826.40	56.57	67.73		67.85	3.02
Main Branch 1	.685	100-yr (Exist) M	8797.00	56.23	67.67		67.75	2.67
Main Branch 1	.685	100-yr ex +29.4	8826.40	56.23	67.68		67.76	2.67
Main Branch 1	.600	100-yr (Exist) M	8797.00	56.18	67.42		67.48	2.27
Main Branch 1	.600	100-yr ex +29.4	8826.40	56.18	67.43		67.49	2.27
Main Branch 1	.566	100-yr (Exist) M	8797.00	56.00	67.01		67.32	5.02
Main Branch 1	.566	100-yr ex +29.4	8826.40	56.00	67.02		67.33	5.03
Main Branch 1	.515	100-yr (Exist) M	8797.00	55.85	66.79		66.95	3.85
Main Branch 1	.515	100-yr ex +29.4	8826.40	55.85	66.80		66.96	3.85
Main Branch 1	.467	100-yr (Exist) M	8797.00	55.85	66.16		66.55	5.69
Main Branch 1	.467	100-yr ex +29.4	8826.40	55.85	66.17		66.56	5.69
Main Branch 1	.3220	100-yr (Exist) M	8797.00	51.70	64.31		64.57	4.37
Main Branch 1	.3220	100-yr ex +29.4	8826.40	51.70	64.33		64.58	4.37
Main Branch 1	.1894	100-yr (Exist) M	8797.00	51.40	63.05		63.28	3.84
Main Branch 1	.1894	100-yr ex +29.4	8826.40	51.40	63.06		63.29	3.84
Main Branch 1	.0189	100-yr (Exist) M	8797.00	51.40	59.70		60.44	8.29
Main Branch 1	.0189	100-yr ex +29.4	8826.40	51.40	59.71		60.44	8.30
Main Branch 1	.0142	100-yr (Exist) M	8797.00	47.00	58.56		58.60	2.00
Main Branch 1	.0142	100-yr ex +29.4	8826.40	47.00	58.57		58.62	2.00
Main Branch 1	.014	100-yr (Exist) M	8797.00	45.80	55.58	51.98	56.39	7.19
Main Branch 1	.014	100-yr ex +29.4	8826.40	45.80	55.60	52.00	56.41	7.20
Main Branch 1	.0137	100-yr (Exist) M	8797.00	39.00	48.40		49.16	7.02
Main Branch 1	.0137	100-yr ex +29.4	8826.40	39.00	48.40		49.17	7.03
Main Branch 1	.0133	100-yr (Exist) M	8797.00	37.00	47.87		47.88	1.32
Main Branch 1	.0133	100-yr ex +29.4	8826.40	37.00	47.87		47.89	1.32
Main Branch 1	.013	100-yr (Exist) M	8797.00	29.40	47.59	41.19	47.60	0.96
Main Branch 1	.013	100-yr ex +29.4	8826.40	29.40	47.60	41.21	47.60	0.96
Main Branch 1	.012	100-yr (Exist) M	8797.00	29.70	47.59	36.73	47.59	0.13
Main Branch 1	.012	100-yr ex +29.4	8826.40	29.70	47.59	36.74	47.59	0.13
Main Branch 1	.011	100-yr (Exist) M	8797.00	24.40	47.40		47.55	3.47
Main Branch 1	.011	100-yr ex +29.4	8826.40	24.40	47.40		47.56	3.48
Main Branch 1	.0109	100-yr (Exist) M	8797.00	25.29	47.47	34.51	47.49	1.50
Main Branch 1	.0109	100-yr ex +29.4	8826.40	25.29	47.47	34.52	47.49	1.50

LOW FLOW COMPARISON 23.3 cfs to 36.1cfs (HEC-RAS OUTPUT):

HEC-RAS Plan: POC Existing

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Channel 3	4.314	24.3 cfs	1.00	70.85	70.85	70.71	70.85	0.000948	0.27	3.66	22.39	0.12
Main Channel 3	4.314	36.1 cfs	1.00	70.66	70.86	70.71	70.85	0.000944	0.27	3.66	22.40	0.12
Main Channel 3	4.279	24.3 cfs	1.00	70.11	70.32	70.28	70.34	0.029293	1.12	0.89	8.40	0.81
Main Channel 3	4.279	36.1 cfs	1.00	70.11	70.32	70.28	70.34	0.033900	1.20	0.83	8.11	0.88
Main Channel 3	4.184	24.3 cfs	1.00	69.04	69.86	69.31	69.86	0.000237	0.24	4.09	10.01	0.07
Main Channel 3	4.184	36.1 cfs	1.00	69.04	69.86	69.31	69.86	0.000228	0.24	4.15	10.06	0.07
Main Channel 3	4.016	24.3 cfs	1.00	69.00	69.32	69.21	69.33	0.007714	0.77	1.30	8.07	0.34
Main Channel 3	4.016	36.1 cfs	1.00	69.00	69.29	69.21	69.30	0.013186	0.94	1.06	7.28	0.44
Main Channel 3	3.878	24.3 cfs	1.00	67.32	68.04	67.63	68.04	0.000765	0.40	2.48	6.01	0.12
Main Channel 3	3.878	36.1 cfs	1.00	67.32	68.11	67.63	68.11	0.000595	0.33	3.04	9.60	0.10
Main Channel 3	3.800		Bridge									
Main Channel 3	3.762	24.3 cfs	1.00	67.00	67.58		67.59	0.000615	0.30	3.38	11.48	0.10
