

Appendix I

Water Supply Assessment

March 9, 2021

Justin Horner, Associate Planner
City of Berkeley
Department of Planning & Development
1947 Center Street, 2nd Floor
Berkeley, CA 94704

Re: Water Supply Assessment – Ashby and North Berkeley BART Station Transit-Oriented Development Zoning Standards Project

Dear Mr. Horner:

This letter is in response to your request made on January 4, 2021, for water agency consultation (Enclosure 1) concerning the Water Supply Assessment (WSA) for the Ashby and North Berkeley BART Station Transit-Oriented Development Zoning Standards Project (Project), located in the City of Berkeley (City), which is within East Bay Municipal Utility District's (EBMUD's) Ultimate Service Boundary. EBMUD appreciates the opportunity to provide this response.

Pursuant to Sections 10910-10915 of the California Water Code, the Project meets the threshold requirement for an assessment of water supply availability based on the amount of water this Project would require, which is greater than the amount of water required by a 500-dwelling-unit project.

Please note this WSA addresses the issue of water supply only and is not a guarantee of service; future water service is subject to the rates and regulations in effect at that time.

Project Demand

The water demand for the Project is accounted for in EBMUD's water demand projections, as published in EBMUD's Urban Water Management Plan (UWMP) 2015 (Enclosure 2). EBMUD's water demand projections account for anticipated future water demands within EBMUD's service boundaries and for variations in demand-attributed changes in development patterns. The existing land uses consist of parking spaces and transit BART stations with historical water use of approximately 14,000 gallons per day (GPD). The projected water use at Project build-out is approximately 440,000 GPD.

EBMUD's demand projections indicate both densification and land use changes in a few existing land use classifications, including commercial and residential land use areas. These changes increase demand for EBMUD water. EBMUD's UWMP 2015 projects water demands over time, accounting for estimated variations in demand usage minus

conservation and recycled supply sources, as noted in the UWMP 2015, Table 4-1, Mid-Cycle Demand Projections (Table 1). Typically, EBMUD prepares a full demand study every ten years; the most recent version, the 2050 Demand Study, was completed in 2020. For planning purposes, water demands are estimated in five-year increments, but it is recognized that actual incremental amounts may occur stepwise in shorter time increments. An increase in usage by one customer in a particular customer class does not require a strict gallon-for-gallon increase in conservation by other customers in that class, as, in actuality, the amount of potable demand, conservation and recycled water use EBMUD-wide will vary somewhat. In 2014, EBMUD prepared the Mid-Cycle Demand Assessment (MCDA) in order to assess any significant effects on metered water consumption caused by the 2008-2010 drought, and the economic downturn that affected growth in the Bay Area. As part of the MCDA, EBMUD reviewed recently updated city and county general plans for significant changes since the 2040 Demand Study, and held meetings with representatives from the cities of Alameda, Oakland, Richmond and San Ramon. The MCDA concluded that, while the cities and counties might reach their build-out goals later than originally anticipated, they would still reach these goals by 2040. Accordingly, the MCDA validated the 2040 Demand Study, as demands are expected to gradually increase back to 2040 projected levels as development and water use return to pre-drought and pre-recession conditions. EBMUD completed a comprehensive demand study in 2020 with a long-term horizon of 2050. As part of the demand study, EBMUD reached out to each city and county in the service area to ask about projected development and future land-use changes. The study results will be incorporated into the UWMP 2020.

Table 1
Mid-Cycle Demand Projections (UWMP 2015, Table 4-1)

TABLE 4-1 AVERAGE ANNUAL DEMAND (MGD)	MID-CYCLE DEMAND PROJECTIONS					
	2015	2020	2025	2030	2035	2040
PROJECTED TOTAL DEMAND	232	267	276	290	304	312
CONSERVATION ¹	-33	-39	-44	-51	-57	-62
NON-POTABLE WATER ^{1,2}	-9	-11	-14	-17	-18	-20
PLANNING LEVEL OF DEMAND	190	217	218	222	229	230

¹ See Chapters 6 and 7 for more discussion of water recycling and conservation, respectively.
² Non-potable water includes recycled water and raw water projects.

