

## **APPENDIX N**

*Evaluation of Luffenholtz Creek  
Diversion Capacity – Trinidad  
Water System & Proposed Moss  
Minor Subdivision Project  
(LACO, 2009)*

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**Subject: Evaluation of Luffenholtz Creek Diversion Capacity – Trinidad Water System & Proposed Moss Minor Subdivision Project**

Dear Mr. Wheeler:

This letter report presents an evaluation of the potential impacts of the Moss Minor Subdivision project (Project) to Luffenholtz Creek and its downstream water users – particularly the City of Trinidad. Included herein are findings based on our review of the following:

- City of Trinidad’s historic diversion from Luffenholtz Creek from 1997 to 2008;
- Evaluation of Supply and Demand of Trinidad Water System letter report prepared by Winzler and Kelly Consulting Engineers issued January 24, 1995;
- A letter from the City of Trinidad Public Works Director Bryan Buckman, received June 4<sup>th</sup>, 2009;
- City of Trinidad General Plan, Housing Element dated May, 1997
- Water system production and metered delivery records provided by the City of Trinidad Public Works Department from 1997 to 2008
- Brown & Caldwell/SHN Consulting Engineers & Geologists, Inc., *Martin Slough Interceptor Project – Basis of Design Report and Ten Percent Design. March, 2004.*

Findings in this report are based on water system production and distribution data recorded from January 1997 through December 2008; as well as an estimation of the additional creek diversion needed to supply the proposed Moss Minor Subdivision parcels. The results of this analysis will be used to assess the impacts of the Project to the City of Trinidad’s continued capability to divert sufficient water from Luffenholtz Creek to meet system demands.

The Project – Moss Minor Subdivision

The proposed project is located in Humboldt County, approximately one mile east of the City of Trinidad, on both sides of Fox Farm Road, approximately 0.91 mile northeast from the intersection of Fox Farm Road with North Westhaven Drive, on the properties known as 900, 1180, 1190 and 1199 Fox Farm Road. The project applicant proposes to divide an approximately 94 acre parcel into four parcels ranging from 20.11 acres to 32.11 acres with the expectation that the lots will subsequently be developed in conformance with the County General Plan and Zoning Ordinance. The General Plan land use designation for the site, as shown in the North Humboldt General Plan (NHGP) is split with the southerly approximately 20 acres of the site designated as TIMBER; RECREATION and the northerly approximately 74 acres designated as DISPERSED HOUSES; TIMBER.

The site is within the Exclusive Agriculture (AE) Zone which permits a maximum of one residential unit per parcel. Three of these proposed parcels are adjacent to Luffenholtz Creek and would obtain water from a diversion prior to the City of Trinidad's raw water intake structure; the fourth proposed parcel is adjacent to Dead Man Creek – a separate drainage which does not impact flows in Luffenholtz Creek and is not included in the scope of this study.

Project water demand was estimated based on the demand per service connection established for the City of Trinidad – 327 gallons per day (see City of Trinidad Water Use, below). The Project consists of up to three additional residential homes obtaining water from Luffenholtz Creek, resulting in an average day demand of 981 gallons per day (0.3 percent of the dry-weather available creek flow); and a maximum day demand of 1,570 gallons per day (0.5 percent of the dry-weather available creek flow). The estimated annual diversion is 358,065 gallons per year.

#### City of Trinidad System Description

The City of Trinidad's water system currently consists of a 180 gallon per minute (259,200 gallons per day) capacity surface water treatment plant. Raw surface water is collected from Luffenholtz Creek and treated by direct filtration and chlorination. The distribution system consists of approximately 13 miles of predominantly asbestos-cement piping and includes two 150,000 gallon redwood storage tanks. The system serves 315 metered connections and 5 unmetered connections. As stated in the attached letter from the City of Trinidad Director of Public Works Bryan Buckman, current system improvement activity includes system-wide leak detection which has already identified and repaired a significant leakage estimated at 20 gallons per minute (28,800 gallons per day) in October of 2008.