Main Channel 3	3.762	36.1 cfs	1.00	67.00	67.96		67.96	0.000035	0.11	8.30	19.02	0.03
Main Channel 3	3.648	24.3 cfs	1.00	66.15	67.58	66.40	67.58	0.000007	0.06	16.30	22.66	0.01
Main Channel 3	3.648	36.1 cfs	1.00	66.15	67.97	66.40	67.97	0.000002	0.04	26.66	29.21	0.01
Main Channel 3	3.532	24.3 cfs	1.00	65.82	67.58	66.07	67.58	0.000002	0.04	24.42	25.75	0.01
Main Channel 3	3.532	36.1 cfs	1.00	65.82	67.97	66.07	67.97	0.000001	0.03	35.62	29.89	0.00
Main Channel 3	3.457	24.3 cfs	1.00	65.80	67.57	65.97	67.57	0.000000	0.02	43.74	31.86	0.00
Main Channel 3	3.457	36.1 cfs	1.00	65.80	67.97	65.97	67.97	0.000000	0.02	56.60	32.56	0.00
Main Channel 3	3.455		Bridge									
Main Channel 3	3.451	24.3 cfs	24.30	65.80	67.57	66.40	67.58	0.000240	0.56	43.74	31.86	0.08
Main Channel 3	3.451	36.1 cfs	36.10	65.80	67.97	66.51	67.98	0.000235	0.64	56.60	32.55	0.09
Main Branch 2	3.395	24.3 cfs	24.30	65.30	67.49	66.01	67.49	0.000140	0.44	54.92	38.06	0.06
Main Branch 2	3.395	36.1 cfs	36.10	65.30	67.98	66.13	67.99	0.000147	0.51	70.68	40.59	0.07
Main Branch 2	3.270	24.3 cfs	24.30	64.65	67.43	65.54	67.43	0.000103	0.42	57.57	34.03	0.06
Main Branch 2	3.270	36.1 cfs	36.10	64.65	67.82	65.70	67.83	0.000121	0.51	71.24	36.73	0.06
Main Branch 2	3.132	24.3 cfs	24.30	64.35	67.31		67.32	0.000263	0.56	43.42	30.61	0.08
Main Branch 2	3.132	36.1 cfs	36.10	64.35	67.69		67.70	0.000298	0.65	55.33	32.27	0.09
Main Branch 2	3.041	24.3 cfs	24.30	63.99	67.20		67.21	0.000184	0.55	44.38	23.04	0.07
Main Branch 2	3.041	36.1 cfs	36.10	63.99	67.56		67.57	0.000244	0.68	52.75	24.06	0.08
Main Branch 2	2.932	24.3 cfs	24.30	63.76	67.10		67.11	0.000174	0.56	44.26	21.56	0.07
Main Branch 2	2.932	36.1 cfs	36.10	63.76	67.42		67.43	0.000240	0.71	51.16	22.01	0.08
Main Branch 2	2.863	24.3 cfs	24.30	63.90	67.09		67.09	0.000017	0.18	133.01	73.41	0.02
Main Branch 2	2.863	36.1 cfs	36.10	63.90	67.40		67.40	0.000024	0.23	156.91	79.49	0.03
Main Branch 2	2.782	24.3 cfs	24.30	63.90	67.09		67.09	0.000002	0.07	350.37	148.71	0.01
Main Branch 2	2.782	36.1 cfs	36.10	63.90	67.40		67.40	0.000003	0.09	396.94	148.85	0.01
Main Branch 2	2.723	24.3 cfs	24.30	62.89	67.07	66.14	67.08	0.002051	1.06	22.47	27.06	0.21
Main Branch 2	2.723	36.1 cfs	36.10	62.89	67.36	66.35	67.40	0.001903	1.14	31.73	32.92	0.20
Main Branch 2	2.598	24.3 cfs	24.30	62.62	65.21		65.28	0.003865	2.01	12.09	9.32	0.31
Main Branch 2	2.598	36.1 cfs	36.10	62.62	65.60		65.68	0.004084	2.26	15.96	10.71	0.33
Main Branch 2	2.517	24.3 cfs	24.30	62.39	64.81		64.82	0.000488	0.72	33.65	27.83	0.12
Main Branch 2	2.517	36.1 cfs	36.10	62.39	65.21		65.22	0.000496	0.79	45.71	32.44	0.12
Main Branch 2	2.449	24.3 cfs	24.30	62.23	64.66		64.66	0.000412	0.68	35.87	29.67	0.11
Main Branch 2	2.449	36.1 cfs	36.10	62.23	65.06		65.06	0.000397	0.74	48.82	34.65	0.11
Main Branch 2	2.398	24.3 cfs	24.30	61.72	64.57		64.58	0.000234	0.57	42.76	30.00	0.08
Main Branch 2	2.398	36.1 cfs	36.10	61.72	64.97		64.98	0.000255	0.65	55.70	34.24	0.09
Main Branch 2	2.244	24.3 cfs	24.30	61.99	64.07	63.06	64.11	0.002856	1.73	14.06	11.36	0.27
Main Branch 2	2.244	36.1 cfs	36.10	61.99	64.41	63.32	64.47	0.003136	1.96	18.27	12.95	0.29
Main Branch 2	2.205	24.3 cfs	24.30	61.47	63.60	62.66	63.63	0.002004	1.36	17.90	16.82	0.23
Main Branch 2	2.205	36.1 cfs	36.10	61.47	63.90	62.86	63.94	0.002166	1.55	23.31	19.19	0.25
Main Branch 2	2.167	24.3 cfs	24.30	61.38	63.44	62.20	63.05	0.000687	0.69	35.41	32.79	0.12
Main Branch 2	2.167	36.1 cfs	36.10	61.38	63.72	62.36	63.73	0.000558	0.80	45.27	37.07	0.13

