Water and Wastewater Career Pathways

Connecting People to Water Industry Jobs in the Bay Area

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Jewish Vocational Service transforms lives by helping people to build in-demand skills and make connections to find good jobs.

BAYWORK is a consortium of Bay Area water and wastewater utilities working together to ensure that we will have the reliable workforce needed to serve our customers and protect the environment.

The Centers of Excellence, in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development.

Important Disclaimer

All representations included in this report have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings; however, neither the Centers of Excellence, COE host District, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon components or recommendations contained in this study.

Contents

Acknowledgements 2

Executive Summary 3

Introduction 6

Industry Overview 8

Industry Demand for Mission-Critical Skilled Trades 10

Training and Education for Mission-Critical Skilled Trades 15

Gaps in the Water and Wastewater Career Pathway 15

Detailed Recommendations and Best Practices 18

Glossary 22

Appendices 23

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Bay Area Council
California Water Environment Association
Sonoma County Water Agency
The San Francisco Foundation

BAYWORK would also like to thank the 43 utilities in the six-county region of the Bay Area who took the time to complete the workforce survey. These survey results provide critical information about the workforce needs and requirements of water and wastewater utilities. This information is vital for Bay Region community colleges, foundations, workforce intermediaries, other government agencies and community organizations that are strengthening training and education pathways for the water and wastewater sector.

Alameda County Water District
Central Contra Costa Sanitary District
Central Marin Sanitation Agency
City of Brentwood
City of Daly City
City of Fairfield
City of Gilroy
City of Hayward
City of Livermore
City of Menlo Park Municipal Water District
City of Pittsburg
City of Pleasanton
City of Redwood City
City of Richmond
City of San Jose
City of San Leandro WWTP
City of San Mateo
Coastside County Water District
Contra Costa Water District
Delta Diablo
Diablo Water District
Dublin San Ramon Services District
East Bay Municipal Utility District
Fairfield-Suisun Sewer District
Ironhouse Sanitary District
Montara Water and Sanitary District
Napa Sanitation District
North Marin Water District
Oro Loma Sanitary District
Ross Valley Sanitary District
San Francisco Public Utilities Commission
San Jose Water Company
Santa Clara Valley Water District
Silicon Valley Clean Water
Sausalito-Marin City Sanitary District
South San Francisco Water Quality Control Plant
Town of Hillsborough
Union Sanitary District
Veolia North America
West County Wastewater District
West Valley Sanitation District
Westborough Water District
Zone 7 Water Agency

Water and wastewater agencies and utilities in six Bay Area counties are projected to hire as many as 800 staff in nine mission-critical occupations over the next three years.

Source: BAYWORK/Centers of Excellence

Executive Summary

The water and wastewater industry in the Bay Area is approaching a crisis point in workforce reliability. The number of qualified applicants entering career pathways in water and wastewater skilled trades is declining. This is converging with the significant number of retirements scheduled for the next three to five years, leading to a lack of talent in our most critical water and wastewater jobs.

This challenge presents a unique opportunity to link job seekers to high paying, stable jobs, that are also frontline environmental stewards and protect the people and the environment of the Bay Area.

The purpose of this report is to communicate the role of water and wastewater utilities, nonprofit organizations, foundations, unions, state, local, and national government agencies, and education providers in building career pathways to skilled trades careers in the Bay Area water and wastewater industry. **The impending retirement crisis facing the industry offers a rare workforce development opportunity that could help struggling job seekers acquire the training, experience and connections they need to access family-sustaining employment and stay in the Bay Area.**

Since 2008, the Bay Area water and wastewater industry organized around a shared problem of workforce reliability. Water industry leaders in the region were concerned about the declining pipeline of talent entering careers in water and wastewater and the impending need to capture knowledge from experts set to retire. The San Francisco Public Utilities Commission, the Santa Clara Valley Water District, East Bay Municipal Utility District, and Union Sanitary District organized to create BAYWORK in 2009 and called for a collaborative, regional response to these problems to develop qualified candidates for water and wastewater jobs, train workers in new and emerging technologies, and share best practices.

In 2009, BAYWORK, in partnership with the San Francisco Bay and Greater Silicon Valley Centers of Excellence for Labor Market Research, developed the Water Industry Environmental Scan Report in order to provide up-to-date industry data and hiring projections to support stronger coordination between industry and the community colleges that provide training.

In 2016, BAYWORK collaborated with Jewish Vocational Service (JVS) San Francisco to reassess industry needs and training program offerings and identify the gaps in career pathways from high school to journey level careers in the skilled trades. After securing funding through a California Workforce Development Board Accelerator 3.0 grant, JVS and BAYWORK worked with the San Francisco Bay Center of Excellence for Labor Market Research (COE) and the Deputy Sector Navigator for Agriculture, Water and Environmental Technologies (AGWET) for the Bay Area Community Colleges to update the research done in 2009 by surveying water and wastewater agencies and utilities in six Bay Area counties.[1]

This report identifies the workforce needs of employers related to nine mission-critical occupations. The report is concerned with the technical-level segment of the workforce, also called the 'skilled trades' or 'mission-critical' careers, which are closely aligned with community college education programs. Forty-three out of the 77 agencies and utilities that were identified by BAYWORK in the six-county region responded to the survey.

- Water and Wastewater agencies and utilities reported that they would have as many as 828 job openings over the next three years in these nine mission-critical occupations.
- The clear majority of these openings—as many as 600—would be due to current workers who are eligible to retire during that same time period. In addition, employers reported a need to hire 236 workers due to vacancies in the past 12 months.
- The survey results indicate that over 50% of employers are having difficulty hiring qualified candidates for all nine occupations, and over 90% of employers indicated difficulty in hiring Electricians and Electronic Maintenance/Instrument Technicians.

1 San Francisco, Marin, Alameda, Contra Costa, San Mateo, Santa Clara

In addition to understanding the anticipated hiring need, difficulty in hiring, and barriers to hiring, the report includes a rigorous analysis of the gaps in the career pathways from high school to journey level employment and the available training resources for the three highest-need positions: Electrician, Machinist, and Electronic Maintenance Technician/Instrument Technician.

The analysis of gaps in career pathways for all water and wastewater skilled trades reveals clear patterns, which inform the following recommendations:

- There is a widespread **lack of awareness of the industry and the trades** limiting the pipeline of candidates entering relevant training programs.
  RECOMMENDATION: Expand current programs for improving the awareness of the water and wastewater industry and skilled trades jobs among students, parents, teachers, and counselors.
- Young people with barriers to employment often **lack the basic skills**, including math, science and English skills, needed to enter those programs.
  RECOMMENDATION: Support high school students to graduate with the math, science, and communication skills needed for success in career technical training.
- The Bay Area **lacks classroom training** required to learn skilled trades and receive necessary certification linked to the water and wastewater industry.
  RECOMMENDATION: Offer dual enrollment for high school students to enroll in community colleges and earn credit toward technical degrees and develop pre-apprenticeship training programs to prepare students for advanced training (such as apprenticeships and on-the-job training) in the trades.
- Agencies indicate that the greatest barrier to recruiting fully qualified candidates is the **lack of relevant work experience.**
  RECOMMENDATION: Increase the pipeline of qualified candidates for journey level and supervisory positions in utilities by developing and posting more sub-journey level job and internship opportunities.
- **Tuition, fees, and the income lost by taking unpaid work** (i.e. internships) are major barriers for students who must support themselves and their families financially.
  RECOMMENDATION: Reduce barriers to entry for job seekers pursuing careers in the water and wastewater industry by offering more financial support to students seeking classroom training and on-the-job training.

The following graphic representation shows how these five recommendations and accompanying strategies could work together to achieve our goal of a workforce pipeline that connects talented and diverse job-seekers to mission critical roles in the water and wastewater industry. Throughout the report, there are references to these recommendations. For a more detailed description of these recommendations, including specific actions and needed resources, refer to the Detailed Recommendations and Best Practices that follows this report.