#### City of Trinidad Supply

LACO Associates (LACO) accepts the assessment of the available water diversion from Luffenholtz Creek as presented in the attached 1995 Winzler and Kelly letter report. This letter report establishes a baseline minimum available creek flow rate of 220 gallons per minute from Luffenholtz Creek identified in the excerpt of the report, below:

*“...Two previous studies of Luffenholtz Creek flows were researched in the development of this report: the Trinidad water supply feasibility study performed in 1968-69 by Winzler & Kelly and the 1980 report by the Citizen's Committee on Water. The 1968-69 report measured flows of 480 gallons per minute in Luffenholtz Creek and predicted 100 year return low flows of 290 gallons per minute. The 1980 study increased the 100 year return low flow to 300 gallons per minute and presented flow rate measurements of 310 gallons per minute that were made in Luffenholtz Creek in 1977, a year widely recognized as one of the driest in California history.*

*After comparing the 1994 stream flow measurements with those reported in previous studies, it was concluded that 290 gallons per minute is the best value for predicting low flow in Luffenholtz Creek.*

*California Department of Fish and Game minimum allowable fish flows in Luffenholtz Creek were documented in the 1980 Citizen's Committee report as 112 gallons per minute for normal years and 67 gallons per minute for dry years. Water appropriation rights below the Trinidad water plant were also documented in the report as totaling less than 3 gallons per minute. Combining these values with the established dry year flow of 290 gallons per minute leaves 220 gallons per minute available for the City to use in dry years (if the lower fish flow value is implemented).*

*-Winzler & Kelly, 1995*

In summary, a minimum creek flowrate of 67 gallons per minute is required to maintain fish habitat in the creek in "dry" years, and 112 gallons per minute in "normal" years. The 100-year return low creek flow has been established at 290 gallons per minute.

For the purpose of this evaluation, LACO Associates establishes the Available Creek Flow (ACF) as the 100-year return low flow of 290 gallons per minute, less the normal-year fish passage flow of 112 gallons per minute and the 3 gallon per minute water appropriation below the City of Trinidad. This results in an ACF of 175 gallons per minute (252,000 gallons per day; 91,980,000 gallons per year) – the most conservative estimate of water available to Trinidad based on existing Luffenholtz Creek flow data.

#### City of Trinidad Water Use

The California Code of Regulations Title 22, Chapter 16 CALIFORNIA WATERWORKS STANDARDS (hereinafter referred to as the Waterworks Standards), Article 2 *Permit Requirements*, Section 64554 New and Existing Source Capacity requires that at all times a public water system's water source(s) shall have the capacity to meet the system's maximum day demand (MDD). Trinidad, having a treatment capacity of 180 gallons per minute, is therefore assumed to have a supply capacity of 259,200 gallons per day.

Water use records over the study period (1997 to 2009) were analyzed to determine a peaking factor and maximum day demand. Peak day usage was calculated in accordance with the methods prescribed in the Waterworks Standards for extrapolating maximum daily demand from monthly total water delivery records.

Over the study period, the maximum monthly metered water demand was 3,243,000 gallons in July, 2006 (note that the maximum month did not occur in the maximum year). This gives an average daily demand during the maximum month of 104,613 gallons per day; 40 percent of the treatment plant capacity and 42 percent of the volume available for diversion from Luffenholtz Creek. The system served a total of 320 service connections in 2006 according to system records. Dividing the total volume of metered deliveries by the total number of service connections yields an average daily demand (ADD) of 327 gallons per day per service. *Water-Resources Engineering, 3<sup>rd</sup> Ed.* (Linsley, R., and Franzini J.; McGraw-Hill, 1979) and *Wastewater Engineering: Treatment Disposal Reuse, 2<sup>nd</sup> Ed.* (Metcalf & Eddy, Inc.; McGraw-Hill, 1979) put the average daily per-capita water use at 160 and 166 gallons per day, respectively. The City of Trinidad average household size is 1.85 persons per household (U.S. Census Bureau, Census 2000 Demographic Profile). This puts the average daily demand per service at 307 gallons per day. Other local water purveyors, Humboldt