Project Area

The Project includes three proposed development sites located within or adjacent to the Ashby BART and North Berkeley BART Stations. The Ashby BART Station includes two proposed development sites within the existing 4.4-acre transit station and the 1.9-acre surface parking lot. The existing 4.4-acre transit station site is located west of the Ed Roberts Campus and bounded by Ashby Avenue (California State Route 13) to the north; Martin Luther King Jr. Way to the west; and Adeline Street to the east. The existing 1.9-acre surface parking lot is located immediately east of the Ed Roberts Campus and

bounded by Tremont Street to the east; Woolsey Street to the south; and residential houses to the north. At build-out, the areas of the Ashby BART locations will include the development of up to 1,200 residential dwelling units and 100,000 square feet of non-residential space. The North Berkeley BART station includes one proposed development site located at the existing 8.1-acre transit station and parking lot. The site is located west of Ohlone Park and bounded by Sacramento Street to the east; Acton Street to the west; Virginia Street to the north; and Delaware Street to the south. At build-out, the areas of the North Berkeley BART location will include development of up to 1,200 residential dwelling units and 25,000 square feet of non-residential space. The total Project area consists of 14.4 acres. At build-out, the Project will include the combined development of up to 2,400 residential dwelling units and 125,000 square feet of non-residential space.

EBMUD Water Demand Projections

Since the 1970s, water demand within EBMUD's service area has ranged from 200 to 220 million gallons per day (MGD) in non-drought years. Section 4.1 of the UWMP 2015 outlines past and current EBMUD water demand, including Figure 4-1 which shows historic water use (including metered and unmetered demands) within EBMUD's service area, along with the number of customer accounts. The 2040 water demand forecast of 312 MGD for EBMUD's service area can be reduced to 230 MGD with the successful implementation of water recycling and conservation programs, as outlined in the UWMP 2015. Current demand is lower than estimated in the MCDA as a result of the recent multi-year drought. This is because the planning level of demand may differ from the actual demand in any given year due to water use reductions that typically occur during droughts. After droughts, a rebound effect is expected wherein demand rises back to projected levels. Thus, the MCDA still reflects a reasonable expectation for demand in year 2040, as the demands are expected to gradually increase back to 2040 projected demand levels as development and water use return to pre-drought and pre-recession conditions. The proposed Project's future development and operations will not change EBMUD's 2040 demand projection.

EBMUD Water Supply, Water Rights and the UWMP 2015

EBMUD has water right permits and licenses that allow for delivery of up to a maximum of 325 MGD from the Mokelumne River, subject to the availability of Mokelumne River runoff and the senior water rights of other users. EBMUD's position in the hierarchy of Mokelumne River water users is determined by a variety of agreements between Mokelumne River water right holders and the terms of the appropriative water right permits and licenses.

Conditions that could, depending on hydrology, restrict EBMUD's ability to receive its full entitlement include:

- Upstream water use by senior water right holders.

- Downstream water use by riparian and senior appropriators and other downstream obligations, including protection of public trust resources.
- Variability in precipitation and runoff.

During prolonged droughts, the Mokelumne River supply cannot meet EBMUD's projected customer demands. To address this, EBMUD has completed construction of the Freeport Regional Water Facility and the Bayside Groundwater Project Phase 1, which are discussed below in the Supplemental Water Supply and Demand Management section of this assessment. EBMUD has obtained and continues to seek supplemental supplies.

The UWMP 2015, adopted on June 28, 2016 by EBMUD's Board of Directors under Resolution No. 34092-16, is a long-range planning document used to assess current and projected water usage, water supply planning, and conservation and recycling efforts. EBMUD's water supply sources are discussed in Section 1.5.1 of the UWMP 2015. EBMUD's main water supply is the Mokelumne River, and EBMUD has rights to receive up to 325 MGD of water from this source subject to the availability of runoff, senior water rights of other users, and downstream fishery flow requirements. EBMUD also has a Long-Term Renewal Contract (Contract No. 14-06-200-5183A-LTR1) with the United States (U.S.) Bureau of Reclamation to receive water from the Central Valley Project (CVP) through the Freeport Regional Water Facility in years when EBMUD's water supplies are relatively low (for more details, see Section 3.3.2 of the UWMP 2015). During some dry years, EBMUD may purchase water transfers to help meet customer demands. Section 5.1 of the UWMP 2015 discusses EBMUD's water transfer program.

EBMUD maintains a biennial budget and five-year capital improvement program to optimize investments and maximize drinking water quality, and the reliability, safety, flexibility, and overall efficiency of the water supply system. EBMUD's most recently adopted budget, which includes capital expenditures for the delivery of water supplies to its customers, can be found at <http://www.ebmud.com/about-us/investors/budget-and-rates/>.

EBMUD complies with applicable local, state, and federal regulations in the operation of its water supply system. Figure 1-4 of the UWMP 2015 illustrates the numerous local, state, and federal agencies that may regulate EBMUD's facilities and operations.