HEC-RAS Plan: POC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Main Branch 2	2.111	24.3 cfs	24.30	61.08	63.29		63.30	0.000539	0.73	33.23	30.11	0.12
Main Branch 2	2.111	36.1 cfs	36.10	61.08	63.54		63.55	0.000670	0.88	41.21	33.52	0.14
Main Branch 2	2.051	24.3 cfs	24.30	60.87	63.16		63.16	0.000339	0.59	40.87	35.75	0.10
Main Branch 2	2.051	36.1 cfs	36.10	60.87	63.37		63.38	0.000467	0.74	48.73	39.03	0.12
Main Branch 2	1.987	24.3 cfs	24.30	60.70	63.10	61.47	63.10	0.000116	0.36	67.79	58.58	0.06
Main Branch 2	1.987	36.1 cfs	36.10	60.70	63.28	61.60	63.28	0.000173	0.46	78.58	60.89	0.07
Main Branch 2	1.935	24.3 cfs	24.30	60.52	63.08	61.17	63.08	0.000057	0.21	114.04	82.04	0.03
Main Branch 2	1.935	36.1 cfs	36.10	60.52	63.26	61.29	63.26	0.000087	0.28	130.20	95.14	0.04
Main Branch 2	1.879	24.3 cfs	24.30	60.34	62.96	62.96	63.03	0.072879	2.15	11.28	78.07	1.00
Main Branch 2	1.879	36.1 cfs	36.10	60.34	63.19	63.01	63.20	0.008129	0.94	38.38	146.38	0.32
Main Branch 2	1.825	24.3 cfs	24.30	60.13	62.70	60.85	62.70	0.000055	0.26	98.23	72.50	0.04
Main Branch 2	1.825	36.1 cfs	36.10	60.13	63.14	60.96	63.14	0.000054	0.26	123.63	86.08	0.04
Main Branch 2	1.763	24.3 cfs	24.30	60.05	62.07	62.07	62.59	0.050595	5.76	4.22	4.16	1.01
Main Branch 2	1.763	36.1 cfs	36.10	60.05	62.41	62.41	63.02	0.058022	6.26	5.77	4.89	1.01
Main Branch 2	1.739	24.3 cfs	24.30	59.92	61.56	60.60	61.57	0.000508	0.59	41.43	50.49	0.11
Main Branch 2	1.739	36.1 cfs	36.10	59.92	61.81	60.72	61.82	0.000528	0.66	54.97	58.16	0.12
Main Branch 2	1.699	24.3 cfs	24.30	59.71	61.39		61.40	0.001413	0.89	27.66	29.24	0.19
Main Branch 2	1.699	36.1 cfs	36.10	59.71	61.63		61.65	0.001546	1.13	31.94	33.35	0.20
Main Branch 2	1.634	24.3 cfs	24.30	59.60	60.92	60.26	60.93	0.001357	0.83	29.35	44.56	0.18
Main Branch 2	1.634	36.1 cfs	36.10	59.60	61.19	60.37	61.20	0.001115	0.85	42.53	53.64	0.17
Main Branch 2	1.602	24.3 cfs	24.30	59.31	60.83	59.99	60.83	0.000303	0.43	56.52	74.54	0.09
Main Branch 2	1.602	36.1 cfs	36.10	59.31	61.11	59.98	61.11	0.000270	0.45	79.43	88.36	0.08
Main Branch 2	1.512	24.3 cfs	24.30	59.20	60.42	60.01	60.46	0.005378	1.56	15.56	25.53	0.35
Main Branch 2	1.512	36.1 cfs	36.10	59.20	60.79	60.14	60.81	0.002953	1.36	26.22	33.14	0.27
Main Branch 2	1.480	24.3 cfs	24.30	59.05	60.33	59.51	60.33	0.000264	0.36	67.93	106.53	0.08
Main Branch 2	1.480	36.1 cfs	36.10	59.05	60.74	59.59	60.74	0.000128	0.30	119.67	141.40	0.06
Main Branch 2	1.435	24.3 cfs	24.30	59.05	60.24	59.53	60.24	0.000508	0.47	51.36	86.56	0.11
Main Branch 2	1.435	36.1 cfs	36.10	59.05	60.70	59.62	60.71	0.000191	0.36	98.81	120.64	0.07
Main Branch 2	1.386	24.3 cfs	24.30	59.68	60.19		60.19	0.000111	0.26	93.82	124.85	0.05
Main Branch 2	1.386	36.1 cfs	36.10	59.68	60.68		60.68	0.000054	0.22	165.91	165.76	0.04
Main Branch 1	1.322	24.3 cfs	24.30	59.57	60.16	59.01	60.16	0.000065	0.20	118.57	149.40	0.04
Main Branch 1	1.322	36.1 cfs	36.10	59.57	60.67	59.08	60.67	0.000032	0.17	207.15	197.47	0.03
Main Branch 1	1.289	24.3 cfs	24.30	58.43	60.14		60.15	0.000082	0.24	100.04	116.70	0.05
Main Branch 1	1.289	36.1 cfs	36.10	58.43	60.66		60.66	0.000044	0.21	169.44	151.88	0.04
Main Branch 1	1.249	24.3 cfs	24.30	59.30	60.11		60.12	0.000243	0.43	56.01	61.75	0.09
Main Branch 1	1.249	36.1 cfs	36.10	59.30	60.64		60.65	0.000137	0.39	93.52	79.79	0.06
Main Branch 1	1.208	24.3 cfs	24.30	58.28	60.10		60.10	0.000034	0.17	148.60	158.90	0.03