Community Services District and the City of Eureka have determined their average day demand per service connection (residential) at 256 gallons per day and 243 gallons per day, respectively (Brown & Caldwell/SHN Consulting Engineers & Geologists, Inc., *Martin Slough Interceptor Project – Basis of Design Report and Ten Percent Design*. March, 2004). Given that the calculated value of 327 gallons per day based on Trinidad’s system records is the most conservative, 327 gallons per day will be used as the City of Trinidad’s ADD per service connection.

In order to estimate maximum daily demand (MDD), the Waterworks Standards require multiplying the ADD by a peaking factor of at least 1.5. Peaking factors typically vary system to system – therefore LACO assessed the peaking factor using the following methods:

1. Calculated Peaking Factor

Based on Trinidad’s water system records from 1997 to 2008, a peaking factor of 1.6 was calculated by dividing the average monthly demand over the entire period by the maximum monthly demand observed over the same period (3,243,000 gallons).

2. Correspondence with the City of Trinidad

The City of Trinidad letter of June 4, 2009 provided a value for average day demand of approximately 90,000 gallons per day, and value for maximum day demand of approximately 160,000 gallons per day. This equates to a peaking factor of 1.8.

3. Literature Review

*Water-Resources Engineering*, 3<sup>rd</sup> Ed. (Linsley, R., and Franzini J.; McGraw-Hill, 1979) and *Wastewater Engineering: Treatment Disposal Reuse*, 2<sup>nd</sup> Ed. (Metcalf & Eddy, Inc.; McGraw-Hill, 1979) both site typical maximum day demand peaking factors for water consumption at 1.8.

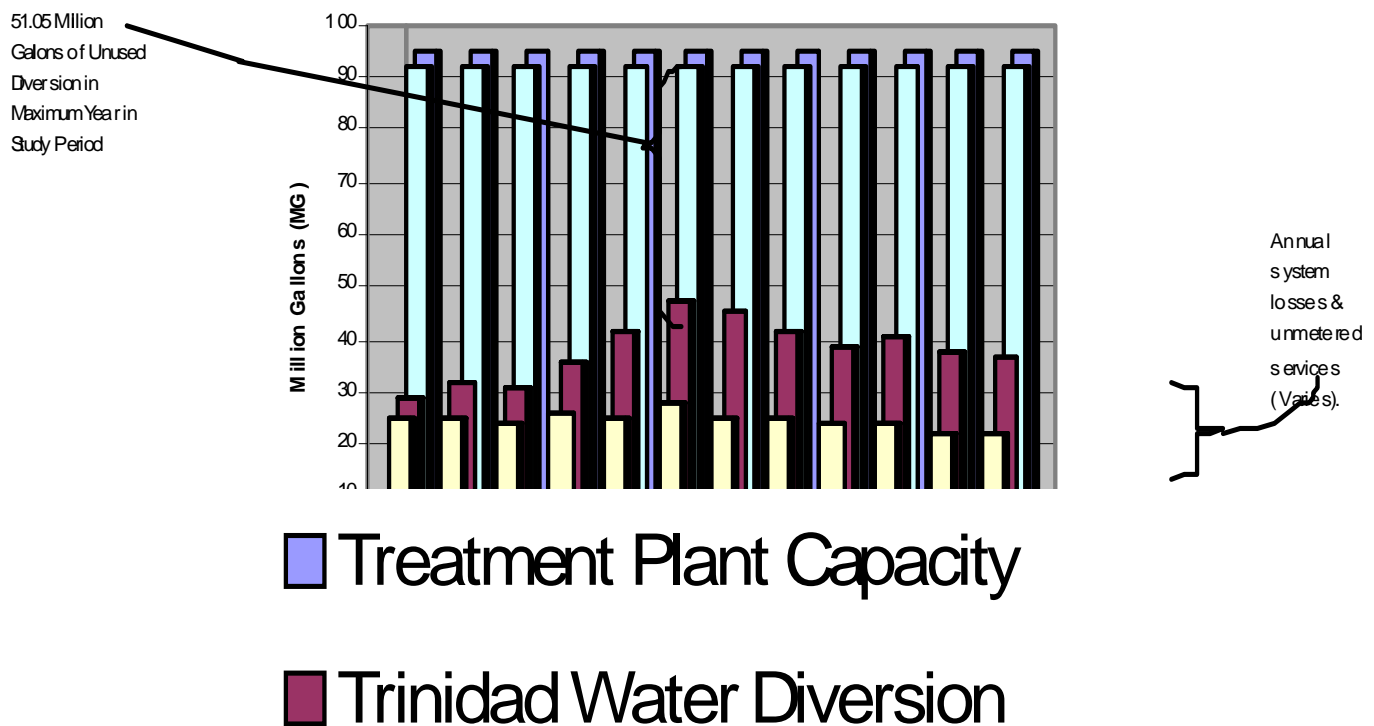
The agreement between the City of Trinidad’s estimate and published literature suggests that a maximum day peaking factor of 1.8 is appropriate for estimating the MDD for the purpose of this investigation.