Recommendations to Address Gaps in Career Pathways

Recommendation	Strategy	Tactics	Stakeholder Commitment
Increase awareness of industry and trades	Expand Existing Awareness Campaigns	Create strong, customized messaging	Funding to support outreach activities
		Expand career fairs, internships & tours	Agencies host activities & internships
		Develop industry-specific, contextualized curriculum	Funding for culturally competent, wrap-around services
	Collaborate with peer industries to address common training needs	Convene local training providers to design scalable, cross-sector programs	Training providers to collaborate on identified needs
		Design system to cross-refer applicants across industries	Employers to create a cross-referral system
		Support regional, multi-sector efforts to solve workforce challenges	Employers to collaborate on identified needs
Increase classroom training capacity	Effectively connect students to technical training	Offer students the ability to earn high school & college credit concurrently	Funding from school systems
		Develop pre-apprenticeship training courses	Funding for pre-apprenticeship & apprenticeship costs
		Develop more EMT/IT training capacity	
	Address the need for qualified instructors with industry experience	Identify agency staff to provide instruction	Agencies to provide qualified instructors
		Identify best practices among industry/ school partnerships	Agencies & training providers to address identified barriers
Increase entry-level job opportunities for mission-critical positions	Develop more sub-journey level job opportunities for targeted trades	Identify existing underutilized apprenticeship agreements	Agencies & unions to develop sub-journey level positions
		Train & support worksite supervisors	Funding to support costs of instruction & supervision
		Create & share best practices guide	Agencies to collaborate to identify best practices
	Develop opportunities to ensure successful onboarding of sub-journey workers	Provide mentoring & job shadowing opportunities	Agencies & unions to identify & prepare mentors
Increase readiness of youth & other job seekers for the trades	Ensure students have the required skills to qualify for & succeed in jobs	Clearly communicate the required skills for technical training & entry-level jobs	Clear messaging about minimum requirements
		Incorporate water/wastewater curriculum in STEM courses	Schools to incorporate lesson plans into curricula
		Increase the availability of career/ college counseling available to students pursuing the trades	Funding from schools to increase counseling resources
Address financial barriers to training leading to the trades	Offer more financial support for classroom & on-the-job training	Expand access to apprenticeships	Agencies to support apprentice wages
		Communicate information about employer-sponsored education benefits	Agencies to provide access to education benefits
		Offer more financial aid to students pursuing trades training	Funding to support financial aid for students enrolled in trades training

Introduction

This report is one of several deliverables resulting from the Water and Wastewater Career Pathways project led by BAYWORK and JVS, funded through a California Workforce Development Board Accelerator 3.0 grant. **The purpose of the Water and Wastewater Career Pathways project is to identify career pathways for mission-critical roles, engage training programs and industry in a shared dialogue about gaps in regional availability of training, and ultimately design pathways from training into employment, leveraging BAYWORK's roles as a hub and convener of employers.** This project increases awareness of, and exposures to, careers in the water and wastewater industry, especially among under-represented groups, and supports diversity within the workforce by connecting vulnerable job seekers to stable jobs in water and wastewater management.

The operational reliability of water and wastewater utilities depends on having both sufficient staffing in mission-critical classifications and staff who are sufficiently prepared to do their work.[2]

BAYWORK members collaborate to ensure the long-term viability of both their individual agencies as well as the broader Bay Area water system. Two key strategies for addressing short- and long-term labor needs have emerged from BAYWORK's efforts:

- Get enough of the right people in mission-critical positions, and
- Give staff information they need to do quality work.

JVS is a workforce development organization and workforce intermediary experienced in developing strong sector strategies. JVS works with multiple employers within a sector, and partners closely with training providers to develop training programs and approaches that meet employer needs for skilled workers while also addressing the training and employment needs of job seekers with barriers to employment.

The California Community Colleges Chancellor's Office has charged the Centers of Excellence for Labor Market Research with identifying industries and occupations with unmet employee development needs and with initiating partnerships that hold potential for regional colleges' programs. The San Francisco Bay Center of Excellence for Labor Market Research serves the 28 community colleges in the 12-county Bay Area.

The Centers of Excellence for Labor Market Research, BAYWORK, and JVS developed this report to accomplish the following:

- Raise awareness of significant workforce needs facing the water industry in the near future.
- Identify high-need jobs in the water industry that lack an adequate pool of qualified candidates.
- Clearly communicate opportunities for water and wastewater utilities, nonprofit organizations, foundations, unions, state, local, and national government agencies, and education providers to create pathways that connect young people and others with barriers to employment.

Research Methods

This report presents the results from two primary research activities. **The first activity was conducting a workforce survey with Bay Area water and wastewater utilities, using a survey co-created by BAYWORK and JVS.**

To estimate the total number of water and/or wastewater utilities and agencies in the region, the following inputs were considered.

- A comprehensive database of utilities and agencies in the six target counties.
- A post-survey review of the database compared the original list to the responding agencies (sample) for duplications and other errors.

These inputs were analyzed and the total number for the database was then combined into the "universe of employers" estimate (77).

Forty-three (43) employers, representing a combined workforce of more than 5,900 employees in water and/or wastewater departments or sections, responded to the survey. These respondents came from carefully selected water and/or wastewater utilities or agencies identified through BAYWORK as employing one or more of the nine target occupations. The respondent's size and regional location were recorded where possible. Caution should be used in generalizing results to the entire population of employers to the degree that the sample may differ from the universe of water and wastewater agencies.

This workforce study focused on gathering both quantitative and qualitative data from these employers about the following:

2 BAYWORK Charter, http://baywork.org/about-us/charter-and-signatories/

- The current number and size of utilities, as well as geographic concentration.
- Numbers of vacancies by occupation during the past 12 months.
- Numbers of workers eligible to retire within the next three years in mission-critical occupations.
- Employer needs and challenges for hiring and training employees.
- Skill sets and education requirements needed for key occupations.
- Career pathways within the industry.
- Industry interest in accessing community college education and training programs.

BAYWORK and JVS selected nine occupations for study because (1) their work is essential to reliable water and wastewater operations and (2) there were concerns about whether sufficient numbers of qualified candidates would be available to fill current and future vacancies. The nine "mission-critical" occupation definitions are:

Water Treatment Operator: Performs water treatment function. T-3 certification from Department of Health Services is generally where the journey level starts.

Water Distribution Operator: Operates water transmission and distribution systems (e.g., pumps and valves), often using a SCADA control system. Generally does not perform construction, maintenance, or plumbing work. D-3 certification from Department of Health Services is generally where the journey level starts.

Wastewater Treatment Operator: Performs wastewater treatment function. Usually requires Grade 3 certification by Regional Water Quality Control Board.

Wastewater Collections Operator: Performs wastewater collections function. Usually requires Grade 2 certification by California Water Environment Association.

Machinist: Maintains mechanical equipment associated with water and wastewater transmission, distribution, storage, and treatment.

Electrician: Maintains, repairs, tests, installs, modifies, calibrates, and trouble-shoots electrical equipment used in the facilities and systems of water and wastewater utilities.

Electronic Maintenance/Instrument Technician: Maintains, repairs, tests, installs, modifies, calibrates, and trouble-shoots electronic, pneumatic, and control equipment associated with the facilities and systems of water and wastewater utilities.

High Voltage Electrician: Installs, maintains, repairs high voltage electrical wiring, equipment, and fixtures, and ensures that work is in accordance with relevant codes.

Heavy Equipment Operator: Operates one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement.

The second research activity focused on the supply of qualified candidates to meet water and wastewater agency demand for mission critical positions. This included a survey of Bay Area community college programs related directly to occupations in water and wastewater operations and to the Machinist, and Electrical Maintenance Technician/Instrument Technician trades. The survey results identified certificate and degree programs that colleges offer and apprenticeship programs that can supply qualified workers for employer job openings. This also included in-depth interviews with subject matter experts from unions and community colleges to identify gaps in training and education.

Figure 1 below illustrates the method used to select the three highest-need positions: Electrician, Electronic Maintenance/Instrument Technician, and Machinist. The approximate scale (number of positions) and the difficulty to hire for those positions is shown below and demonstrated in the pyramid graphic. Starting from the bottom of the pyramid to the top, each position increases in difficulty to hire and decreases in scale. The three positions highlighted in the middle of the pyramid below constitute sufficient scale, accessibility through training and certification, and job quality.

In this report, these positions are classified as high need, fulfilling both a vital workforce need to employers and potential to provide meaningful employment to job seekers. This designation is used to focus the research on career pathways and gaps, further explored in **Gaps in the Water Wastewater Career Pathways** section.

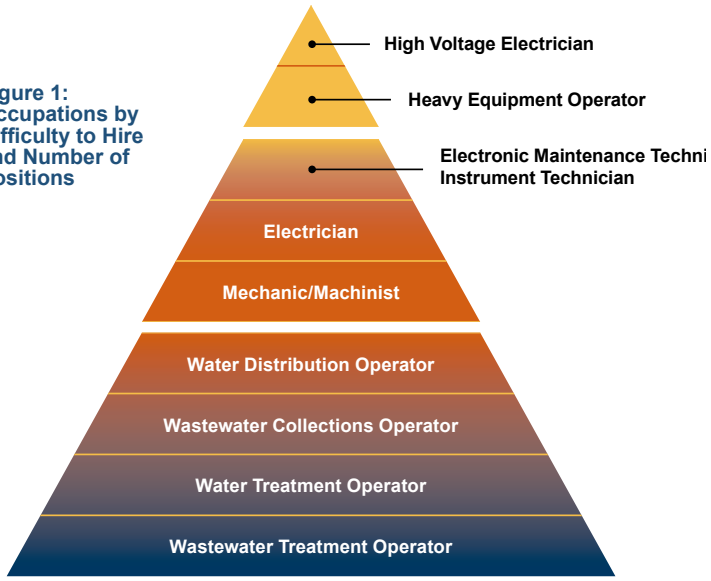


Figure 1: Occupations by Difficulty to Hire and Number of Positions

Industry Overview

Impact of the Water Industry

Maintaining our region's water system depends on an adequate and prepared workforce. The water and wastewater industry offers a wide range of high quality, career pathway jobs in a stable industry, which is fundamental to the rest of the Bay Area economy. At the same time, these efforts could not only help build a stronger and more diverse workforce for the water industry, but also build out sustainable local feeder programs for entry-level employees who are more likely to stay with their local utility agency long-term.