Main Branch 1	1.208	36.1 cfs	36.10	58.28	60.64		60.64	0.000020	0.15	242.93	201.91	0.02
Main Branch 1	1.187	24.3 cfs	24.30	59.13	60.10		60.10	0.000036	0.18	137.01	139.37	0.03
Main Branch 1	1.187	36.1 cfs	36.10	59.13	60.63		60.63	0.000022	0.16	222.25	177.51	0.03
Main Branch 1	1.157	24.3 cfs	24.30	58.00	60.09		60.09	0.000116	0.33	73.82	70.79	0.06
Main Branch 1	1.157	36.1 cfs	36.10	58.00	60.63		60.63	0.000075	0.31	117.14	89.16	0.05
Main Branch 1	1.118	24.3 cfs	24.30	57.88	60.07		60.07	0.000034	0.18	132.29	120.59	0.03
Main Branch 1	1.118	36.1 cfs	36.10	57.88	60.62		60.62	0.000023	0.18	208.27	150.58	0.03
Main Branch 1	1.079	24.3 cfs	24.30	57.68	60.07		60.07	0.000026	0.16	137.57	115.22	0.03
Main Branch 1	1.079	36.1 cfs	36.10	57.68	60.62		60.62	0.000021	0.17	207.87	141.83	0.03
Main Branch 1	1.020	24.3 cfs	24.30	57.55	60.06		60.06	0.000008	0.10	241.16	191.87	0.02
Main Branch 1	1.020	36.1 cfs	36.10	57.55	60.61		60.61	0.000007	0.10	357.88	233.73	0.01
Main Branch 1	.982	24.3 cfs	24.30	57.47	60.06		60.06	0.000010	0.11	220.56	170.19	0.02
Main Branch 1	.982	36.1 cfs	36.10	57.47	60.61		60.61	0.000008	0.11	323.86	206.24	0.02
Main Branch 1	.957	24.3 cfs	24.30	57.31	60.06		60.06	0.000064	0.27	90.57	66.91	0.04
Main Branch 1	.957	36.1 cfs	36.10	57.31	60.61		60.61	0.000045	0.26	130.39	79.08	0.04
Main Branch 1	.906	24.3 cfs	24.30	57.05	60.05		60.05	0.000011	0.13	186.40	125.46	0.02

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (fps)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Main Branch 1	.806	36.1cfs	36.10	57.05	60.60		60.60	0.000010	0.14	263.72	148.43	0.02
Main Branch 1	.829	24.3cfs	24.30	56.96	60.05		60.05	0.000006	0.09	258.59	167.34	0.01
Main Branch 1	.829	36.1cfs	36.10	56.96	60.60		60.60	0.000005	0.10	359.86	197.14	0.01
Main Branch 1	.802	24.3cfs	24.30	56.84	59.35	59.35	59.98	0.083113	6.41	3.79	3.03	1.01
Main Branch 1	.802	36.1cfs	36.10	56.84	59.77	59.77	60.52	0.079220	6.95	5.19	3.54	1.01
Main Branch 1	.785	24.3cfs	24.30	56.70	58.59	57.63	58.81	0.001115	0.95	25.56	26.99	0.17
Main Branch 1	.785	36.1cfs	36.10	56.70	58.86	57.79	58.86	0.001216	1.08	33.30	30.81	0.18
Main Branch 1	.722	24.3cfs	24.30	56.62	58.38		58.39	0.000834	0.78	31.87	38.21	0.14
Main Branch 1	.722	36.1cfs	36.10	56.62	58.63		58.64	0.000907	0.87	41.54	41.34	0.15
Main Branch 1	.696	24.3cfs	24.30	56.57	58.01		58.11	0.011947	2.94	9.55	13.23	0.53
Main Branch 1	.696	36.1cfs	36.10	56.57	58.20		58.34	0.013757	2.86	12.19	14.94	0.58
Main Branch 1	.685	24.3cfs	24.30	56.23	57.84		57.85	0.001519	0.95	25.45	33.96	0.19
Main Branch 1	.685	36.1cfs	36.10	56.23	58.01		58.03	0.001789	1.16	31.16	34.73	0.22
Main Branch 1	.600	24.3cfs	24.30	56.18	56.95		56.98	0.002600	0.83	30.15	80.36	0.24
Main Branch 1	.600	36.1cfs	36.10	56.18	57.09		57.11	0.002382	0.86	43.15	96.20	0.22
Main Branch 1	.566	24.3cfs	24.30	56.00	56.77		56.78	0.000525	0.47	53.15	93.11	0.11
Main Branch 1	.566	36.1cfs	36.10	56.00	56.93		56.93	0.000534	0.56	67.64	95.27	0.11
Main Branch 1	.515	24.3cfs	24.30	55.85	56.69		56.69	0.000191	0.33	74.26	104.30	0.07
Main Branch 1	.515	36.1cfs	36.10	55.85	56.83		56.84	0.000233	0.41	89.09	105.21	0.08
Main Branch 1	.467	24.3cfs	24.30	55.05	56.57	56.22	56.60	0.001976	0.85	28.72	55.89	0.21
Main Branch 1	.467	36.1cfs	36.10	55.85	56.68	56.28	56.70	0.002272	1.03	35.20	56.97	0.23
Main Branch 1	.3220	24.3cfs	24.30	51.70	53.14		53.21	0.017385	2.02	12.01	29.81	0.56
Main Branch 1	.3220	36.1cfs	36.10	51.70	53.39		53.42	0.010809	1.62	22.32	56.67	0.45
