

Technical Memorandum

February 8, 2023

To: Julia Klein
Principal Planner
City of San Mateo

Prepared by: Shannon Brown
Reviewed by: Courtney King, PE and Frederick Yukic, PE

Subject: Bespoke (Downtown San Mateo) - Sanitary Sewer Flows Evaluation

Ms. Klein:

As part of the entitlement process for the proposed project at South B Street and 5th Avenue in the Downtown Core of San Mateo (Project), the City of San Mateo (City) has requested that Harvest Properties (Project Applicant) provide wastewater generation estimates for the existing site and proposed development. Sherwood Design Engineers, Inc. (SDE) has prepared this technical memorandum to establish a basis for these wastewater generation estimates.

To estimate the Project's wastewater generation flows, water unit demand factors are used to calculate the projected water use for the proposed development. Standard consumptive factors are then applied to determine the projected wastewater flows. The water unit demand factors are developed from industry-standard literature references and information from similar, contemporary urban developments in alignment with the latest California Green Building Standards Code (CALGreen, 2019) and the Leadership in Energy and Environmental Design (LEED) rating system. The proposed water unit demand factors account for high-performance water conservation measures (such as low-flow fixtures), as required by CALGreen.

1. Existing Site

The existing site includes approximately 4,400 gross square feet (GSF) of restaurant space, 29,000 GSF of retail space, and 6,350 GSF of office space. The buildings on the existing site were built between the 1940's and 1990's; minimal upgrades have been made to the water fixtures (such as toilets and faucets) since when the buildings were originally built.

The existing site's wastewater flows are calculated based on estimated water usage, assuming a 90% pass through for consumptive flows (such as sinks) and a 100% pass through for non-consumptive flows (such as toilet flushing).

1.1. Water Unit Demand Factors for Existing Site

Water usage is calculated based on the water unit demand factors presented in Table.1. These water unit demand factors align with expected performance for buildings built before CALGreen was established in 2009 and thus will be higher than the water unit demand factors for buildings built more recently that include high-performance water conservation measures (such as low-flow fixtures).

Table 1: Water Unit Demand Factors for Existing Site

	Water Unit Demand Factor*
	gpd/GSF
Office	0.042
Retail	0.017
Residential	-
Restaurant	0.316

* based on average annual day demands

1.1.1. Office

The existing office water unit demand factor is based on average existing flow rates in California, in accordance with the comprehensive water use study: "Waste Not, Want Not" by Pacific Institute (2003). Appendix E of the study, "Details of Commercial Water Use and Potential Savings by Sector", which contains fixture flow rates for existing fixtures in California. Uses per day of fixtures are based on the SFPUC Water Use Calculator. Water demands for offices include restrooms, drinking fountains, and a small kitchen demand to account for office kitchens. Table 2 presents office fixture flows and a water unit demand build up using these flow rates. Application of these office fixture flows results in an interior office demand of 13 gallons per capita per day (gal/ca-d). Note that water use is dependent on assumptions about human behavior (e.g., faucet flow durations).

Accounting for a typical office density of 300 GSF/seat and a standard occupancy rate of 65% (adjusted for weekends, holidays, and business travel), the duty factor would be 0.042 gal/GSF-d.

Table 2: Existing Office Fixture Flows (Pacific Institute, SFPUC)

	Flow Rate**	Unit	Duration*	Unit	FTE Uses/Day*	Unit Demand (gal/ca-d)
Lavatory Faucet	0.11	gal/use	1	use/flush	3	0.33
Water Closet	3	gal/flush	1	flush	3	9
Drinking Fountain	0.5	gal/min	0.25	min	3	0.38
Office Kitchen	10.1	gal/meal	0.33	meals	1	3.3
Total Unit Demand		gal/ca-d				13

* per the SFPUC Water Use Calculator¹

**per Pacific Institute, "Waste Not, Want Not"²

¹ SFPUC District-scale Water Use Calculator, 2022:

<https://sfpu.org/construction-contracts/design-guidelines-standards/onsite-water-reuse>

²"Waste Not Want Not" Pacific Institute, Appendix E, 2003: <https://pacinst.org/publication/waste-not-want-not/>

1.1.2. Retail & Restaurant

Water demands at retail/commercial spaces can vary depending on the type of establishment. Retail spaces are expected to have demands primarily associated with restrooms for employees and transients (customers). Restaurants have a water demand for activities including cooking, cleaning, and consumption.

The existing retail and restaurant duty factors are based on average existing flow rates in California, from “Waste Not, Want Not” by Pacific Institute (2003). Appendix E of the study, “Details of Commercial Water Use and Potential Savings by Sector”. Uses per day of fixtures are based on the SFPUC Water Use Calculator and remain consistent between existing and proposed water demands for Retail.