Water and wastewater jobs pay well and provide opportunities for advancement along a career pathway of increasing skills and wages. Table 1 below summarizes the estimated salary range for skilled trades positions in the Bay Area based on the 2014 BAYWORK salary survey:

Table 1: Salary Range Data

Occupation	Journey Level Salary Range[3]
Electrician	$79,000–$96,000
Electronic Maintenance Technician / Instrument Technician	$80,000–$96,000
Heavy Equipment Operator	$73,000–$80,000[4]
Mechanic/Machinist	$70,000–$85,000
Wastewater Collections Operator	$63,000–$80,000
Wastewater Treatment Operator	$69,000–$85,000
Water Distribution Operator	$62,000–$77,000
Water Treatment Operator	$75,000–$90,000

Recommendation: BAYWORK should expand existing industry awareness campaigns, including career fairs, student internships and teacher externships.

The nine jobs studied for this report are middle-skill jobs requiring more education than high school, but less than a four-year degree—and are well within reach for lower-skilled and low-income workers, if they have access to effective training programs and appropriate supports. However, middle skill jobs in this sector require workers to get continuous training and certifications in their job and may require several years of classroom training and work experience to be qualified for journey level positions.

Understanding the Water Workforce

Water, wastewater, and stormwater utilities will contribute $524 billion to the U.S. economy over the next decade, supporting 289,000 permanent jobs.[5] The workforce includes occupations that relate directly to collection, treatment and distribution of water or wastewater as well as the maintenance, repair, and construction of related systems, technology and infrastructure. It is difficult to define the size and scope of the workforce due to the incorporation of public utility employment data in government sector data (as opposed to its own separate classification) or integration of those performing support functions for the industry into broader occupational groups (e.g., Mechanic/Machinist). From 2014 to 2023, the operating and capital expenditures of the participating utilities will generate $52 billion per year in total annual economic output across the United States. This results in a national economic contribution of $524 billion over the next decade, supporting approximately 289,000 permanent jobs. These jobs encompass employment that will be provided by the utilities (their direct effects), within other industries that are supported by utility expenditures, and employee wages (their indirect and induced effects).[6]

Like many industries, water and wastewater agencies are confronting a series of changes to their workforce at the same time as they are managing an evolution in the way they perform and deliver their services. According to the Bureau of Labor Statistics, the median water sector employee is 48 years old—six years senior to the national median employee age of 42. Meanwhile, the typical water and wastewater employee retires at age 56.[7] The American Water Works Association's 2017 *State of the Water Industry Annual Report* states: "Workforce issues continue to be a concern the water industry with 'Aging workforce/ anticipated retirements' rated as #12, 'Talent attraction and retention' rated as #14, and 'Certification and training' rated as #23 among the most important issues. The water industry seems to face difficulty in recruiting, training, and retaining skilled employees, especially for small systems. Likewise, a large number of water industry employees are nearing or are currently eligible for retirement; this group represents a significant amount of institutional knowledge that could be lost without proper succession planning and process documentation.

3 BAYWORK Salary Survey, 2014
4 Estimated range from Bureau of Labor Statistics data for Operating Engineers for the SF Bay Area, 2016, Standard Occupational Classification (SOC) code for the Heavy Equipment Operator - 47-2073
5 National Economic Labor Impacts of the Water Utility Sector Executive Report, Water Research Foundation and Water Environment Research Foundation, 2014
6 Ibid, page 2.
7 BLS-3. 2013. Employed Persons by Detailed Industry and Age. Available at: www.bls.gov/cps/industry_age.xls

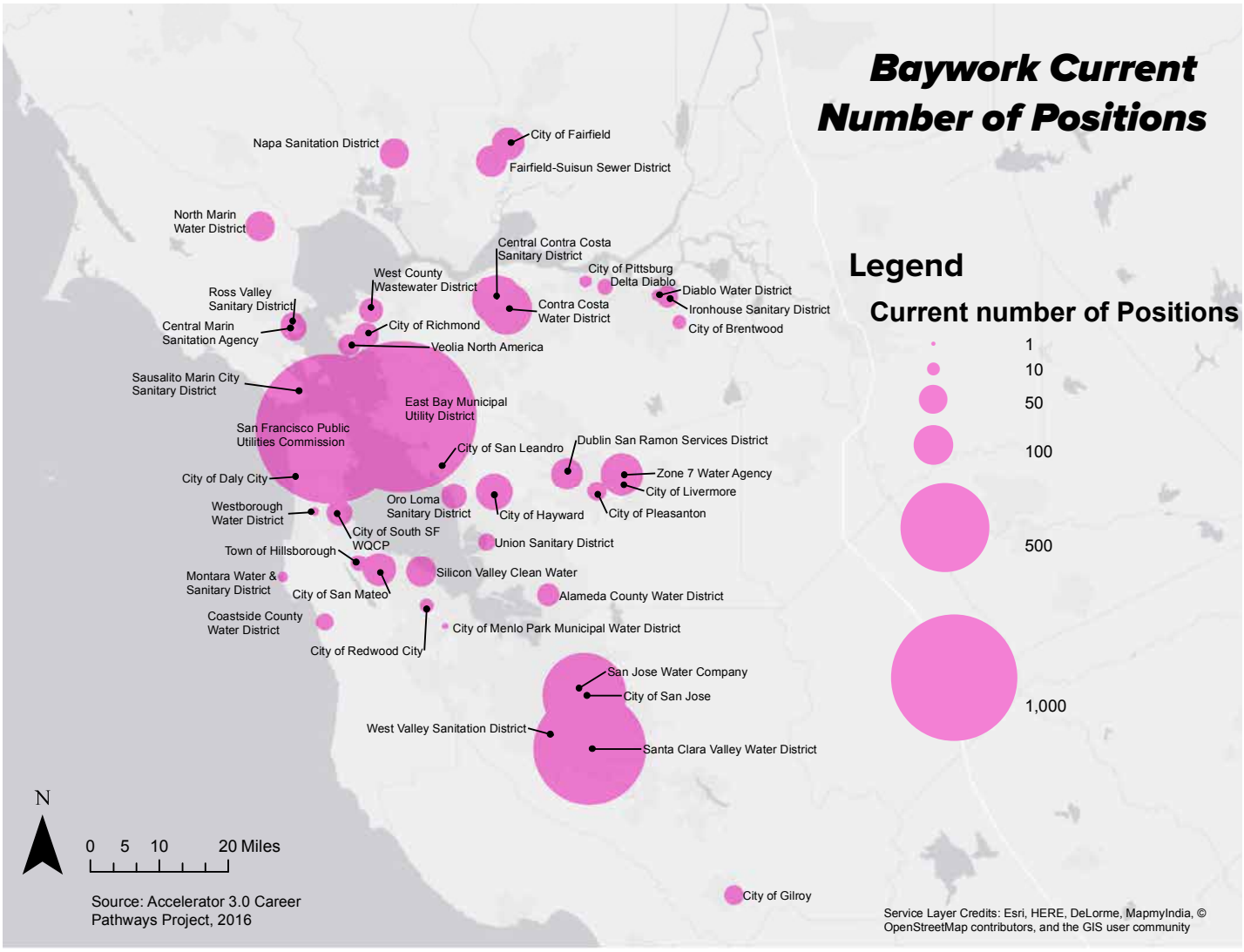
Recommendation: Agencies should explore opportunities like mentorship and job shadowing to ensure successful onboarding and knowledge transfer.

Number and Size of Utilities in the Bay Area

Map 1 below shows total budgeted positions at the 43 responding agencies. Most of the water and wastewater departments or sections are small, with a majority (60%) reporting fewer than 50 employees.

BAYWORK has member agencies ranging in size from 2,300 employees to 10 employees. Regardless of scale, BAYWORK agencies share a need to develop a strong talent pool for skilled trades. For small utilities, BAYWORK may provide value as an outreach and awareness program where none exists due to a small staff and outreach budget. For larger utilities, BAYWORK provides value as a platform to lead the Bay Region in best practices and scale utility-level solutions to workforce challenges to strengthen to overall talent pipeline in the Bay Area. As a coalition of like-minded and proactive water utilities, BAYWORK leads as a national example of collaboration.

Map 1



Industry Demand for Mission-Critical Skilled Trades

Water and wastewater agencies are facing a workforce gap in mission-critical skilled trades. This gap comes from an aging workforce, difficulty hiring qualified applicants, and a lack of internal career pathways to promote within agencies. The gap between hiring needs and qualified applicants affects agencies' ability to deliver essential water and wastewater services.