Main Branch 1	.1894	24.3cfs	24.30	51.40	52.97		52.97	0.000066	0.25	96.87	111.89	0.05
Main Branch 1	.1894	36.1cfs	36.10	51.40	53.19		53.20	0.000091	0.30	121.64	112.96	0.05
Main Branch 1	.0189	24.3cfs	24.30	51.40	52.40	52.40	52.66	0.048813	4.07	5.97	11.95	1.01
Main Branch 1	.0189	36.1cfs	36.10	51.40	52.58	52.58	52.87	0.045009	4.37	8.26	14.05	1.01
Main Branch 1	.0142	24.3cfs	24.30	47.00	47.96	47.16	47.96	0.000151	0.32	76.57	94.20	0.06
Main Branch 1	.0142	36.1cfs	36.10	47.00	48.18	47.21	48.18	0.000162	0.37	97.50	100.72	0.07
Main Branch 1	.014	24.3cfs	24.30	45.80	46.21	46.21	46.32	0.064774	2.85	9.16	44.30	1.02
Main Branch 1	.014	36.1cfs	36.10	45.80	46.28	46.28	46.41	0.057185	2.92	12.34	46.73	1.00
Main Branch 1	.0137	24.3cfs	24.30	39.00	41.46	39.26	41.46	0.000011	0.14	168.84	93.29	0.02
Main Branch 1	.0137	36.1cfs	36.10	39.00	41.46	39.33	41.46	0.000023	0.21	169.47	93.40	0.03
Main Branch 1	.0133	24.3cfs	24.30	37.00	41.45		41.45	0.000001	0.05	477.90	134.77	0.00
Main Branch 1	.0133	36.1cfs	36.10	37.00	41.45		41.45	0.000001	0.08	477.95	134.78	0.01
Main Branch 1	.013	24.3cfs	24.30	29.40	41.45	30.62	41.45	0.000000	0.04	675.37	114.48	0.00
Main Branch 1	.013	36.1cfs	36.10	29.40	41.45	30.83	41.45	0.000000	0.05	675.37	114.48	0.00
Main Branch 1	.012	24.3cfs	24.30	29.70	41.45	30.37	41.45	0.000000	0.00	21186.63	1064.00	0.00
Main Branch 1	.012	36.1cfs	36.10	29.70	41.45	30.48	41.45	0.000000	0.00	21186.79	1064.00	0.00
Main Branch 1	.011	24.3cfs	24.30	24.40	41.45		41.45	0.000000	0.01	1905.16	184.00	0.00
Main Branch 1	.011	36.1cfs	36.10	24.40	41.45		41.45	0.000000	0.02	1905.16	184.00	0.00
Main Branch 1	.0109	24.3cfs	24.30	25.29	41.45	26.06	41.45	0.000000	0.01	3465.05	395.75	0.00
Main Branch 1	.0109	36.1cfs	36.10	25.29	41.45	26.22	41.45	0.000000	0.01	3465.05	395.75	0.00

PEAK FLOW COMPARISON from WWTP to Reasons Farms +90.1cfs (HEC-RAS OUTPUT):

HEC-RAS Plan: PGC Existing

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Channel 4	5.039	100-yr (Exist) M	6798.00	72.56	91.85	81.56	91.98	4.03
Main Channel 4	5.039	100-yr ex +90	6798.00	72.56	91.85	81.56	91.98	4.03
Main Channel 4	5.033		Culvert					
Main Channel 4	5.020	100-yr (Exist) M	6798.00	72.48	91.32	81.10	91.42	3.59
Main Channel 4	5.020	100-yr ex +90	6798.00	72.48	91.32	81.10	91.42	3.59
Main Channel 4	4.974	100-yr (Exist) M	6798.00	72.35	91.21	84.49	91.31	2.58
Main Channel 4	4.974	100-yr ex +90	6798.00	72.35	91.21	84.49	91.32	2.58
Main Channel 4	4.853	100-yr (Exist) M	6798.00	72.00	90.60	83.31	90.74	2.98
Main Channel 4	4.853	100-yr ex +90	6798.00	72.00	90.61	83.31	90.75	2.98
Main Channel 4	4.742	100-yr (Exist) M	6798.00	71.69	89.90	84.00	90.02	2.85
Main Channel 4	4.742	100-yr ex +90	6798.00	71.69	89.90	84.00	90.03	2.84
Main Channel 4	4.642	100-yr (Exist) M	6798.00	71.33	89.50	80.64	89.62	2.84
Main Channel 4	4.642	100-yr ex +90	6798.00	71.33	89.50	80.64	89.63	2.84
Main Channel 4	4.6		Bridge					
Main Channel 4	4.528	100-yr (Exist) M	6798.00	72.00	88.37	82.41	88.65	4.23
Main Channel 4	4.528	100-yr ex +90	6798.00	72.00	88.38	82.41	88.66	4.23
Main Channel 4	4.409	100-yr (Exist) M	6798.00	71.95	87.63	81.03	87.78	3.05
Main Channel 4	4.409	100-yr ex +90	6798.00	71.95	87.64	81.03	87.79	3.05
Main Channel 3	4.314	100-yr (Exist) M	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.314	100-yr ex +90	8173.00	70.65	87.52		87.59	2.10