Commercial kitchen fixture flows account for industry-standard equipment to serve restaurant cooking and cleaning needs. Restroom use by customers and staff is broken out from kitchen flows to account for any non-potable demands. Totalized commercial kitchen demands assume all potable demand.

Refer to Table 3 and Table 4 for estimated retail & restaurant fixture flows and existing unit demands. Accounting for retail and restaurant density, the proposed duty factors for the Project’s retail spaces is 0.02 gal/GSF-d and for the Project’s restaurant spaces is 0.32 gal/GSF-d.

Table 3: Existing Retail Fixture Flows (Pacific Institute, SFPUC)

	Fixture Flows				Staff (FTE)		Transients (customers)		TOTAL
	Flow Rate**	Unit	Duration*	Unit	Uses /Day*	Unit Demand (gal/ca-d)	Uses /Day *	Unit Demand (gal/ca-d)	Unit Demand (gal/GSF-d)
Lavatory Faucet	0.11	gal/use	1	use/flush	3	0.33	0.5	0.055	
Water Closet	3	gal/flush	1	flush	2	6	0.3	0.9	
Unit Demand		gal/ca-d				6.3		0.96	-
Retail Density*		GSF/ca				550		130	
Total Unit Demand		gal/GSF-d				0.012		0.007	0.017

* per the SFPUC Water Use Calculator³

**per Pacific Institute, “Waste Not, Want Not”⁴

³ SFPUC District-scale Water Use Calculator, 2022:

<https://sfpuc.org/construction-contracts/design-guidelines-standards/onsite-water-reuse>

⁴“Waste Not Want Not” Pacific Institute, Appendix E, 2003: <https://pacinst.org/publication/waste-not-want-not/>

Table 4: Existing Restaurant Fixture Flows (Pacific Institute, SFPUC)

	Fixture Flows				Staff & Customers		Unit Demand (gal/GSF-d)
	Flow Rate**	Unit	Duration*	Unit	Uses/Day**	Unit Demand (gal/ca-d)	
Lavatory Faucet	0.11	gal/use	1	use/flush	0.9	0.1	
Water Closet	3	gal/flush	1	flush	0.9	2.6	
Commercial Kitchen	7.21	gal/meal	1	meal	1	7.21	
Unit Demand		gal/ca-d				9.9	
Restaurant Density*		GSF/ca				31	
Unit Demand		gal/GSF-d					0.316

* per the SFPUC Water Use Calculator⁵

**per Pacific Institute, "Waste Not, Want Not"⁶

1.2. Water Usage and Wastewater Generation

The estimated existing water usage of 2,150 gal/d and wastewater generation of 2,039 are shown in Table 5. To determine Maximum Day Demand (MDD) a peaking factor of 3.0 is applied which results in 6,100 gal/h of wastewater generation. To calculate Peak Hour Demand (PHD) a peaking factor of 4.0 is applied which results in 8,200 gal/h of wastewater flows.

Table 5: Existing - Water Demands & Wastewater Flows

	Water Usage			Wastewater Generation			Peak Wastewater Flows	
	Annual		Annual Average	Annual		Annual Average	3.0 Peaking Factor Applied	4.0 Peaking Factor Applied
	CCF per year	MGY	gal/d	CCF per year	MGY	gpd	gal/h	gal/h
Office	132	0.10	270	128	0.10	262		
Retail	240	0.18	492	239	0.18	489		
Residential	-	-	-	-	-	-		
Restaurant	679	0.51	1,391	629	0.47	1,288		
Total	1,051	0.79	2,150	995	0.74	2,039	6,100	8,200

⁵ SFPUC District-scale Water Use Calculator, 2022:

<https://sfpuc.org/construction-contracts/design-guidelines-standards/onsite-water-reuse>

⁶"Waste Not Want Not" Pacific Institute, Appendix E, 2003: <https://pacinst.org/publication/waste-not-want-not/>

2. Proposed Development

The proposed development will include approximately 162,000 GSF of office space (540 seats), 12,000 GSF of retail space, 5,000 GSF of restaurant space, and 63,000 GSF of residential space (60 units). The proposed development will be in compliance with the latest CALGreen code, will pursue LEED Gold certification, and is being designed to run on all-electric systems with the potential exception of the restaurant tenant.

Wastewater flows for each option are calculated based on estimated water usage, assuming a 90% pass through for consumptive flows (such as sinks) and a 100% pass through for non-consumptive flows (such as toilet flushing). Water usage is calculated based on the proposed unit demand factors presented in Section 2.1.