A summary of EBMUD's demand and supply projections, in five-year increments, for a 25-year planning horizon is provided in UWMP 2015, Table 4-5, Preliminary EBMUD Baseline Supply and Demand Analysis (Table 2).

EBMUD's evaluation of water supply availability accounts for the diversions of both upstream and downstream water right holders and fishery releases on the Mokelumne River. Fishery releases are based on the requirements of a 1998 Joint Settlement Agreement (JSA) between EBMUD, U.S. Fish and Wildlife Service, and the California Department of Fish and Wildlife. The JSA requires EBMUD to make minimum flow

releases from its reservoirs to the lower Mokelumne River to protect and enhance the fishery resources and ecosystem of the river. As this water is released downriver, it is, therefore, not available for use by EBMUD's customers.

Table 2
Preliminary EBMUD Baseline Supply and Demand Analysis
(UWMP 2015, Table 4-5)

TABLE 4-5 PRELIMINARY EBMUD BASELINE SUPPLY & DEMAND ANALYSIS

SUPPLY AND DEMAND COMPARISON - NORMAL YEAR (MGD)		2015	2020	2025	2030	2035	2040
MOKELUMNE SYSTEM		>190	>217	>218	>222	>229	>230
DEMAND TOTALS		190	217	218	222	229	230
DIFFERENCE		0	0	0	0	0	0
DRY YEAR RESULTS FROM EBMUDSIM (MGD)		2015	2020	2025	2030	2035	2040
SINGLE DRY YEAR OR FIRST YEAR OF MULTI-YEAR DROUGHT	MOKELUMNE SYSTEM	145	169	170	173	179	179
	CVP SUPPLIES ²	36	35	35	35	35	35
	BAYSIDE ³	0	0	0	0	0	0
	SUPPLY TOTALS	181	204	205	209	214	215
	PLANNING LEVEL DEMAND ¹	190	217	218	222	229	230
	RATIONING ⁴	5%	6%	6%	6%	7%	7%
	DEMAND TOTALS	180	203	204	208	213	214
NEED FOR WATER (TAF) ⁵		0	0	0	0	0	0
SECOND YEAR	MOKELUMNE SYSTEM	81	103	103	107	112	113
	CVP SUPPLIES ²	71	71	71	71	71	71
	BAYSIDE ³	0	0	0	0	0	0
	SUPPLY TOTALS	152	174	174	178	183	184
	PLANNING LEVEL DEMAND ¹	190	217	218	222	229	230
	RATIONING ⁴	20%	20%	20%	20%	20%	20%
	DEMAND TOTALS	152	174	175	178	184	185
NEED FOR WATER (TAF) ⁵		0	0	0	0	0	0
THIRD YEAR	MOKELUMNE SYSTEM	111	132	132	125	120	104
	CVP SUPPLIES ²	40	40	40	40	40	40
	BAYSIDE ³	1	1	1	1	1	1
	SUPPLY TOTALS	152	174	173	166	162	145
	PLANNING LEVEL DEMAND ¹	190	217	218	222	229	230
	RATIONING ⁴	20%	20%	20%	20%	20%	20%
	DEMAND TOTALS	152	174	174	178	183	184
NEED FOR WATER (TAF) ⁵		0	0	2	13	24	48

1. Planning Level of Demand accounts for projected savings from water recycling and conservation programs as discussed in Chapters 6 and 7 respectively. Customer demand values are based on the Mid Cycle Demand Assessment, October 2014.
 2. Projected available CVP supplies are taken according to the Drought Management Program Guidelines discussed in Chapter 3.
 3. For the purposes of this modeling effort, it is assumed that the Bayside Groundwater Project would be brought online in the third year of a drought.
 4. Rationing reduction goals are determined according to projected system storage levels in the Drought Management Program Guidelines discussed in Chapter 3.
 5. Need for Water includes unmet customer demand as well as shortages on the Lower Mokelumne River.

The available supply and demand shown in Table 2 were derived from EBMUD's baseline hydrologic model with the following assumptions:

- Customer demand values are based on the MCDA, and planning-level demands account for projected savings from water recycling and conservation programs.
- EBMUD Drought Planning Sequence assumes water years 1976, 1977 and a modified 1978 hydrology.
- Total system storage is depleted by the end of the third year of the drought.
- EBMUD will implement its Drought Management Program (DMP) when necessary.
- The diversions by Amador and Calaveras Counties upstream of Pardee Reservoir will increase over time, eventually reaching the full extent of their senior rights.
- Releases are made to meet the requirements of senior downstream water right holders and fishery releases, as required by the JSA.
- EBMUD allocation of CVP supply is available the first year of a drought and subsequent drought years, according to the U.S. Bureau of Reclamation's Municipal and Industrial Shortage Policy.
- The Bayside Groundwater Project Phase 1 is available and brought online in the third year of a drought.