Applying this peaking factor to the ADD yields a MDD of 589 gallons per day per service connection and a system-wide demand of 188,352 gallons per day under the maximum day condition. Maximum day conditions equate to 75 percent of the total available diversion from Luffenholtz Creek and 72 percent of the treatment plant’s capacity - meeting California Title 22 source capacity requirements. Capacity to meet peak hour demand (PHD) is provided by the two 150,000 gallon redwood storage tanks. The Waterworks Standards require that systems have sufficient capacity from water sources and/or storage reservoirs to meet four hours of peak demand – estimating peak hour demand conservatively as 2.0 times the MDD gives an instantaneous flow rate of 262 gallons per minute (system-wide) or a four-hour volume of approximately 63,000 gallons. Accounting for the source water contribution of 180 gpm from the treatment plant, the estimated volume of storage needed to meet PHD is approximately 20,000 gallons.

Figure 1 shows the City of Trinidad’s annual water diversion and metered deliveries as compared to the City’s treatment plant capacity and the ACF. Note that the difference

between the City's annual water diversion and metered deliveries is attributed to system leakage and also includes a total of five un-metered connections. The City is currently implementing a leak identification and repair program which aims to reduce the total diversion bringing it more in-line with actual system usage. City of Trinidad Director of Public Works indicated that in October of 2008, a 28,800 gallon per day leak was identified and repaired, equivalent to saving 28 percent of the City's average daily demand during the maximum month in the study period and reducing the City's creek diversion by 11 percent of the available creek flow.

**FIGURE 1**  
**Total Annual Water Production and Deliveries; Plant Capacity and Available Diversion**  
**1997 - 2008**



Luffenholtz Creek Supply Capacity

The ACF from Luffenholtz creek (dry weather conditions, normal-year fish flow) has been established at 175 gallons per minute, or 91,980,000 gallons per year for the purpose of this assessment. Table 1 shows the proportion of flow diverted to the City of Trinidad over the period of study (including the 3 gallon per minute appropriation rights downstream of Trinidad referenced in the 1995 Winzler and Kelly report) as compared to the ACF to establish a total annual diversion pre-project:

**Table 1: Percentage of Total Available Flow Diverted From Luffenholtz Creek (Pre-Project).**

Year	Total Available Diversion* (Gallons/Year)	City of Trinidad Total Diversion (Gallons/Year)	3 GALLONS PER MINUTE Water Appropriation	Total Annual Diversion (Percent)