To capture the range of potential wastewater flows for the Project, minimum, maximum, and expected occupancy scenarios were developed, as detailed in Sections 2.2 through 2.4.

2.1. Proposed Unit Demand Factors

The Project's proposed water unit demand factors are presented in Table 6. The following sections describe the proposed water unit demand factors for each program at the Project.

Table 6: Proposed Water Unit Demand Factors

	Water Unit Demand Factor*
	gal/GSF-d
Office**	0.019
Retail	0.009
Restaurant	0.196
Residential***	0.092

* based on average annual day demands

** includes recommended 50% factor of safety

*** based on the expected residential occupancy

2.1.1. Office

The proposed development will include approximately 162,000 GSF of office space (540 seats). The proposed office duty factor is based primarily on high efficiency fixtures required to meet LEED standards and in accordance with CALGreen (2019), Section 5.303 - Nonresidential Mandatory Measures, Indoor Water Use. Water demands for offices include restrooms, drinking fountains, and a small kitchen demand to account for office "micro-kitchens" with coffee/tea stations. Refer to Table 7 for office fixture flows and a unit demand build up using these standards. Application of these standard office fixture flows results in an interior office demand of 6 gal/ca-d. Note that water use is dependent on human behavior (e.g., faucet flow durations).

The projections for the proposed development indicate office density at the Project will be approximately 300 GSF/seat (540 seats). The projected average daily occupancy in the proposed offices is calculated by reviewing occupancy at the annual level to account for weekends, holidays, and working from home. The resulting occupancy factor is 65%, or about 238 days of the year when offices are at full occupancy. Accounting for office density and anticipated occupancy, the duty factor would be 0.012 gal/GSF-d.

The City of San Mateo's standard water consumption factor for per capita water usage estimates is 65 gal/ca-d⁷. This water consumption factor appears to be based on the full daily demand of a person living and working in San Mateo. As noted in a 2021 California Department of Water Resources study⁸, "current statewide median indoor residential water use is 48 gallons per capita per day". Using the City of San Mateo's per capita water usage of 65 gal/d and the statewide median residential water usage of 48 gal/d, it can be deduced that non-residential per capita water use would be 17 gal/ca-d. These non-residential demands could include offices, restaurants, retail spaces, entertainment venues, etc.

Given the estimated non-residential water use and factoring in human behavior uncertainty, SDE recommends applying a 50% factor of safety to the built up office unit demand previously presented of 6 gal/ca-d. The resulting office unit demand is 9 gal/ca-d. Accounting for office density and anticipated occupancy, the proposed duty factor is 0.019 gal/GSF-d.

Table 7: Office Fixture Flows (LEED, CALGreen)

	Fixture Flows					Unit Demand (gal/ca-d)
	Flow Rate	Unit	Duration	Unit	FTE Uses/Day	
Lavatory Faucet	0.5	gal/min	0.5	min	3	0.75
Water Closet	1.28	gal/flush	1	flush	6	3.84
Drinking Fountain	0.5	gal/min	0.25	min	3	0.38
Kitchen Sink	1.8	gal/min	0.25	min	1	0.5
Dishwasher	3.5	gal/cycle	1	cycle	0.1	0.4
Total Unit Demand (LEED, CALGreen)		gal/ca-d				6
Proposed Unit Demand (includes 50% factor of safety)		gal/ca-d				9

2.1.2. Retail & Restaurant

The proposed development will include approximately 12,000 GSF of retail space and 5,000 GSF of restaurant space. Demands at retail/commercial spaces can vary depending on the type of establishment. Retail spaces are expected to have demands associated with restrooms for employees and transients (customers). Restaurants have water demands for activities including cooking, cleaning, and consumption.

The proposed retail and restaurant duty factors are based primarily on high efficiency fixtures required to meet LEED standards and in accordance with CALGreen (2019), Section 5.303 - Nonresidential Mandatory Measures, Indoor Water Use, as well as industry-standard equipment to serve restaurant cooking and cleaning needs. Refer to Table 8 and Table 9 for estimated retail & restaurant fixture flows and proposed unit demands. Accounting for retail and restaurant density, the proposed water use factors for the Project's retail spaces is 0.012 gal/GSF-d and for the Project's restaurant spaces is 0.196 gal/GSF-d as shown in Tables 8 and 9.

⁷ Email from Karen Magallanes, City of San Mateo. September 7, 2022.

⁸ California Department of Water Resources study, 2021: "Results of the Indoor Residential Water Use Study".