The UWMP 2015 concludes that EBMUD has, and will have, adequate water supplies to serve existing and projected demand within the Ultimate Service Boundary during normal and wet years, but that deficits are projected for multi-year droughts. During multi-year droughts, EBMUD may require significant customer water use reductions and may also need to acquire supplemental supplies to meet customer demand.

As discussed under the DMP Guidelines section in Chapter 3 of the UWMP 2015, EBMUD's system storage generally allows EBMUD to continue serving its customers during dry-year events. EBMUD typically imposes water use restrictions based on the projected storage available at the end of September and, based on recent changes to its DMP Guidelines (summarized below), may also implement water use restrictions in response to a State of California mandate. By imposing water use restrictions in the first dry year of potential drought periods, EBMUD attempts to minimize water use restrictions in subsequent years if a drought persists. Throughout dry periods, EBMUD must continue to meet its current and subsequent-year fishery flow release requirements and obligations to downstream agencies.

The UWMP 2015 includes DMP Guidelines that establish the level of water use restrictions EBMUD may implement under varying conditions. Under the DMP Guidelines, water use restrictions may be determined based upon either projected end-of-September Total System Storage (TSS) or water use restriction mandates from the State Water Resources Control Board. When state-mandated water use restrictions exceed the reductions that would otherwise be called for based upon end-of-September TSS,

EBMUD's water use reduction requirements may be guided by the applicable state mandates. Under either scenario, while EBMUD strives to keep water use reductions at or below 15 percent, if the drought is severe, mandatory water use reductions could exceed 15 percent.

Despite water savings from EBMUD's aggressive conservation and recycling programs and water use restrictions called for in the DMP Guidelines, supplemental supplies are still needed in significant, severe, and critical droughts. The proposed Project will be subject to the same drought restrictions that apply to all EBMUD customers. In addition, the proposed Project will be subject to EBMUD's regulations aimed at encouraging efficient water use, such as Sections 29 and 31 of EBMUD's Regulations Governing Water Service. Section 29, "Water Use Restrictions," promotes efficient water use by EBMUD customers and prohibits certain uses of potable water. Section 31, "Water Efficiency Requirements," identifies the types of water efficiency requirements (i.e., maximum flow rates for flow control devices) for water service.

Supplemental Water Supply and Demand Management

The goals of meeting projected water needs and increased water reliability rely on supplemental supplies, improving reliability of existing water supply facilities, water conservation, and recycled water programs.

By 2011, EBMUD completed construction of the Freeport Regional Water Facility and the Bayside Groundwater Project Phase 1 to augment its water supply during drought periods. However, additional supplemental supplies beyond those provided through these facilities will still be needed, as noted above. Chapter 5 of the UWMP 2015 describes potential supplemental water supply projects that could be implemented to meet projected long-term water demands during multi-year drought periods.

The Freeport Regional Water Facility became operational in February 2011. EBMUD's ability to take delivery of CVP water through the Freeport Regional Water Facility is based on its Long Term Renewal Contract (LTRC) with the U.S. Bureau of Reclamation. The LTRC provides for up to 133,000 acre feet of CVP supply in a single dry year, not to exceed a total of 165,000 acre feet in three consecutive dry years. Under the LTRC, the CVP supply is available to EBMUD only in dry years when EBMUD's total stored water supply is forecast to be below 500,000 total acre feet on September 30 of each year.

EBMUD is developing the Bayside Groundwater Project in phases to provide a source of supplemental supply in dry years. Construction of the first phase (Bayside Groundwater Project Phase 1) was completed in 2010, allowing EBMUD to inject treated potable water into a deep aquifer in the South East Bay Plain Groundwater Basin for later extraction, treatment, and use during severe droughts. A permit from the Department of Public Health is required before the groundwater can be extracted and treated for municipal use. As described in Chapter 4 of the UWMP 2015, EBMUD's drought planning calls for using the

Bayside Groundwater Project Phase 1 during the third year of multi-year droughts to provide up to 1 MGD of water to meet customer demands. Additional information on the Bayside Groundwater Project can be found in Section 5.3 and Appendix E of the UWMP 2015.