			<b>Below Trinidad (Gallons/Year)</b>	
1997	91,980,000	28,943,000	1,576,800	33.2%
1998	91,980,000	31,468,000	1,576,800	35.9%
1999	91,980,000	30,925,000	1,576,800	35.3%
2000	91,980,000	35,952,000	1,576,800	40.8%
2001	91,980,000	40,973,000	1,576,800	46.3%
2002	91,980,000	46,933,000	1,576,800	52.7%
2003	91,980,000	45,079,000	1,576,800	50.7%
2004	91,980,000	41,804,000	1,576,800	47.2%
2005	91,980,000	38,147,000	1,576,800	43.2%
2006	91,980,000	40,555,000	1,576,800	45.8%
2007	91,980,000	37,346,000	1,576,800	42.3%
2008	91,980,000	36,806,000	1,576,800	41.7%

\* "Available Diversion" is the ACF of 175 gallons per minute.

As demonstrated in Table 1, the City of Trinidad's three-hundred-plus service connections utilized no more than 53 percent of the water available in Luffenholtz Creek over the period of study. Figure 2 provides a graphical representation of the City of Trinidad's total annual diversion and the maximum day demand (based on the average daily diversion over the year multiplied by the peaking factor of 1.8) as a percentage of the available dry weather flow from Luffenholtz Creek.