Table 2 below contains the data collected from 39 agencies for the nine mission-critical occupations, using a three-year period. For each occupation, employers were asked to detail their current number of budgeted positions, vacancies during the past 12 months, and retirement eligibility for workers (without penalty) within the next three years. For each occupation, the following job levels were included: apprentice or trainee, journey level, and supervisory.

Results show an average retirement risk[8] of 26% and vacancy rate[9] of 10%. This combines to a maximum potential hiring need[10] of 36%. See Appendix A for detailed maps of maximum potential hiring need for the top three mission-critical positions, Electrician, Mechanic/Machinist, and EMT/Instrument Tech by each responding agency.

Based on the survey responses, the combined totals for the nine occupations within the next three years could result in up to **828 open positions due to vacancies and possible retirements for the Bay Area economy.**

Other highlights include:

- Surveyed agencies employ almost 2,300 workers in the nine skilled trades occupations.
- Wastewater treatment operator is the largest occupation surveyed, with more than 530 budgeted positions in 2016. Retirement eligibility for wastewater treatment operators may be as high as 32% within the next three years. The maximum job openings over this period for this occupation, when both vacancies and possible retirements are combined, would be about 230 openings.
- Mechanic/Machinist has the second highest potential demand for workers. Retirement eligibility for this occupation may be as high as 33% within the next three years. The maximum job openings over this period for Mechanic/Machinist, when both vacancies and possible retirements are combined, would be just over 120 openings.

Table 2: Vacancies and Retirement Data by Occupation

Water and Wastewater Occupations	2016 Budgeted Positions	Vacancies in Last 12 Months	Vacancy Rate	Eligible to Retire Within 3 Years	Retirement Risk	Maximum Openings Within 3 Years	Maximum Replace-ment Rate
Wastewater Treatment Operator	537	58	11%	173	32%	231	43%
Wastewater Collections Operator	520	38	7%	74	14%	112	22%
Water Treatment Operator	305	29	10%	90	30%	119	39%
Mechanic/Machinist	275	31	11%	92	33%	123	45%
Water Distribution Operator	214	19	9%	41	19%	60	28%
Electronic Maintenance Technician / Instrument Technician	145	30	21%	42	29%	72	50%
Electrician	127	10	8%	44	35%	54	43%
Heavy Equipment Operator	108	17	16%	28	26%	45	42%
High Voltage Electrician	45	4	9%	8	18%	12	27%
Total	**2276**	**236**	**10%**	**592**	**26%**	**828**	**36%**

8 Retirement risk is the percentage of workers in a job category that will be or are currently eligible to retire in the next three years.
9 Vacancy rate is the portion of current positions that are recently vacant (within the last 12 months) to approximate the positions that will likely be filled
10 Maximum replacement rate is the maximum potential open positions in the next three years. This approximates the highest potential number of openings based on number of current employees eligible to retire in three years and current vacancies.

- Water Treatment Operator is the third largest occupation, with over 300 budgeted positions. Retirement eligibility for this occupation may be as high as 30% within the next three years. The maximum job openings over this period for Water Treatment Operator, when both vacancies and possible retirements are combined, would be about 120 openings.

Agencies experience some or great difficulty in hiring for all of the occupations studied. Figure 2, below, shows each occupation and how surveyed agencies that employ that occupation report difficulty to hire qualified candidates.

Figure 3, bottom, shows the top three reasons agencies have a difficult time hiring for positions in the mission-critical trades and the percentage of agencies that reported each reason as contributing to hiring difficulty.

Figure 2: Measuring the Workforce Gap: Difficulty Hiring Skilled Trades

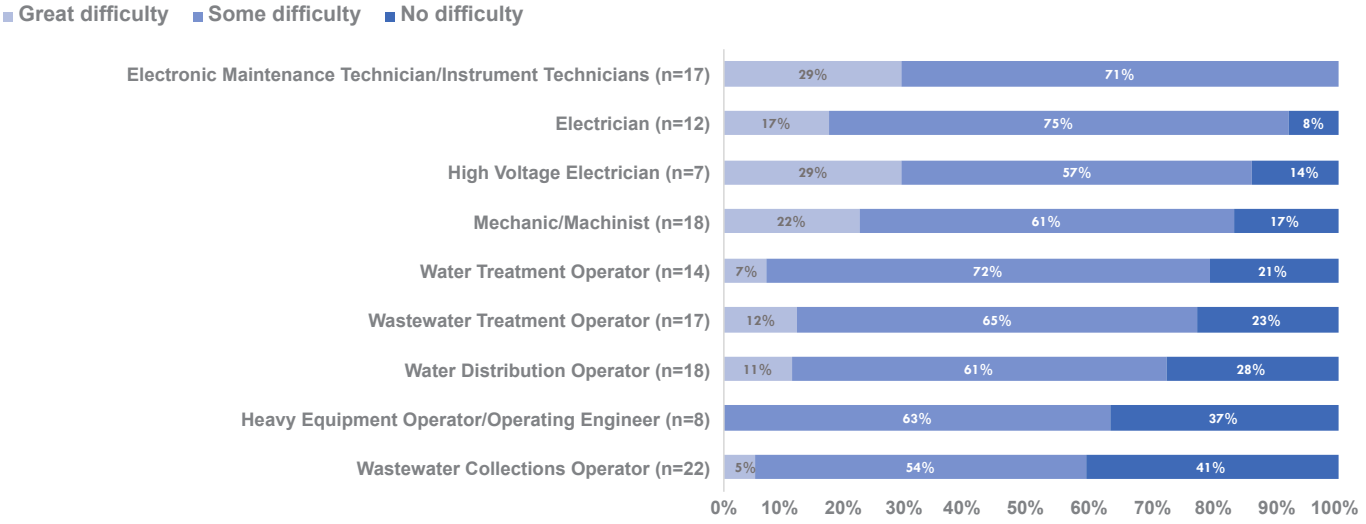
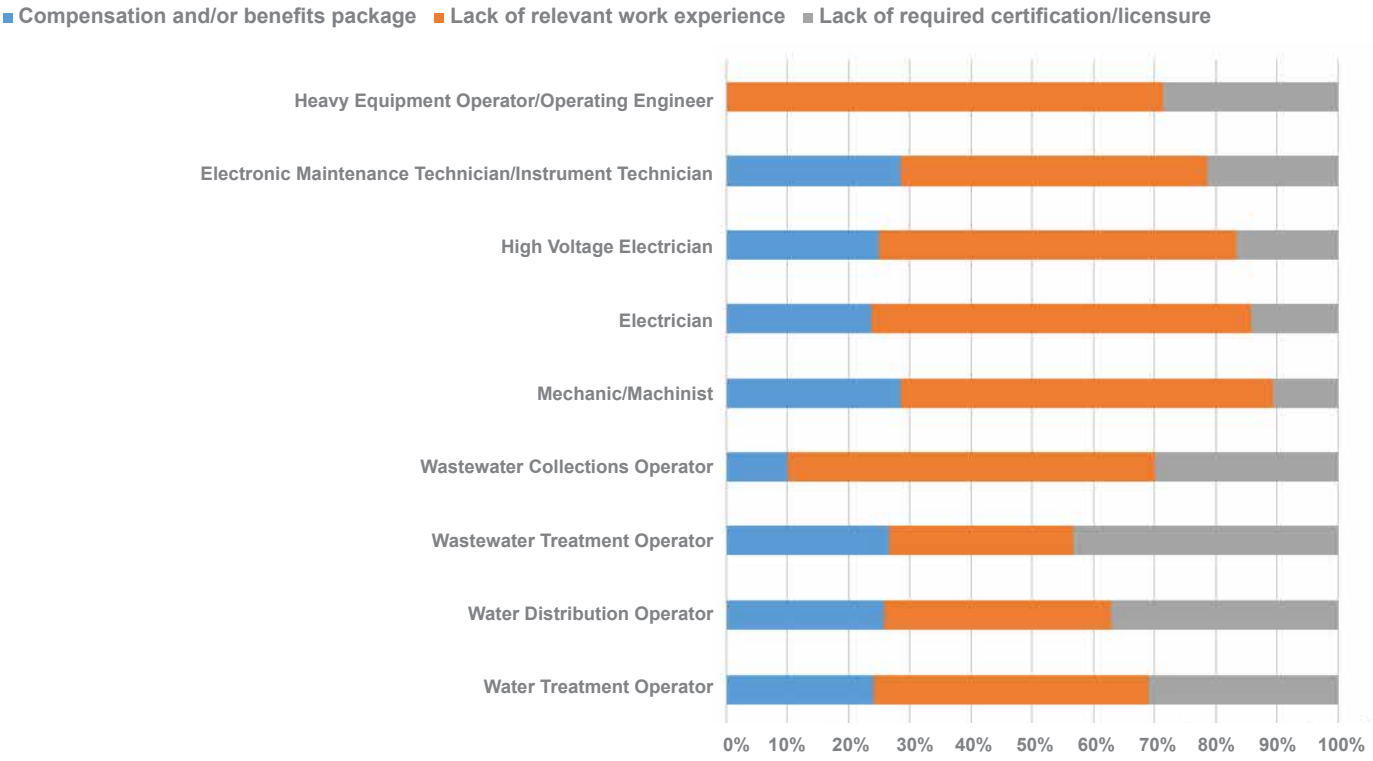


Figure 3: Factors Contribution to Hiring Difficulties



The top three reasons are:

- Applicants lack relevant work experience.
- Applicants reject an offer of employment to take a more competitive wage, benefits package, or more timely job offer.
- Applicants lack required certification or licensure.