Main Channel 3	4.279	100-yr (Exist) M	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.279	100-yr ex +90	8173.00	70.11	87.20		87.49	5.20
Main Channel 3	4.164	100-yr (Exist) M	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.164	100-yr ex +90	8173.00	69.04	86.67	81.37	86.86	3.55
Main Channel 3	4.018	100-yr (Exist) M	8173.00	68.00	85.95	79.77	86.12	3.31
Main Channel 3	4.018	100-yr ex +90	8173.00	68.00	85.97	79.77	86.14	3.30
Main Channel 3	3.878	100-yr (Exist) M	8173.00	67.32	85.40	78.55	85.54	3.05
Main Channel 3	3.878	100-yr ex +90	8173.00	67.32	85.43	78.55	85.57	3.03
Main Channel 3	3.800		Bridge					
Main Channel 3	3.782	100-yr (Exist) M	8173.00	67.00	84.92		85.07	3.19
Main Channel 3	3.782	100-yr ex +90	8173.00	67.00	84.96		85.11	3.17
Main Channel 3	3.648	100-yr (Exist) M	8173.00	66.15	84.42	78.49	84.59	3.46
Main Channel 3	3.648	100-yr ex +90	8173.00	66.15	84.47	78.49	84.64	3.43
Main Channel 3	3.532	100-yr (Exist) M	8173.00	65.82	84.16	77.19	84.24	2.49
Main Channel 3	3.532	100-yr ex +90	8173.00	65.82	84.22	77.19	84.30	2.47
Main Channel 3	3.457	100-yr (Exist) M	8173.00	65.80	83.24	77.42	83.86	6.44
Main Channel 3	3.457	100-yr ex +90	8173.00	65.80	83.33	77.42	83.93	6.33

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Channel 3	3.455		Bridge					
Main Channel 3	3.451	100-yr (Exist) M	B159.00	85.80	82.80	77.41	83.39	7.11
Main Channel 3	3.451	100-yr ex +90	B249.10	85.80	82.64	77.47	83.43	7.16
Main Branch 2	3.356	100-yr (Exist) M	B159.00	85.30	82.52	75.56	82.63	3.35
Main Branch 2	3.356	100-yr ex +90	B249.10	85.30	82.55	75.63	82.67	3.37
Main Branch 2	3.270	100-yr (Exist) M	B159.00	84.65	82.31	77.80	82.40	3.51
Main Branch 2	3.270	100-yr ex +90	B249.10	84.65	82.34	77.81	82.43	3.52
Main Branch 2	3.132	100-yr (Exist) M	B159.00	84.35	81.93		82.03	3.41
Main Branch 2	3.132	100-yr ex +90	B249.10	84.35	81.97		82.07	3.43
Main Branch 2	3.041	100-yr (Exist) M	B159.00	83.99	81.77		81.81	1.70
Main Branch 2	3.041	100-yr ex +90	B249.10	83.99	81.80		81.86	1.71
Main Branch 2	2.932	100-yr (Exist) M	B159.00	83.76	81.51		81.58	2.13
Main Branch 2	2.932	100-yr ex +90	B249.10	83.76	81.54		81.61	2.14
Main Branch 2	2.863	100-yr (Exist) M	B159.00	83.50	81.37		81.45	2.42
Main Branch 2	2.863	100-yr ex +90	B249.10	83.50	81.40		81.48	2.43
Main Branch 2	2.782	100-yr (Exist) M	B159.00	83.30	81.27		81.34	2.28
Main Branch 2	2.782	100-yr ex +90	B249.10	83.30	81.30		81.37	2.29
Main Branch 2	2.723	100-yr (Exist) M	B159.00	82.89	81.11		81.22	3.08
Main Branch 2	2.723	100-yr ex +90	B249.10	82.89	81.14		81.25	3.08
Main Branch 2	2.598	100-yr (Exist) M	B159.00	82.62	80.56		80.71	3.46
Main Branch 2	2.598	100-yr ex +90	B249.10	82.62	80.59		80.74	3.46
Main Branch 2	2.517	100-yr (Exist) M	B159.00	82.39	80.26		80.36	2.64
Main Branch 2	2.517	100-yr ex +90	B249.10	82.39	80.29		80.38	2.65
Main Branch 2	2.448	100-yr (Exist) M	B159.00	82.23	80.00		80.12	3.02
Main Branch 2	2.448	100-yr ex +90	B249.10	82.23	80.03		80.15	3.03
Main Branch 2	2.398	100-yr (Exist) M	B159.00	81.72	79.68		79.87	4.43
Main Branch 2	2.398	100-yr ex +90	B249.10	81.72	79.71		79.90	4.41
Main Branch 2	2.244	100-yr (Exist) M	B159.00	81.59	78.59	73.87	78.76	4.41
Main Branch 2	2.244	100-yr ex +90	B249.10	81.59	78.65	73.92	78.81	4.35
Main Branch 2	2.205	100-yr (Exist) M	B159.00	81.47	76.52	73.16	78.09	10.13
Main Branch 2	2.205	100-yr ex +90	B249.10	81.47	76.59	73.22	78.15	10.13
Main Branch 2	2.167	100-yr (Exist) M	B159.00	81.28	76.01	71.08	76.91	7.61