Chapter 5 of the UWMP 2015 also lists other potential supplemental water projects, including Northern California water transfers, Bayside Groundwater Project Expansion, expansion of Contra Costa Water District's Los Vaqueros Reservoir, and others that could be implemented to meet the projected long-term water supplemental need during multi-year drought periods. The UWMP 2015 identifies a broad mix of projects, with inherent scalability and the ability to adjust implementation schedules for particular components, which will allow EBMUD to pursue the necessary supplemental supplies while minimizing the risks associated with future uncertainties, such as project implementation challenges and global climate change. The Environmental Impact Report that EBMUD certified for the Water Supply Management Program 2040 examined the impacts of pursuing these supplemental supply projects at a program level. Separate project-level environmental documentation will be prepared, as appropriate, for specific components as they are developed in further detail and implemented in accordance with EBMUD's water supply needs.

In addition to pursuing supplemental water supply sources, EBMUD also maximizes resources through continuous improvements in the delivery and transmission of available water supplies and investments in ensuring the safety of its existing water supply facilities. These programs, along with emergency interties and planned water recycling and conservation efforts, would ensure a reliable water supply to meet projected demands for current and future EBMUD customers within the current service area.

Water Conservation and Recycled Water Considerations

The proposed Project presents opportunities to incorporate water conservation measures. Conditions of approval for the implementation of the proposed Project should require that the Project comply with the California Model Water Efficient Landscape Ordinance (Division 2, Title 23, California Code of Regulations, Chapter 2.7, Sections 490 through 495). EBMUD staff would appreciate the opportunity to meet with the City to discuss conservation measures. This meeting will explore early opportunities to expand water conservation via EBMUD's conservation programs and best management practices applicable to the Project.

Conservation strategies will be required to achieve water use reduction goals and restrictions, including compliance with Sections 29 and 31, described above, of EBMUD's Regulations Governing Water Service, and all other legally mandated water conservation requirements.

Justin Horner, Associate Planner
March 9, 2021
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The Project is not currently a candidate for recycled water; however, future recycled water pipeline expansions toward the City could potentially serve a portion of the Project boundaries. Recycled water is appropriate for outdoor landscape irrigation, and EBMUD is evaluating options of recycled water for in-building, non-potable use. As EBMUD further plans its recycled water program, the feasibility of providing recycled water to the Project may change. EBMUD encourages the City and its developers to continue to coordinate closely with EBMUD during the planning of the Project to further explore the options and requirements relating to recycled water use.

The Project sponsor should contact Jennifer L. McGregor, Senior Civil Engineer, at (510) 287-1030 for further information.

Sincerely,



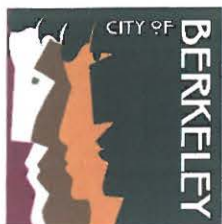
David J. Rehnstrom
Manager of Water Distribution Planning Division

DJR:JML:btf

sb21_022b_Ashby and North Berkeley BART TOD Standards_WSA_Letter.docx

Enclosures: 1. Letter of Request for Water Supply Assessment dated January 4, 2021
2. EBMUD Urban Water Management Plan 2015

cc: Board of Directors w/o Enclosure 2



January 4, 2021

Sent via e-mail to:
drehnstr@ebmud.com

David Rehnstrom
Water Services Planning
East Bay Municipal Utility District
375 Eleventh Street
Oakland, CA 94607

RE: Request for Water Supply Assessment for the Ashby BART Station and North Berkeley BART Station Transit-Oriented Development Zoning Standards Project

Dear Mr. Rehnstrom:

Pursuant to Section 15155 of the California Environmental Quality Act (CEQA) Guidelines and Sections 10910-10915 of the California Water Code, the City of Berkeley requests that EBMUD prepare a Water Supply Assessment (WSA) to determine if there is adequate water supply to meet projected demand for future development under proposed zoning standards at the Ashby BART Station and North Berkeley BART Station.

California Assembly Bill (AB) 2923, passed in 2018, requires the adoption of TOD zoning standards for BART-owned properties within ½-mile of station entrances in Alameda, Contra Costa and San Francisco counties that establish specific local zoning requirements for height, density, parking, and floor area ratio. The Project includes development of standards that comply with AB 2923 and are guided by additional City policy priorities related to affordable housing, an overall emphasis on social equity, and development without displacement. In 2020, the City of Berkeley began a community planning process to develop zoning/site planning scenarios for the Ashby and North Berkeley BART stations to refine into final zoning standards that comply with AB 2923. These sites are shown in Figure 1 and Figure 2.