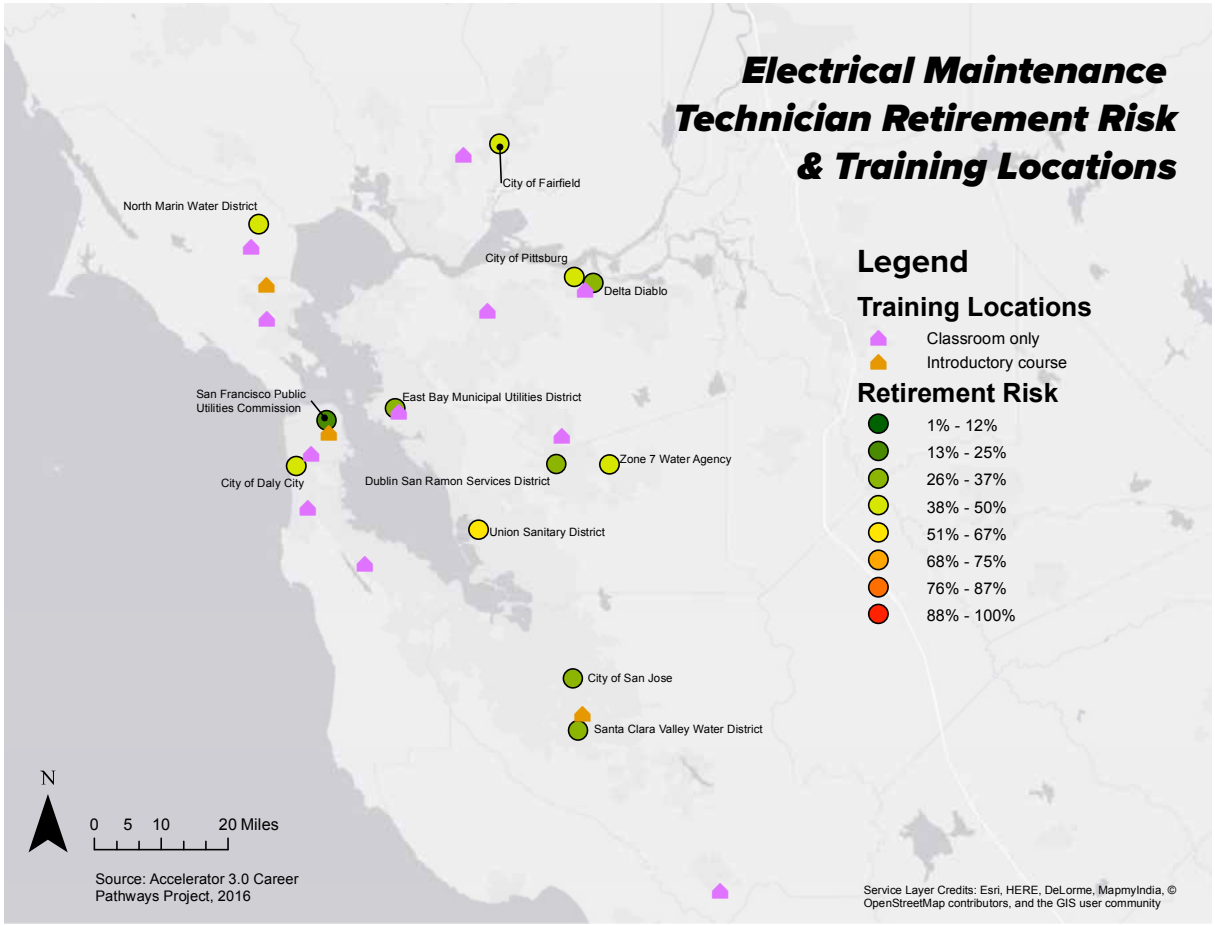
Agencies may have a hard time competing for qualified candidates against organizations offering, in some cases, higher compensation or more nimble hiring processes. Civil service onboarding processes can create a lag between job posting and hiring for the position. In addition, **for trades such as electrician, instrument technician, and machinist, qualified applicants have access to employment opportunities in sectors that may pay higher bonuses or hourly rates.**

Survey results show there is a **mismatch between the demand for applicants in the skilled trades and the supply of qualified applicants. BAYWORK agencies are looking for skilled trades workers with high levels of experience, certification, and training. These requirements often out-pace the certifications and work experience of applicants**.

Recommendation: Agencies should increase entry-level job opportunities by developing more apprentice, intern, and trainee positions.

Another factor contributing to the lack of applicants with adequate work experience for skilled trades positions is the lack of entry-level positions within agencies. Of all of the 2,276 positions in the nine mission-critical trades reported in the survey results, only 9% (226) are trainee, apprentice, or intern positions. **Most BAYWORK agencies hire journey level workers, which requires completed apprenticeship, certification, or years of experience to qualify.** However, there is a lack of apprenticeship opportunity in the Bay Area for the Electronic Maintenance/Instrument Technician trade and few clear connections between existing Electrician and Machinist/ Mechanic apprenticeships and the water and wastewater industry. Map 2, below, shows training locations for the Electronic Maintenance/Instrument Technician trade—there are no apprenticeships for this trade recorded through the research effort.

Map 2



In the Bay Area there many apprenticeships and work-based learning programs leading the Mechanic/Machinist and Electrician trades.[11] However, the apprenticeships have limited effectiveness for the Mechanic/Machinist and Electrician water and wastewater agencies. Utilities are not connected to Electrician apprenticeship programs, but do report a need to attract and recruit apprenticeship graduates. When surveyed about factors contributing to difficulty hiring Electricians, 13 agencies indicated a lack of relevant work experience among applicants and three of those agencies indicated a lack of required certification/ licensure among applicants. These two issues are typically addressed in apprenticeship programs.

Most Electrician apprenticeships in the Bay Area are sponsored by one union, IBEW, which may affect the ability of some agencies to benefit from Electrician apprenticeships as their Electricians belong to a different union. Utilities do not typically hire apprentices for most of the mission-critical positions. There are 34 budgeted apprentice positions across 43 agencies, most of which are for the Water Treatment Operator and Wastewater Treatment Operator positions. **For the three highest-need positions (Electrician, Mechanic/Machinist, and Electronic Maintenance Technician/Instrument Technician), those 43 agencies identified two budgeted apprentice positions.** For some positions, such as the Electronic Maintenance Technician/Instrument Technician position, there are currently no apprenticeship programs available in the Bay Area. In addition, some unions such as AFSCME, do not currently sponsor apprenticeship programs.

The survey data from Table 3 below demonstrates this point. Agencies reported a total of 42 sub-journey level budgeted positions for the three highest-need positions. This data supports our recommendation that agencies increase the availability of sub-journey level positions in these critical positions.

Table 3: Sub-journey level Positions by Occupation

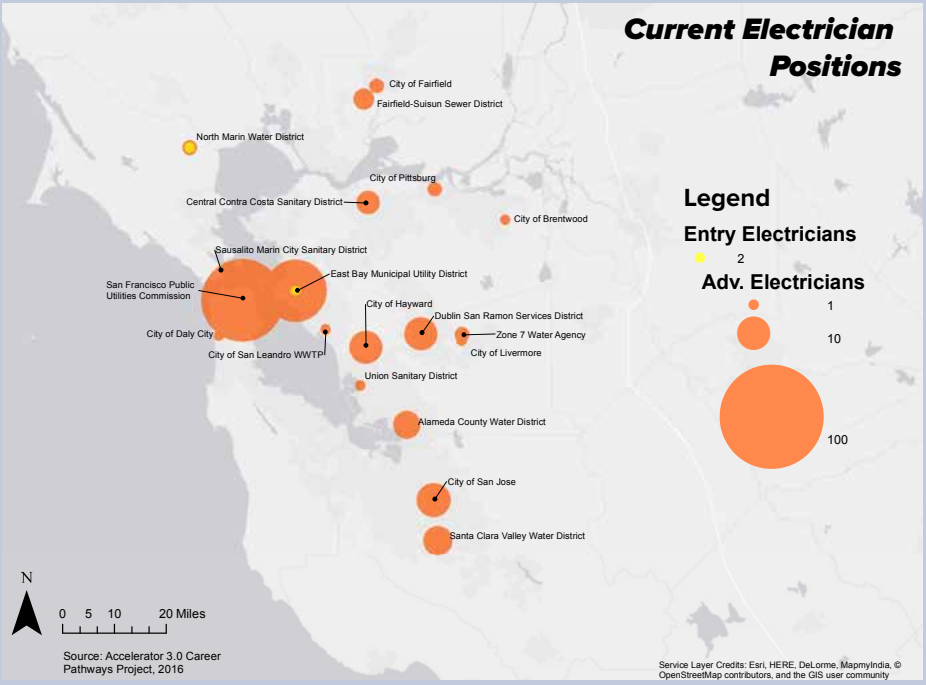
	Current Full-time Budgeted Positions	Number of Full-time Budgeted Entry-level Positions (SUB Journey level)	% Entry level Within Occupation	Current Vacancies Budgeted For But Currently Vacant	% Vacancies Within Occupation
Electronic Maintenance / Instrument Technician	145	8	6%	30	21%
Heavy Equipment Operator	108	8	7%	17	16%
Wastewater Treatment Operator	537	54	10%	58	11%
Mechanic/Machinist	275	30	11%	31	11%
Water Treatment Operator	305	57	19%	29	10%
Water Distribution Operator	214	33	15%	19	9%
High Voltage Electrician	45	0	0%	4	9%
Electrician	127	4	3%	10	8%
Wastewater Collections Operator	520	32	6%	38	7%
Total (all occupations)	**2276**	**226**	**9%**	**236**	**11%**