Main Branch 2	2.167	100-yr ex +90	B249.10	81.28	76.07	71.14	76.98	7.65
Main Branch 2	2.111	100-yr (Exist) M	B159.00	81.08	74.87		75.69	8.10
Main Branch 2	2.111	100-yr ex +90	B249.10	81.08	74.72		75.75	8.15
Main Branch 2	2.051	100-yr (Exist) M	B159.00	80.87	73.61		74.33	6.78
Main Branch 2	2.051	100-yr ex +90	B249.10	80.87	73.65		74.37	6.83

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 2	1.987	100-yr (Exist) M	8159.00	60.70	73.55	68.46	73.66	2.68
Main Branch 2	1.987	100-yr ex +90	8249.10	60.70	73.59	68.49	73.71	2.69
Main Branch 2	1.935	100-yr (Exist) M	8159.00	60.52	73.40	66.93	73.49	2.39
Main Branch 2	1.935	100-yr ex +90	8249.10	60.52	73.44	66.96	73.53	2.40
Main Branch 2	1.879	100-yr (Exist) M	8159.00	60.34	73.27	66.54	73.36	2.31
Main Branch 2	1.879	100-yr ex +90	8249.10	60.34	73.31	66.56	73.40	2.32
Main Branch 2	1.825	100-yr (Exist) M	8159.00	60.13	72.83	67.39	73.15	4.55
Main Branch 2	1.825	100-yr ex +90	8249.10	60.13	72.86	67.42	73.19	4.58
Main Branch 2	1.783	100-yr (Exist) M	8159.00	60.05	72.59		72.74	3.16
Main Branch 2	1.783	100-yr ex +90	8249.10	60.05	72.62		72.78	3.18
Main Branch 2	1.738	100-yr (Exist) M	8159.00	59.92	72.50		72.64	3.03
Main Branch 2	1.738	100-yr ex +90	8249.10	59.92	72.53		72.68	3.05
Main Branch 2	1.699	100-yr (Exist) M	8159.00	59.71	72.25		72.46	3.71
Main Branch 2	1.699	100-yr ex +90	8249.10	59.71	72.28		72.49	3.73
Main Branch 2	1.634	100-yr (Exist) M	8159.00	59.60	71.68	66.46	71.98	4.38
Main Branch 2	1.634	100-yr ex +90	8249.10	59.60	71.71	66.50	72.01	4.42
Main Branch 2	1.602	100-yr (Exist) M	8159.00	59.31	71.63	66.17	71.78	3.10
Main Branch 2	1.602	100-yr ex +90	8249.10	59.31	71.65	66.19	71.80	3.13
Main Branch 2	1.512	100-yr (Exist) M	8159.00	59.20	71.29	66.43	71.44	3.14
Main Branch 2	1.512	100-yr ex +90	8249.10	59.20	71.30	66.45	71.46	3.17
Main Branch 2	1.480	100-yr (Exist) M	8159.00	59.05	71.25	63.75	71.34	2.37
Main Branch 2	1.480	100-yr ex +90	8249.10	59.05	71.27	63.78	71.35	2.39
Main Branch 2	1.435	100-yr (Exist) M	8159.00	59.05	71.20	63.85	71.26	2.05
Main Branch 2	1.435	100-yr ex +90	8249.10	59.05	71.21	63.87	71.28	2.07
Main Branch 2	1.388	100-yr (Exist) M	8159.00	58.88	71.00		71.16	3.17
Main Branch 2	1.388	100-yr ex +90	8249.10	58.88	71.01		71.17	3.20
Main Branch 1	1.322	100-yr (Exist) M	8797.00	58.57	70.89	63.29	70.98	2.59
Main Branch 1	1.322	100-yr ex +90	8826.40	58.57	70.90	63.30	71.00	2.60
Main Branch 1	1.289	100-yr (Exist) M	8797.00	58.43	70.77		70.91	3.00
Main Branch 1	1.289	100-yr ex +90	8826.40	58.43	70.78		70.92	3.01
Main Branch 1	1.248	100-yr (Exist) M	8797.00	58.30	70.60		70.77	3.35
Main Branch 1	1.248	100-yr ex +90	8826.40	58.30	70.61		70.78	3.36
Main Branch 1	1.208	100-yr (Exist) M	8797.00	58.23	70.47		70.62	3.15
Main Branch 1	1.208	100-yr ex +90	8826.40	58.23	70.48		70.63	3.15
Main Branch 1	1.167	100-yr (Exist) M	8797.00	58.13	70.37		70.55	3.40
Main Branch 1	1.167	100-yr ex +90	8826.40	58.13	70.38		70.56	3.41
Main Branch 1	1.157	100-yr (Exist) M	8797.00	58.00	70.27		70.44	3.38

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 1	1.157	100-yr ex +90	8826.40	58.00	70.28		70.45	3.38
Main Branch 1	1.116	100-yr (Exist) M	8797.00	57.88	70.00		70.24	4.02
Main Branch 1	1.116	100-yr ex +90	8826.40	57.88	70.01		70.25	4.03
Main Branch 1	1.079	100-yr (Exist) M	8797.00	57.68	69.91		70.06	3.10
Main Branch 1	1.079	100-yr ex +90	8826.40	57.68	69.92		70.07	3.10
Main Branch 1	1.020	100-yr (Exist) M	8797.00	57.55	69.73		69.87	3.03