An EIR will analyze potential environmental impacts of development that could be encouraged by the land use regulation changes in the proposed Project. At the Ashby BART station, the EIR will evaluate the impact of up to 1,200 dwelling units and 100,000 square feet of non-residential space that would be constructed, distributed between the 4.4-acre station site and the 1.9 acre surface parking lot east of the Ed Roberts campus. At the North Berkeley BART station, the EIR will evaluate the impact of up to 1,200 dwelling units, as well as 25,000 square

Mr. David Rehnstrom
January 4, 2021
Page 2

feet of non-residential space, located on the main 8.1-acre station site. The three auxiliary lots located northwest of the station along the Ohlone Greenway are not anticipated to include any new development. Per the Memorandum of Understanding (MOU) between BART and the City of Berkeley, and due to their location directly above the underground BART right of way, it is anticipated that these lots would include only surface infrastructure enhancements.

City Planning staff and its consultant team led by Rincon Consulting are currently in the process of preparing the EIR for this project. The City anticipates releasing draft EIR for public review in Spring 2021.

The City understands that this WSA request is a required part of the environmental documentation for the project and that EBMUD has up to 90 days to prepare the WSA. The timing of this request coincides with the EIR preparation currently underway.

Please contact me at JHorner@cityofberkeley.info if you have any questions or require additional information. Thank you for your time and assistance on this matter.

Sincerely,



Justin Horner
Associate Planner
City of Berkeley

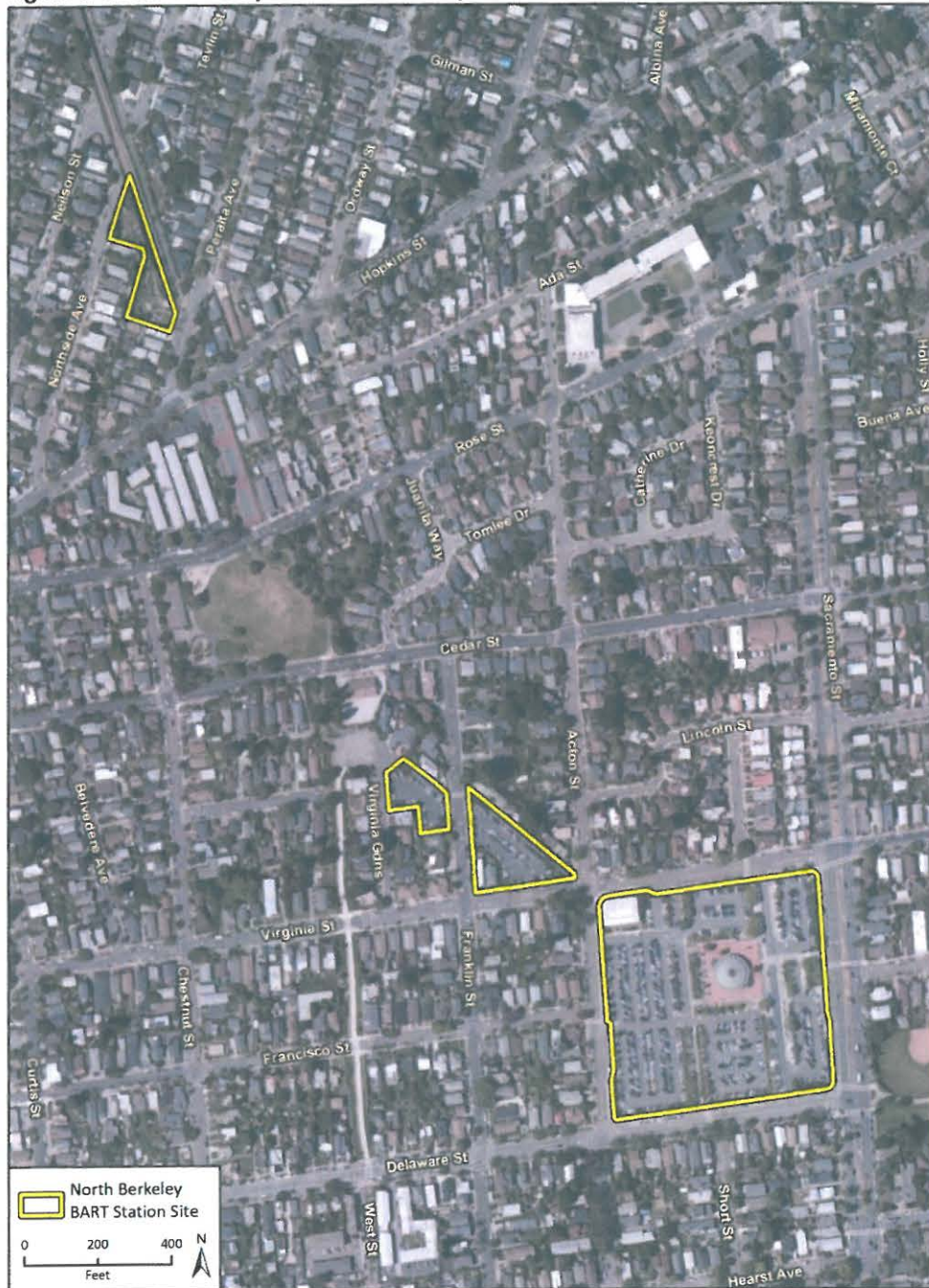
Attachments:

1. Water use estimates for the project
2. EBMUD water use factors used to develop the water use estimate

Figure 1 Ashby BART Station Map



Figure 2 North Berkeley BART Station Map



Imagery provided by Microsoft Bing and its licensors © 2020.

Attachment 1: WATER USAGE ESTIMATES

**Proposed 2030 Water Demand Under the
Ashby BART Station and North Berkeley BART Station TOD Development Standards Project**

Use	Quantity	Unit	Typical water demand (gallons per unit)*	Average Daily Water Demand (gpd)
Ashby BART Station (1, 2)				
Residential	3,000	Person	50	150,000
Non-residential (retail)	100,000	SF	0.388	38,800
			<i>Subtotal</i>	<i>188,800</i>
North Berkeley BART Station (3, 4)				
Residential	3,000	Person	50	150,000
Non-residential (retail)	12,500	SF	0.388	4,850
			<i>Subtotal</i>	<i>154,850</i>
			Total	343,650

Notes:

*Flowrate factors are based on reference material provided by EBMUD (see attachment)

50 gpd/person for high-rise apartments

0.173 gpd/sf for general office (-10 years)

0.388 gpd/sf for department store

(1) Assumed 1,200 units at Ashby BART and 2.5 persons per unit = 3,000 people

(2) Assumed 100,000 square feet of non-residential at Ashby BART, all retail (to be conservative)

(3) Assumed 1200 units at North Berkeley BART and 2.5 persons per unit

(4) Assumed 25,000 square feet of non-residential at NB BART, all retail

Enclosure 2

WASTEWATER ENGINEERING
Treatment, Disposal,
and Reuse

Third Edition

METCALF & EDDY, INC.

Revised by

George Tchobanoglous

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University of California, Davis*

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Commercial facilities. The water used by commercial facilities for sanitary purposes will vary widely depending on the type of activity (e.g., an office as compared to a restaurant). Typical water-use values for various types of commercial facilities are reported in Table 2-3. For large commercial water-using facilities such as laundries and car washes, careful estimates of actual water use should be made.

Institutional facilities. Water used by facilities such as hospitals, schools, and rest homes is usually based on some measure of the size of the facility and the type of housing function provided (e.g., per student or per bed). Water use for schools will vary significantly depending on whether the students are housed on campus or are day students. Representative water-use values for institutional facilities are reported in Table 2-4.

TABLE 2-3
Typical rates of water use for commercial facilities^a

User	Unit	Flow, gal/unit · d	
		Range	Typical
Airport	Passenger	3-5	4
Apartment house	Person	100-200	100
Automobile service station	Employee	8-15	13
	Vehicle served	8-15	10
Boarding house	Person	25-50	40
Department store	Toilet room	400-600	550
	Employee	8-13	10
Hotel	Guest	40-60	50
	Employee	8-13	10
Lodging house and tourist home	Guest	30-50	40
Motel	Guest	25-40	35
Motel with kitchen	Guest	25-60	40
Laundry (self-service)	Machine	400-650	550
	Wash	45-55	50
Office	Employee	8-20	15
Public lavatory	User	3-6	5
Restaurant (including toilet)	Customer	8-10	9
		3-8	6
	Customer	2-4	3
		15-25	20
Shopping center	Parking space	1-3	2
	Employee	8-13	10
Theater	Seat	2-4	3
	Car	3-5	4

^a Adapted in part from Refs. 7 and 8.