11 Appendix B Retirement Risk and Training Location Maps

Occupation Profile - Electrician

Map 3, right, shows total current budgeted Electrician positions by utility split between entry-level and advanced positions. Entry-level means any position requiring less experience and training than a journey level worker does. Entry-level includes trainee, pre-apprentice, and apprentice positions, and advanced means any position at or above the journey level.

North Marin Water District and East Bay Municipal Utility District are the two agencies that reported entry-level positions in the Electrician trade, with four positions.[12]



Map 3: **Current budgeted Electrician positions by utility and type of position, entry level or advanced.**

The primary workforce challenge faced by water and wastewater utilities is finding qualified candidates for the skilled trades jobs. The biggest barriers include inadequate work experience and credentials among candidates, as well as uncompetitive wages and benefits packages. Wastewater Treatment Operator, Mechanic/Machinist and Water Treatment Operator have the highest projected hiring need over the next three years. **Of the nine jobs studied, those that are not specific to the water industry present the greatest hiring difficulties because there is more competition for these skills.** These highest need positions are Mechanic/Machinist, Electrician, Electronic Maintenance/Instrument Technician.[13]

The next section of this report will focus on the need for increased collaboration among training providers and employers to address these mission-critical positions.

12 Maps for the Mechanic/Machinist and Electronic Maintenance/Instrument Technician are in Appendix B.
13 High-need is defined as mission-critical roles for which agencies have a hard time finding qualified candidates.

Training and Education for Mission-Critical Skilled Trades

The Bay Area Community College system has 28 colleges located throughout the San Francisco Bay region. Of those colleges, 14 offer programs (certificates and/or AA degrees) that prepare individuals for mission-critical careers in the water and wastewater industry. An estimated 41 candidates graduate annually with certificate or degree awards from community colleges that offer programs of study that align with the water treatment operator, wastewater treatment operator, water distribution operator, and wastewater collections operator trades. In addition, 114 skills builder students[14] annually attend the three community colleges that offer programs aligned with these four occupations.

- Santa Rosa Junior College, located in Sonoma County, offers a Certificate and Associate Degree in Wastewater Treatment Operations as well as a Water Utility Operations certificate. This program currently has an average of 11 students graduating each year with awards and 33 students who are skills builders
- Gavilan College, located in Santa Clara County, offers a Certificate and Associate Degree in Water Resources Management and prepares students for employment in both water and wastewater occupations. This program currently has an average of 14 students graduating each year and 34 students who are skills builders.
- Solano College, located in Solano County, offers a Certificate and Associate Degree in Water and Wastewater Technology as well as a contract education program, which can be delivered to colleges and employers throughout the region through the Bay Area Consortium for Water and Wastewater Education (BACWWE). Solano has an average of 16 students who graduate each year and 47 students who are skills builders.

An estimated 371 candidates graduate annually with certificate or degree awards from community colleges who offer programs that align with the Electrician, Mechanic/Machinist, Electronic Maintenance Technician/ Instrument Technician job categories, which are not specific to the water and wastewater industry. In addition, 779 skills builder students annually attend community colleges that offer programs aligned with these three occupations.

Currently the community colleges in the region do not have programs specifically that prepare students for the High Voltage Electrician or Heavy Equipment Operator/ Operating Engineer occupations.

Appendix C details the certifications and degrees applicable to each job category by community college and region. Appendix D details community colleges in the region with relevant programs and their estimated annual supply of graduates with certificate/degree awards, as well as skills builder students.

Gaps in the Water and Wastewater Career Pathway

Annual degrees awarded sometimes exceed projected demand from the water industry in the Electrician, Mechanic/Machinist, and Electronic Maintenance/Instrument Technician; however, utilities still report difficulty hiring for these positions.

The supply of qualified graduates for the Electrician, Mechanic/Machinist, and Electronic Maintenance/Instrument Technician occupations does not appear to be adequate when compared to demand based on two factors:

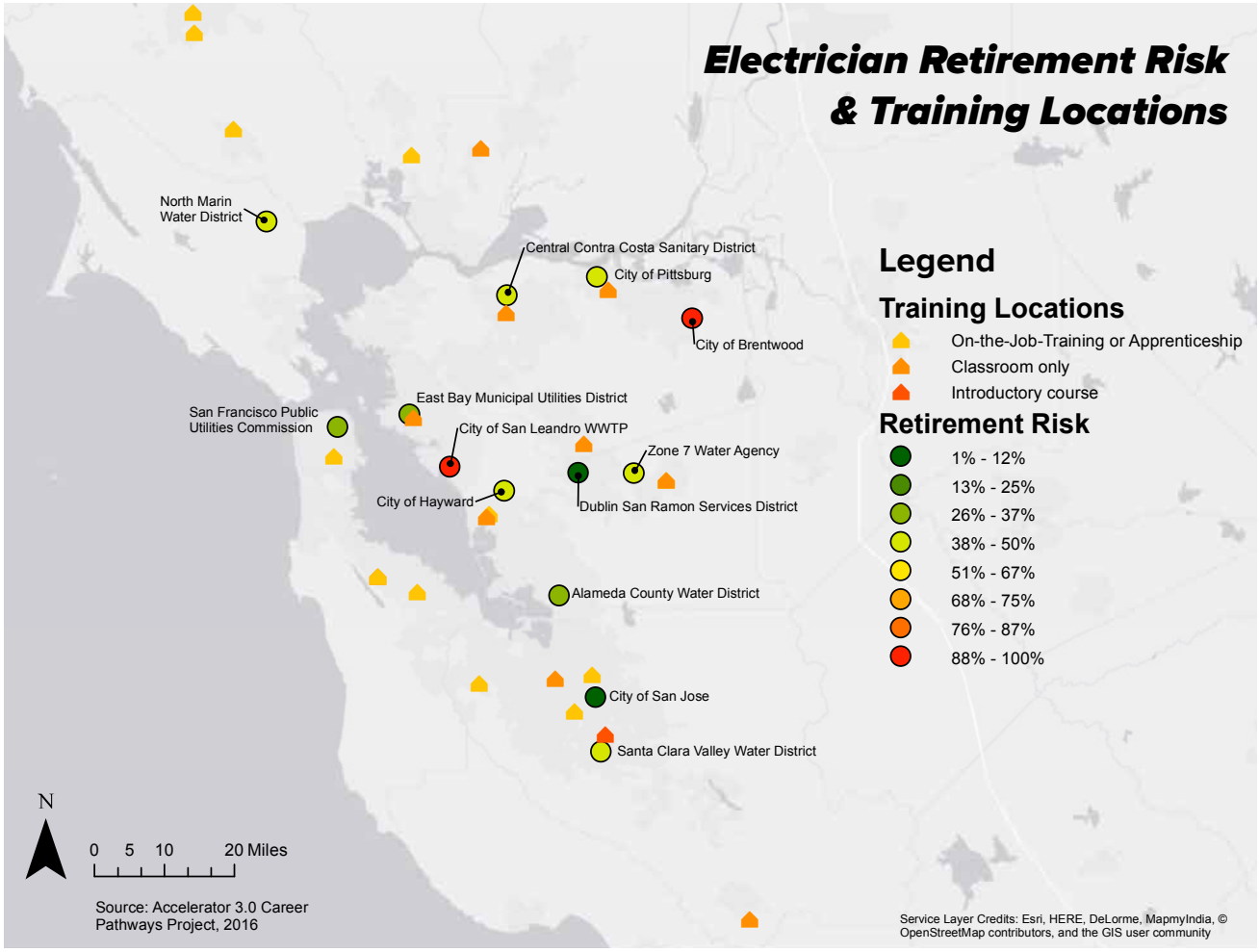
1) Employers indicate high levels of difficulty in hiring qualified candidates for all three support occupations

2) Graduates have many employment options in multiple industry sectors, because their skill sets are in high demand

Recommendation: Increase readiness of candidates by providing the required math, science and English skills needed to succeed in training and jobs.