Table 8: Retail Fixture Flows (LEED, CALGreen)

	Fixture Flows				Staff (FTE)		Transients (customers)		TOTAL
	Flow Rate	Unit	Duration	Unit	Uses/Day	Unit Demand (gal/ca-d)	Uses/Day	Unit Demand (gal/ca-d)	Unit Demand (gal/GSF-d)
Lavatory Faucet	0.5	gal/min	0.5	min	3	0.75	0.5	0.125	
Water Closet	1.28	gal/flush	1	flush	3	3.84	0.3	0.384	
Unit Demand		gal/ca-d				4.6		0.51	-
Retail Density*		GSF/ca				550		130	
Total Unit Demand		gal/GSF-d				0.008		0.004	0.009

* per the SFPUC Water Use Calculator⁹

Table 9: Restaurant Fixture Flows (LEED, CALGreen)

	Fixture Flows				Staff (FTE)		Transients (customers)		Total
	Flow Rate	Unit	Duration	Unit	Uses/Day	Unit Demand (gal/ca-d)	Uses/Day	Unit Demand (gal/ca-d)	Unit Demand (gpd/GSF)
Lavatory Faucet	0.5	gal/min	0.5	min	3	0.75	0.5	0.125	
Water Closet	1.28	gal/flush	1	flush	3	3.84	0.3	0.384	
Commercial Kitchen*	5.1	gal/meal	1	meal	0	0	1	5.1	
Unit Demand		gal/ca-d				4.6		5.61	-
Restaurant Density*		GSF/ca				435		30	
Total Unit Demand		gal/GSF-d				0.011		0.187	0.198

* per the SFPUC Water Use Calculator¹⁰

⁹ SFPUC District-scale Water Use Calculator, 2022:
<https://sfpuc.org/construction-contracts/design-guidelines-standards/onsite-water-reuse>

¹⁰ SFPUC District-scale Water Use Calculator, 2022:
<https://sfpuc.org/construction-contracts/design-guidelines-standards/onsite-water-reuse>

2.1.3. Residential

The Project plan proposes 60 residential units encompassing 63,000 GSF. Residential demands can vary depending on total occupancy. Residential demands are based on household fixtures that require water, such as showering, cooking, cleaning, clothes washing, and toilet flushing.

Project-specific interior residential demands were calculated based on the frequency of use and fixture flow rates of high efficiency residential fixtures, as defined by LEED and in accordance with the 2019 California Green Building Standards Code (CALGreen), Section 4.303 - Residential Mandatory Measures, Indoor Water Use. Refer to Table 10 for residential fixture flows and estimated daily water use. Based on these standard residential fixture flows, the resulting residential unit demand is 41 gal/ca-d. Accounting for expected residential occupancy, the proposed duty factor is 0.092 gal/GSF-d.

Table 10: Residential Fixture Flows (LEED, CALGreen)

	Fixture Flows				Residents	
	Flow Rate	Unit	Duration	Unit	Uses/Day	Unit Demand (gal/ca-d)
Shower	2	gal/min	8	min	1	16
Lavatory Faucet	1.5	gal/min	1	min	5	7.5
Residential Clothes Washer	13	gal/cycle	1	cycle	0.25	3.3
Water Closet	1.28	gal/flush	1	flush	5	6.4
Kitchen Sink	1.75	gal/min	1	min	4	7
Residential Dishwasher	3.5	gal/cycle	1	cycle	0.25	0.88
Unit Demand		gal/ca-d				41

2.2. Wastewater Flows - Minimum Residential Occupancy Option

The minimum residential occupancy option is based on minimum occupancy standards for affordable housing - 1 occupant per studio (15 units), 1 occupant per 1-bedroom (11 units), 2 occupants per 2-bedroom (17 units), and 3 occupants per 3-bedroom (17 units)¹¹. For the proposed development, these standards result in an average residential density of 1.8 occupants per residential unit and a total of 111 occupants.

The estimated water demands and wastewater flows for the minimum residential occupancy option are shown in Table 11. A peaking factor of 3.0 results in a MDD of 23,000 gal/h of wastewater flows, while a peaking factor of 4.0 results in a PHD of 30,000 gal/h of wastewater flows.

¹¹ Email from Jennifer Wong, Alta Housing. January 30, 2023.