Main Branch 1	1.020	100-yr ex +90	8826.40	57.55	69.74		69.88	3.03
Main Branch 1	.982	100-yr (Exist) M	8797.00	57.47	69.63		69.76	2.96
Main Branch 1	.982	100-yr ex +90	8826.40	57.47	69.63		69.77	2.97
Main Branch 1	.957	100-yr (Exist) M	8797.00	57.31	69.53		69.68	3.30
Main Branch 1	.957	100-yr ex +90	8826.40	57.31	69.53		69.68	3.31
Main Branch 1	.906	100-yr (Exist) M	8797.00	57.05	69.18		69.42	3.97
Main Branch 1	.906	100-yr ex +90	8826.40	57.05	69.19		69.42	3.98
Main Branch 1	.829	100-yr (Exist) M	8797.00	56.96	68.99		69.09	2.75
Main Branch 1	.829	100-yr ex +90	8826.40	56.96	69.00		69.10	2.75
Main Branch 1	.802	100-yr (Exist) M	8797.00	56.84	68.34		68.88	6.26
Main Branch 1	.802	100-yr ex +90	8826.40	56.84	68.35		68.88	6.24
Main Branch 1	.765	100-yr (Exist) M	8797.00	56.70	68.09		68.33	4.08
Main Branch 1	.765	100-yr ex +90	8826.40	56.70	68.10		68.34	4.08
Main Branch 1	.722	100-yr (Exist) M	8797.00	56.62	67.83		68.02	3.71
Main Branch 1	.722	100-yr ex +90	8826.40	56.62	67.84		68.03	3.72
Main Branch 1	.698	100-yr (Exist) M	8797.00	56.57	67.72		67.84	3.01
Main Branch 1	.698	100-yr ex +90	8826.40	56.57	67.73		67.85	3.02
Main Branch 1	.685	100-yr (Exist) M	8797.00	56.23	67.67		67.75	2.67
Main Branch 1	.685	100-yr ex +90	8826.40	56.23	67.68		67.76	2.67
Main Branch 1	.600	100-yr (Exist) M	8797.00	56.18	67.42		67.48	2.27
Main Branch 1	.600	100-yr ex +90	8826.40	56.18	67.43		67.49	2.27
Main Branch 1	.566	100-yr (Exist) M	8797.00	56.00	67.01		67.32	5.02
Main Branch 1	.566	100-yr ex +90	8826.40	56.00	67.02		67.33	5.03
Main Branch 1	.515	100-yr (Exist) M	8797.00	55.85	66.79		66.95	3.85
Main Branch 1	.515	100-yr ex +90	8826.40	55.85	66.80		66.96	3.85
Main Branch 1	.467	100-yr (Exist) M	8797.00	55.85	66.16		66.55	5.69
Main Branch 1	.467	100-yr ex +90	8826.40	55.85	66.17		66.56	5.69
Main Branch 1	3220	100-yr (Exist) M	8797.00	51.70	64.31		64.57	4.37
Main Branch 1	3220	100-yr ex +90	8826.40	51.70	64.33		64.58	4.37
Main Branch 1	1894	100-yr (Exist) M	8797.00	51.40	63.05		63.28	3.84
Main Branch 1	1894	100-yr ex +90	8826.40	51.40	63.06		63.29	3.84

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 1	.0189	100-yr (Exist) M	8797.00	51.40	59.70		60.44	8.29
Main Branch 1	.0189	100-yr ex +90	8826.40	51.40	59.71		60.44	8.30
Main Branch 1	.0142	100-yr (Exist) M	8797.00	47.00	58.56		58.60	2.00
Main Branch 1	.0142	100-yr ex +90	8826.40	47.00	58.57		58.62	2.00
Main Branch 1	.014	100-yr (Exist) M	8797.00	46.80	56.58	51.99	58.39	7.19
Main Branch 1	.014	100-yr ex +90	8826.40	46.80	56.60	52.00	58.41	7.20
Main Branch 1	.0137	100-yr (Exist) M	8797.00	39.00	48.40		49.16	7.02
Main Branch 1	.0137	100-yr ex +90	8826.40	39.00	48.40		49.17	7.03
Main Branch 1	.0133	100-yr (Exist) M	8797.00	37.00	47.67		47.68	1.32
Main Branch 1	.0133	100-yr ex +90	8826.40	37.00	47.67		47.69	1.32
Main Branch 1	.013	100-yr (Exist) M	8797.00	29.40	47.59	41.18	47.60	0.96
Main Branch 1	.013	100-yr ex +90	8826.40	29.40	47.60	41.21	47.60	0.96
Main Branch 1	.012	100-yr (Exist) M	8797.00	29.70	47.59	36.73	47.59	0.13
Main Branch 1	.012	100-yr ex +90	8826.40	29.70	47.59	36.74	47.59	0.13
Main Branch 1	.011	100-yr (Exist) M	8797.00	24.40	47.40		47.55	3.47
Main Branch 1	.011	100-yr ex +90	8826.40	24.40	47.40		47.56	3.48
Main Branch 1	.0109	100-yr (Exist) M	8797.00	25.29	47.47	34.51	47.49	1.50
Main Branch 1	.0108	100-yr ex +90	8826.40	25.29	47.47	34.52	47.49	1.50

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