Note: gal × 3.7854 = L

TABLE 2-4
Typical water-

User
Assembly hall
Hospital, medical
Hospital, mental
Prison
Rest home
School, day
With cafeteria, g and showers
Without cafeteria
School, boarding

^a Adapted in part from
Note: gal × 3.7854 = L

Recreati
bowling alleys,
involving water

Industrial (No
pal agencies to i
water-using ind
their own suppl
those involved i
ments, may dep
water use to be
Because industr
work to inspect
of both water u

Public Servic
smallest compo
used for public
system mainter
new water line
flushing of sew
sanitary sewer

TABLE 2-9
 Typical wastewater flowrates from
 residential sources^a

Source	Unit	Flow, gal/unit · d	
		Range	Typical
Apartment:			
High-rise	Person	35-75	50
Low-rise	Person	50-80	65
Hotel	Guest	30-55	45
Individual residence:			
Typical home	Person	45-90	70
Better home	Person	60-100	80
Luxury home	Person	75-150	95
Older home	Person	30-60	45
Summer cottage	Person	25-50	40
Motel:			
With kitchen	Unit	90-180	100
Without kitchen	Unit	75-150	95
Trailer park	Person	30-50	40

^a Adapted in part from Ref. 7.

Note: gal × 3.7854 = L

vary with the region, climate, and type of facility. The actual records of institutions are the best sources of flow data for design purposes.

Recreational Facilities. Wastewater flowrates from many recreational facilities are highly seasonal. Typical data on wastewater flowrates from recreational facilities are presented in Table 2-12.

Sources and Rates of Industrial (Nondomestic) Wastewater Flows

Nondomestic wastewater flowrates from industrial sources vary with the type and size of the facility, the degree of water reuse, and the onsite wastewater treatment methods, if any. Extremely high peak flowrates may be reduced by the use of detention tanks and equalization basins. Typical design values for estimating the flows from industrial areas that have no or little wet-process type industries are 1000 to 1500 gal/acre · d (9 to 14 m³/ha · d) for light industrial developments and 1500 to 3000 gal/acre · d (14 to 28 m³/ha · d) for medium industrial developments. Alternatively, for estimating industrial flowrates where the nature of the industry is known, data such as those reported in Table 2-6 can be used. For industries without internal recycling or reuse programs, it can be assumed that about 85 to 95 percent of the water used in the various operations and processes will become wastewater. For large industries with internal water-reuse programs, separate estimates must be made. Average domestic

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Table 1-6. Summary of Commercial and Institutional Water Use.

Type of Establishment or Institution	Selected Parameter	Annual Water Use (gpd/unit)		Maximum Day Water Use (gpd/unit)		Peak Hour Water Use (gpd/unit)	
		Expected	Design	Expected	Design	Expected	Design
Primary and secondary schools							
public elementary	gpd/student	5.38	8.67	9.68	13.00	49.10	52.40
public senior high	gpd/student	5.64	9.75				
public junior high	gpd/student	6.63	12.20	19.60	25.20	121.00	127.00
private elementary	gpd/student	2.24	6.09	3.10	6.92	25.70	29.50
private senior high	gpd/student	10.40	18.60	15.70	23.90	38.70	46.90
combined (grades 1-12)	gpd/student	8.49	18.70	16.80	27.00	51.30	61.50
Colleges							
students in residence	gpd/student	106	179	114	187	250	323
nonresident students	gpd/student	15	*	27	*	58	*
Hospitals							
	gpd/bed	346	559	551	764	912	1120
Nursing homes and institutions							
	gpd/bed	113	209	146	222	424	500
Apartments							
high-rise	gpd/occupied unit	218	322	426	530	745	849
garden-type	gpd/occupied unit	213	315	272	374	671	773
Hotels							
	gpd/sq. ft.	0.256	*	0.294	*	0.433	*
Motels							
	gpd/sq. ft.	0.224	0.326	0.461	0.563	1.55	1.65
Office buildings							
general offices (- 10 years)	gpd/sq. ft.	0.093	0.164	0.173	0.244	0.521	0.592
general offices (+ 10 years)	gpd/sq. ft.	0.142	0.273				
medical offices	gpd/sq. ft.	0.618	*	1.660	*	4.970	*
Department stores							
	gpd/sq. ft. of total sales area	0.216	0.483	0.388	0.655	0.958	1.230
Car washes							
	gpd/sq. ft.	4.78	*	10.3	*	31.5	*
Service stations							
	gpd/sq. ft. of garage & office space	0.251	0.485	0.590	0.824	4.890	5.120
Laundries							
commercial laundries & dry cleaners	gpd/sq. ft.	0.253	0.639	0.326	0.712	1.570	1.960
laundromats	gpd/sq. ft.	2.170	6.390	*	*	*	*
Restaurants							
drive-ins (parking only)	gpd/car space	109.0					
drive-ins (seating & parking)	gpd/seat	40.6					
conventional restaurants	gpd/seat	24.2	55.2	83.4	114	167	198

(continued)