**FIGURE 2**  
**Annual and Calculated Maximum Day Diversion From Luffenholtz Creek**  
**1997 - 2008**

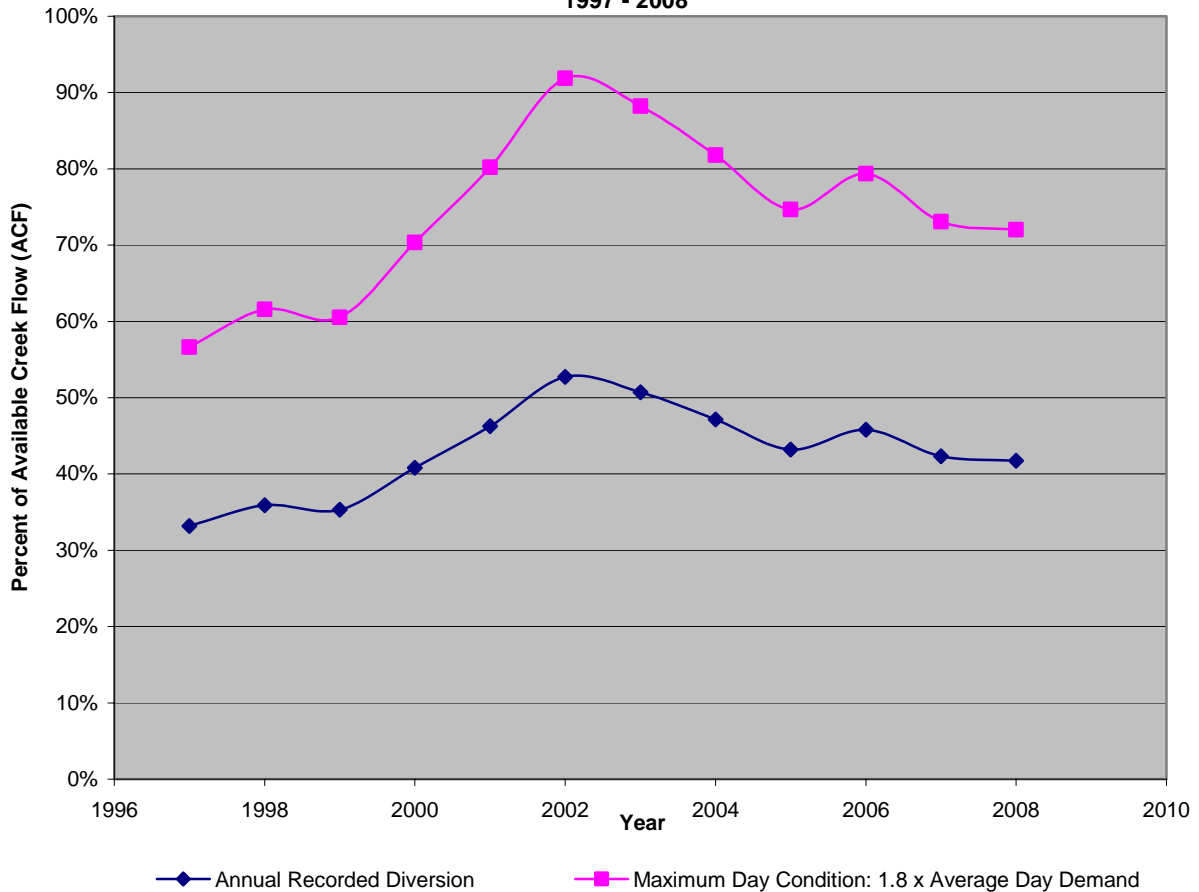


Figure 2 identifies a slight trend of decreasing diversion between 2002 and 2008. This could be attributed to system maintenance and water conservation efforts (e.g. low flow plumbing fixtures); however no specific mechanism was identified in the available data.

Projected Future Demand – City of Trinidad

In order to fully assess the potential impacts of the Project to the City of Trinidad’s source of supply, LACO first looked at trends in City’s water use records. As mentioned above, a trend of decreasing annual diversion is evident over the period of study but this trend is not solely representative of a continued reduction in water consumption, but also likely attributed to system maintenance and repairs reducing water loss in the system demonstrated in Figure 1. Therefore, assessment of long-term impacts was based on the *City of Trinidad General Plan, Housing Element, May 1997* – the most current housing element adopted by the City (an update to the Housing Element is currently being prepared by Streamline Planning of Arcata, California; however the assessment of potential for City growth had not been completed at the time of this report). It should be noted that the City served 319 metered service connections in 1997, 315 metered service connections in 2008, and 5 un-metered connections throughout the period of study.