Based on the difficulty in hiring qualified candidates' survey results, **it is likely that water and wastewater utilities are competing with employers from other industries in the region that also need to fill open Electrician, Mechanic/ Machinist, and Electronic Maintenance/Instrument Technician positions.** It may appear that community colleges are graduating more than sufficient numbers of students to meet demand; however, these graduates are also finding employment in other industries such as transportation, energy, manufacturing, and aerospace. It is difficult to determine how many graduates are actually seeking employment with water and wastewater agencies.

14 Skills builder students are typically workers who are maintaining and adding to skill sets required for ongoing employment and career advancement. Skills builders successfully complete a limited number of courses, but do not earn a certificate or degree, or transfer to a four-year college.



Map 4: Current budgeted Electrician position by utility and type of positions, entry-level or advanced.

For example, utilities report difficulty hiring qualified candidates in the Electrician trade while an abundance of training opportunities exists in the Bay Area. The map above shows the portion of current employees eligible to retire in three years for every utility reporting data and the geographic location and type of training available to develop certified Electricians. Map 4, above, illustrates the mismatch between existing training programs and the needs of the water and wastewater utilities to replace retiring Electricians at the journey and supervisory level.

Recommendation: Collaborate with peer industries, such as petrochemical and aerospace, to address common training needs.

Utilities also have difficulty hiring for the water and wastewater specific trades. **Community colleges in the region are currently graduating candidates at a rate that is lower than average estimated demand for the Water Treatment Operator, Water Distribution Operator, Wastewater Collections Operator and Wastewater Treatment Operator.** There is an annual average demand of up to 174 openings for these four occupations and annual average supply of 41 graduates. The largest discrepancy is for the wastewater treatment operator position with a gap of 66 graduates per year. **Classroom education provided by community colleges is just one of five key areas needed to move along the pathway into a water/wastewater job. Graduation from a program is not sufficient to attain jobs that require work experience to qualify.**

Recommendation: Effectively connect students to technical training by offering dual enrollment in high school and college courses, pre-apprenticeship courses, and adding more training capacity based on demand.

The five key areas, summarized below, show the necessary components of the career pathways for these jobs, gaps, and potential solutions. This table summarizes interviews from key experts from education, labor, industry, and the nonprofit sector.

	Mechanic/ Machinist	Electronic Maint Tech/Inst Tech	Electrician	Problem	Solution	Ways to Support Target Populations
INCREASE AWARENESS OF INDUSTRY AND TRADES				Most students are not aware of either the industry as a good potential employer or of what skilled trades workers do.	1. Distribute occupational profiles and brochures broadly. 2. Offer more student internships, career fairs, and teacher externships. 3. Support teachers with industry-specific lesson plans.	Awareness among students from diverse communities begins in high school where students experience career fairs, internships and guidance from teachers - critical first steps to a pipeline of more talented and diverse job-seekers.
INCREASE READINESS OF JOBSEEKERS for the trades				High school graduates do not consistently have the required communication, math and science skills to be prepared for success in technical/work-based training.	1. Communicate minimum requirements for training to students and schools. 2. Incorporate water/wastewater curriculum in STEM courses. 3. Increase #s and training of high school career/college counselors.	School counselors and teachers play a critical role in ensuring that talented students from diverse communities know about and are prepared for the rigorous technical training required for these trades.
INCREASE CLASSROOM TRAINING CAPACITY				For machinists, there are several good community college programs and some high school programs. For EMT/IT's and Electricians, classroom training at the community college level is uneven and exposure at high schools is very limited. For Electricians, there are union-based apprenticeship programs. Training there often focuses on construction and maintenance work, not high voltage work.	1. Offer students pursuing trades training the ability to earn high school and college credit concurrently. 2. Develop pre-apprenticeship training courses to prepare talented and diverse job seekers for rigorous technical training. 3. Develop more EMT/IT training capacity, aligned geographically with industry need.	Even with an awareness of the trades and a strong skills foundation, talented students and job-seekers from diverse communities still struggle to find trades-related training that meets their geographic and financial needs. The next step is to connect these students with training and jobs in the water industry as quickly as possible.
INCREASE ENTRY-LEVEL JOBS for mission-critical positions				For machinists, a registered apprenticeship program was recently launched at SFPUC and there is some interest in expanding to other agencies. There are no registered apprenticeships for EMT/ITs in the Bay Area. There are registered apprenticeships for basic Electricians; but they do not prepare apprentices for high voltage work.*	1. Develop and post more intern, trainee and apprentice positions. 2. Offer worksite supervisors the training and resources needed to support sub-journey workers. 3. Create best practices guide and other supports to share across agencies.	For students and job seekers who have limited financial resources, apprenticeships and other paid training programs are critical to their success. This experience can also result in journey-level workers becoming instructors and mentors to other young people, an important part of developing a more diverse pipeline of workers.
ADDRESS FINANCIAL BARRIERS to training leading to the trades				Loans are available but paid opportunities for sub-journey level work are limited. The exception is the electrical apprentices.	1. Develop apprenticeships and other "earn while you learn" training programs. 2. Offer more grants and scholarships to students pursuing trades training. 3. Communicate information about employer-sponsored education benefits.	Students pursuing trades training have access to fewer financial aid resources compared to those in a traditional 4-year college program. Thus providing students from diverse communities with limited resources with access to more financial aid, paid training, and employer-sponsored education benefits is critical to these students successfully completing training.

*Both EBMUD and PG&E have internal training programs for High Voltage Electricians. These programs require highly specialized equipment, which most training providers, including community colleges, are not able to fund.

Key: **GREEN=OK** **YELLOW=SOME GAPS** **RED=LOTS OF GAPS**

Detailed Recommendations and Identified Best Practices

Meeting the workforce needs of Bay Area water and wastewater agencies requires building **awareness of the career opportunities in the trades and connecting job seekers to foundational skill building, technical training and education, and work experiences to qualify for entry-level jobs.** Addressing the water and wastewater industry's workforce reliability challenges requires thoughtful coordination between the Bay Area community college system and water and wastewater utilities to create accessible career pathways for job seekers. The following matrix of recommendations details each major step on the career pathway to water and wastewater skilled trades careers, specific recommendations to strengthen each step, the major stakeholders involved in each recommendation and resources needed to implement the recommendation.

1. Increase Awareness of the Water and Wastewater Industry and Trades

a) Expand existing campaigns to raise awareness about both the water and wastewater industry and skilled trades.

Why? Awareness continues to be a significant barrier for recruiting applicants to the water and wastewater industry. Stakeholders should invest in targeted outreach to young people and job seekers to connect with diverse, talented, and motivated residents in the Bay Area.

***Key Stakeholders:* Agencies, community colleges, high schools**

- Create messaging and materials that effectively reach youth, teachers, school counselors and parents.
  - More detailed flyers and informational products to help teachers, counselors and parents understand the industry and career pathways.
  - Targeted social media marketing to youth, ex: Virtual Job Shadow, YouTube, Instagram, Snapchat and the Baywork.org website.
  - Ad campaigns on high visibility public spaces to broadcast messaging about job opportunities and training resources.
- Continue and expand teacher externships, career fairs, internships, facility tours for students and educators, and partnerships with local high schools that integrate project-based learning experiences.
- Continue developing industry-specific, contextualized curriculum and integrate into high school and college curriculum.

b) Collaborate with energy, aerospace and manufacturing sectors to cross-refer and create training programs around common skillsets

Why? The scale of the water and wastewater industry is relatively small, but the skills needed for mission-critical trades are transferable across industries.

***Key Stakeholders:* Utilities, Foundations, Public, Agencies, Community Colleges**

- Support the Bay Area Council and the Bay Area Community College Consortium joint "Occupational Marketplace" for Industrial Maintenance Technicians/ Mechanics. The Marketplace brings together employers, community colleges, and apprenticeship programs to address common workforce challenges.
- Create a system to cross-refer qualified applicants across industries and share awareness and outreach materials.
- Partner with local training providers to build more scalable training programs that support the water and wastewater industry.

Resources needed to implement recommendations:

- Funding for student and teacher outreach activities such as coordination, stipends, printing, website improvements, etc.
- Commitment from agencies to host student interns and teacher externs as well as participate in regional career fairs and other Baywork-sponsored events.
- Funding for culturally competent, wrap-around services to support the needs of students and job seekers from diverse backgrounds.