Table 11: Proposed Development - Minimum Water Demands & Wastewater Flows

	Water Usage			Wastewater Generation			Peak Wastewater Flows	
	Annual		Annual Average	Annual		Annual Average	3.0 Peaking Factor Applied	4.0 Peaking Factor Applied
	CCF per year	MGY	gal/d	CCF per year	MGY	gal/d	gal/h	gal/h
Office*	1,500	1.1	3,000	1,400	1.1	3,000		
Retail	51	0.040	100	50	0.040	100		
Restaurant	480	0.36	980	440	0.33	900		
Residential	2,000	1.5	4,100	1,800	1.4	3,800		
Total	4,000	3.0	8,200	3,800	2.8	7,700	23,000	30,000

* Includes 50% factor of safety for office wastewater flows

2.3. Wastewater Flows - Maximum Residential Occupancy Option

The maximum residential occupancy option is based on maximum occupancy standards for affordable housing - 2 occupants per studio (7 units), 3 occupants per 1-bedroom (19 units), 5 occupants per 2-bedroom (17 units), and 7 occupants per 3-bedroom (17 units)¹². For the proposed development, these standards result in an average residential density of 4.6 occupants per residential unit and a total of 275 occupants.

The estimated water demands and wastewater flows for the maximum residential occupancy option are shown in Table 12. A peaking factor of 3.0 results in a MDD of 40,000 gal/h of wastewater flows, while a peaking factor of 4.0 results in a PHD of 53,000 gal/h of wastewater flows.

Table 12: Proposed Development - Maximum Water Demands & Wastewater Flows

	Water Usage			Wastewater Generation			Peak Wastewater Flows	
	Annual		Annual Average	Annual		Annual Average	3.0 Peaking Factor Applied	4.0 Peaking Factor Applied
	CCF per year	MGY	gal/day	CCF per year	MGY	gal/day	gal/h	gal/h
Office*	1,500	1.1	3,000	1,400	1.1	3,000		
Retail	51	0.040	100	50	0.040	100		
Restaurant	480	0.36	980	440	0.33	900		
Residential	5,000	3.7	10,000	4,500	3.4	9,300		
Total	7,000	5.2	14,000	6,400	4.8	13,000	40,000	53,000

* Includes 50% factor of safety for office wastewater flows

¹² Email from Jennifer Wong, Alta Housing. January 30, 2023.

2.4. Wastewater Flows - Expected Residential Occupancy Option

The expected residential occupancy option is based on the development's expected occupancy - 1.5 occupants per studio (11 units), 1.5 occupants per 1-bedroom (15 units), 3 occupants per 2-bedroom (17 units), and 4.5 occupants per 3-bedroom (17 units) For the proposed development, these standards result in an average residential density of 2.6 occupants per residential unit and a total of 167 occupants.

The estimated water demands and wastewater flows for the expected residential occupancy option are shown in Table 13. A peaking factor of 3.0 results in a MDD of 27,000 gal/h of wastewater flows, while a peaking factor of 4.0 results in a PHD of 36,000 gal/h of wastewater flows.

Table 13: Proposed Development - Expected Water Demands & Wastewater Flows

	Water Usage			Wastewater Generation			Peak Wastewater Flows	
	Annual		Annual Average	Annual		Annual Average	3.0 Peaking Factor Applied	4.0 Peaking Factor Applied
	CCF per year	MGY	gal/day	CCF per year	MGY	gal/day	gal/h	gal/h
Office*	1,500	1.1	3,000	1,400	1.1	3,000		
Retail	51	0.040	100	50	0.040	100		
Restaurant	480	0.36	980	440	0.33	900		
Residential	2,700	2.0	5,500	2,500	1.9	5,000		
Total	4,700	3.5	9,700	4,400	3.3	9,000	27,000	36,000

* Includes 50% factor of safety for office wastewater flows

3. Conclusions and Recommendations

The proposed development at South B Street and 5th Avenue will include approximately 162,000 GSF of office space (540 seats), 12,000 GSF of retail space, 63,000 GSF of residential space (60 units), and 5,000 GSF of restaurant space; replacing approximately 6,350 GSF of office space, 29,000 GSF of retail space, and 4,400 GSF of restaurant space that exists currently at the site. The minimum flow option assumes an occupancy of 111 residents, the maximum flow option assumes 275 residents, and the expected flow options assumes 167 residents.

Sherwood recommends that the City adopt the estimated water consumption unit demand factors for estimating the Project's wastewater generation flows. Sherwood also recommends using a peaking factor of 4.0 to conservatively estimate the Project's peak wastewater flows. Using a peaking factor of 4.0, the Project's peak wastewater flows are estimated to be 36,000 gal/h for the Expected Residential Occupancy Option. The existing site's peak wastewater flows are estimated to be 8,000 gal/h. Therefore, anticipated new wastewater flows for the Project are 28,000 gal/h at a maximum.

SDE is available to meet and discuss this information with City staff should any questions arise or should any additional information be required.