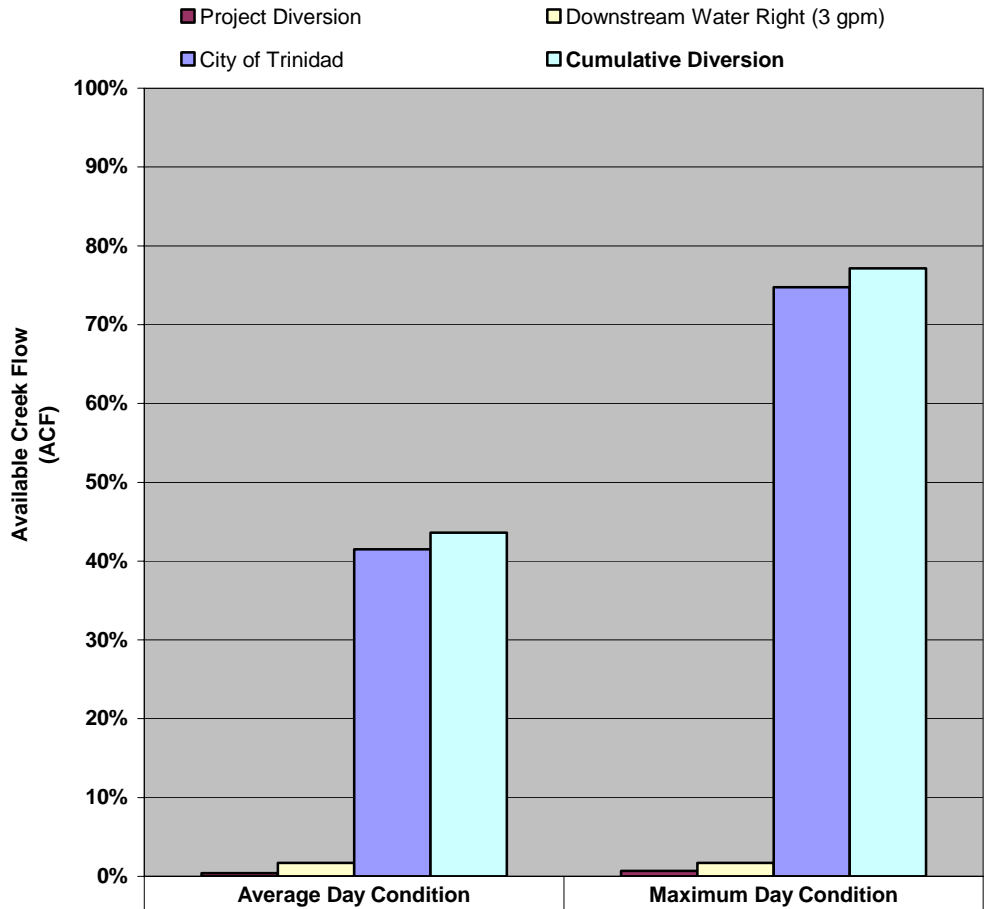
Future increase in service demand was evaluated based on the City's General Plan, page 26 of the Housing Element, Table 18 *Inventory of Land Available for Residential Development by Land Designation and Zoning District*. The Housing Element Table 18 indicates that up to 64 additional residential units could be constructed within the City limits based on existing undeveloped lots at the time of the report. Assuming all 64 units are served by the City of Trinidad's water system, the total number of service connections at build-out would be 391. Based on the average day demand of 327 gallons per day per service and including water appropriations below Trinidad (4,320 gallons per day), the average daily demand at build-out would be 132,177 gallons per day – 51.0 percent of the City's treatment plant capacity and 52 percent of the ACF. Under maximum day conditions, and using the calculated peaking factor of 1.8, the maximum daily demand at build-out would be 230,299 gallons per day – 88.8 percent of the treatment plant capacity and 91.4 percent of the available creek flow.

The Project would add an additional three service connections up-stream of the City of Trinidad's diversion – for the purpose of assessing impacts to Trinidad's supply the three services are treated as a reduction in the ACF. The net reduction under average day conditions is 981 gallons per day (0.4 percent of the ACF); and under maximum day conditions the available creek flow is reduced by 1,766 gpd (0.7 percent of the ACF). Factoring the Project into the average day and maximum day supply capacity assessment, at build-out, shows that the City of Trinidad would use 52.8 percent of the ACF (with Project) under average day conditions; and 92.0 percent of the ACF (with Project) under maximum day conditions.

#### Summary of Moss Minor Subdivision Impacts on Trinidad's Supply

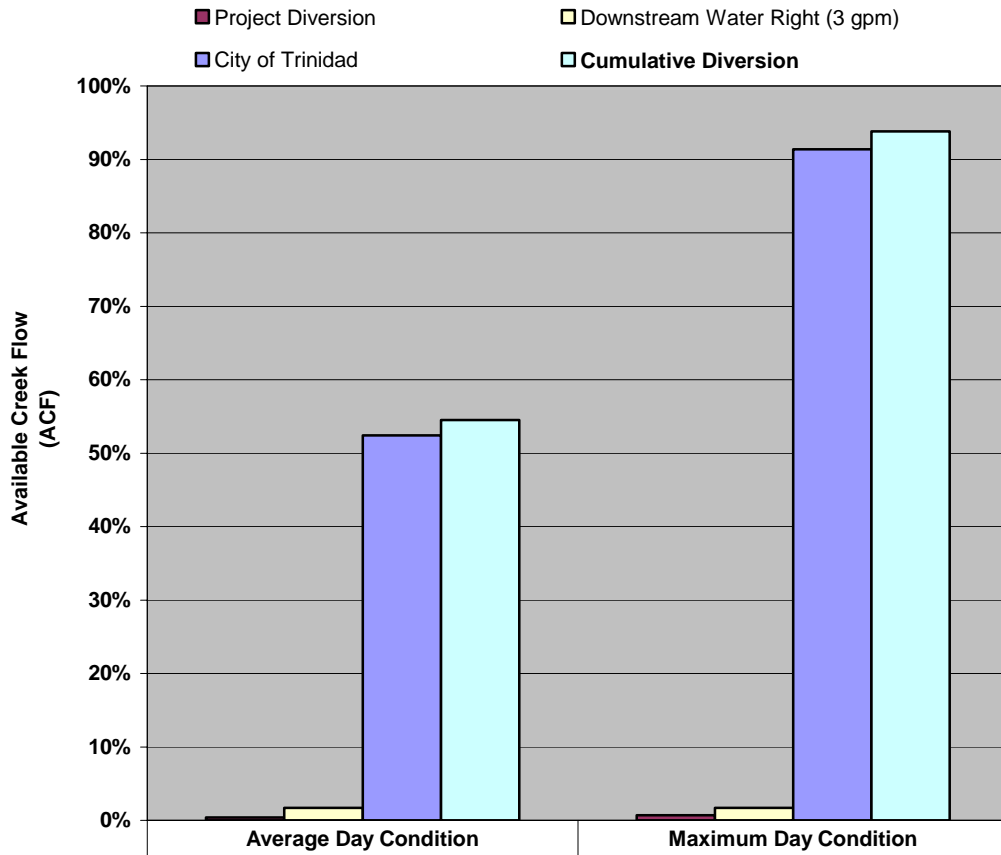
Figure 3 presents a summary of diversions from Luffenholtz Creek as a percent of the ACF based on current conditions. Figure 4 presents the same summary under the projected build-out scenario.

**FIGURE 3**  
**Summary of Luffenholtz Creek Diversions vs. Available Creek Flow (ACF)**



	Average Day Condition	Maximum Day Condition
Project Diversion	0.4%	0.7%
Downstream Water Right (3 gpm)	2%	2%
City of Trinidad	42%	75%
Cumulative Diversion	44%	77%

**FIGURE 4**  
**Summary of Luffenholtz Creek Diversions vs. Available Creek Flow (ACF) At Build-Out**



	Average Day Condition	Maximum Day Condition
■ Project Diversion	0.4%	0.7%
■ Downstream Water Right (3 gpm)	2%	2%
■ City of Trinidad	52%	91%
■ Cumulative Diversion	55%	94%

As shown above, the maximum of three additional service connections associated with the Moss Minor Subdivision will constitute less than a 1% reduction in the water available to the City of Trinidad under 100-year return low-flow conditions in Luffenholtz Creek even when assuming normal year fish flow allocation of 112 gallons per minute. Over the period of study, the City of Trinidad withdrew an annual volume of 42% of the available diversion in the maximum year between 1997 and 2008. Under a maximum day demand scenario, the City of Trinidad’s water use did not exceed 75 percent of the ACF. Based on the growth potential outlined in the City’s General Plan, at build-out the City would use only 52.8 percent of the ACF under typical conditions and up to 94 percent in a maximum day scenario. It should be noted that even under maximum day demand conditions at build-out, sufficient ACF exists to replenish storage reservoirs from peak hour demands as well as meeting MDD. Given that the Project reduces the creek flow available to Trinidad by a fraction of one percent under 100-year return low-flow conditions in Luffenholtz Creek, it is clear that the additional 3 residential units associated with the Project will have no detrimental impact to the City’s ability to supply water. In fact, these results demonstrate

that under maximum day conditions the system source capacity alone could support over 104 additional services. Lastly, this assessment did not account for the 45 gallon per minute dry-year reduction of dedicated stream flow for fish passage – equivalent to an increase in ACF of 40 percent; at which point treatment plant capacity would limit the service connection capacity to 120 additional services.

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