Best Practices to Increase Awareness

- Agencies participated in BAYWORK's Candidate Development and Outreach Committee to plan the March 2017 Career Fair at Laney College in Oakland. The event attracted over 1,000 high school students, half of whom came from San Jose. With additional funding to support more career fairs, the industry would reach many more students.
- The City of San Jose and San Francisco Public Utilities Commission hosted 24 teachers during the summer of 2017 in a variety of externships, designed to learn about the industry, plan student learning activities, advise on curriculum, and become industry champions for their schools. These externships leveraged funding from the Water Career Pathways grant, which expires in June 2018. With additional funding, the industry would engage more teachers and school counselors and reach many more students.

2. Increase Academic Readiness of Youth and Other Job Seekers for the Trades

a) Ensure students have math, science and English skills required to qualify for and succeed in water and wastewater jobs.

Why? Skills in math, science, and English comprise a substantial percentage of what is tested for in the entry exams for training programs, apprenticeships, and entry-level jobs. Although skilled trades positions usually do not require a bachelor's degree, mastery in these skills is essential for students to enter the trades.

Key Stakeholders: **School Districts, Funders, Public Agencies, Community Organizations, Utilities**

- Clearly communicate to students and families that technical training and entry-level jobs in the skilled trades require high school-level proficiency in math, science, and English skills.
- Increase preparation for and access to STEM courses in high schools and colleges.
- Incorporate water/wastewater contextualized curriculum in STEM course.
- Increase the availability of career/college counseling available to high school students, especially for those pursuing careers that require less than a 4-year degree.

Resources needed to implement recommendations:

- Clear messaging from agencies and apprenticeships about minimum requirements for training and jobs.
- Commitment from school districts and colleges to incorporate water and wastewater lesson plans into curricula.
- Commitment and funding from school districts and colleges to increase counseling services.

Best Practices to Ensure Students have Required Skills

- Advanced Manufacturing and Transportation Apprenticeships of California (AMTAC), in partnership with Diablo Valley College and Santa Rosa Junior College, developed a summer "boot camp" for high school students, providing a 40-hour course that includes math for Mechanics, facility tours and project-based learning activities. Other colleges can replicate this course and adapt it to: 1) target other trades, 2) address other gaps, such as test preparation for civil service exams and 3) link students to entry-level jobs in the water and wastewater industry.

3. Increase Classroom Training Capacity

a) Increase collaboration between school districts, community colleges and apprenticeship programs to ensure students pursuing trades-related training have transferable skills and credits.

Key Stakeholders: **Unions, Community Colleges, School Districts, Utilities, Community Organizations**

i. Offer students pursuing trades-related training the ability to earn high school and college credit concurrently so they graduate from high school with credits toward completion of college and/or apprenticeship programs.
ii. Develop pre-apprenticeship training courses that link foundational skills to the requirements of apprenticeship programs.
iii. Develop fifth-year senior or Middle College programs that allow high school students more time to acquire foundational and technical skills, while also pursuing community college-based technical training and/or work-based learning.
iv. Develop more Electronic Maintenance/Instrument Technician training programs aligned geographically with industry need.

b) The industry and schools should address the dearth of instructors in high school and college settings who have experience in both teaching and the trades.

Key Stakeholders: **Community Colleges, School Districts, Utilities**

i. Identify staff to provide instruction, guidance on curriculum, and mentoring for trades classes in high schools and colleges.
ii. Implement best practices such as employer-sponsored stipends, release time for taking additional course work, and tuition assistance benefits to ensure skilled trades staff are eligible and incentivized to teach in colleges.
iii. Bring knowledgeable industry experts in water and wastewater into the classroom as instructors, and address the problem of colleges requiring associate's or bachelor's degrees for faculty through this innovative approach to addressing colleges' faculty hiring requirements.

Why? Colleges typically require an associate's degree plus six years of industry experience or a bachelor's plus two years of industry experience to teach, which excludes most skilled trades experts who graduated from apprenticeships or completed extensive on-the-job training from becoming instructors. Utilities depend on community colleges' ability to teach the technical components of work.

Resources needed to implement recommendations:

- Commitment and funding from high schools and college systems.
- Commitment from agencies to provide instructors with industry experience or other similar resources.
- Funding from grants and colleges to support pre-apprenticeship and apprenticeship costs (curriculum development, instruction, supervision, outreach, applicant development, test prep, etc.).
- Funding from agencies and grants to support partnership between community colleges and apprenticeships to expand and/or develop new training capacity targeting mission-critical positions.
- Commitment from high schools and colleges to take innovative approaches to hiring instructional staff with critical industry experience.

Best Practices to Improve Classroom Training

- John O'Connell High School, in partnership with the San Francisco Public Utilities Commission, developed a Construction and Environmental Technology career track leading to jobs in the utilities. This program offers relevant courses, internships with local agencies, linkages to community colleges and critical job readiness support from JVS. This model partnership should be replicated to reach more students and offer more work-based learning opportunities leading to apprentice or other entry-level positions.

4. Increase Entry-Level Jobs for Mission-Critical Positions

a) Develop more internship, trainee, and apprenticeship opportunities in the mission-critical trades, with a focus on those trades where agencies have the greatest difficulty hiring skilled workers.

Why? Agencies indicate that the greatest barrier to recruiting fully qualified candidates is the lack of relevant work experience. To address this barrier, agencies should develop and post more sub-journey level job and internship opportunities to increase the pipeline of otherwise qualified candidates. This strategy would also likely bring in younger, more diverse talent—a goal several agencies have indicated is a priority. These positions may require additional investment in supervision and training, which could be supported through partnerships with local high schools, community colleges, apprenticeship programs, and community-based organizations.

Key Stakeholders: **Utilities, Unions, Community Based Organizations**

- Identify existing apprenticeship agreements for skilled trades positions between utilities and unions that are not utilized.
- Offer worksite supervisors the training and resources needed to effectively support these workers through training and into journey-level positions.
- Create a best practices guide for trainee/apprenticeship roles and other supports to share across utilities.
- The utilities that have agreements with unions that do offer apprenticeship training should access this pool of highly skilled apprentices.

b) Prepare students to succeed in apprenticeships by creating pre-apprenticeships to meet technical skill and soft skill requirements.

Why? Pre-apprenticeship programs teach basic technical and job-readiness skills for apprentice-able occupations and are designed to prepare students for an apprenticeship. These programs are effective in increasing the quality and quantity of apprentice candidates and can be customized to address the unique needs of a target population. Specifically, a pre-apprenticeship program could include training in required skills (i.e., math and English), work readiness skills, project-based exercises, facility tours, test-taking skills (i.e., civil service exams), and an orientation to the public sector, industry and the trades.

Key Stakeholders: **Public Agencies, Utilities, Community Organizations, Unions**

Best Practices to Increase Apprenticeships

- San Francisco Department of Human Resources identified Machinists as a significant workforce challenge, given the high retirement risk and insufficient pool of qualified candidates, and prioritized the creation of new apprenticeships for Maintenance Machinists and Automotive Machinists. The San Francisco Public Utilities Commission is one of four city agencies who will host apprentices. Apprentice positions were recently posted; the application, testing, and selection process has been completed. Training is scheduled to start in the fall of 2017. JVS identified and screened five potential candidates, three of which submitted applications. To increase their competitiveness, JVS helped these applicants obtain a certification needed for the Automotive Machinist position and prepared them for the testing and interview process.
- East Bay Municipal Utility District identified entry-level Machinists as a significant challenge, given the retirement risk of their highly skilled machinists and an insufficient pool of qualified candidates. As a result, they are partnering with AMTAC, a local apprenticeship program that will prepare workers for their Level 2 Machinist position.

5. Address Financial Barriers to Training

a) Reduce barriers to entry for job seekers pursuing careers in water and wastewater by offering more financial support to students seeking classroom training and on-the-job training.

Why? Tuition, fees, and the lost wages by taking unpaid work are major barriers for students who must support themselves and their families financially.

Key Stakeholders: **Utilities, Public Agencies, Community Colleges, Unions, Funders**

- Offer more grants and scholarships for students pursuing trades training.
- Communicate information about employer-sponsored education benefits.

Resources needed to ensure these recommendations are actionable:

- Funding from agencies, unions, colleges and grants to support apprenticeships.
- Commitment from agencies to ensure employees access employer-sponsored education benefits when needed.
- Funding from colleges and foundations to support financial aid for students enrolled in trades training.

Glossary

Apprenticeship:
A combination of on-the-job training and related classroom instruction under the supervision of a journey level craft person or trade professional in which workers learn the practical and theoretical aspects of a highly skilled occupation. Apprentices are typically paid during training. Apprenticeships are typically formal training programs, with oversight by state and/or federal agencies.

Career Technical Education:
A term applied to schools, institutions, and educational programs that specialize in the skilled trades, applied sciences, modern technologies, and career preparation. Career Technical Education can be abbreviated to CTE, and is sometimes called Vocational Training.

Journey Level:
A person who has completed an apprenticeship program (classroom training and on-the-job work experience) or is an experienced worker, not a trainee, and is fully qualified and able to perform a specific trade without supervision.

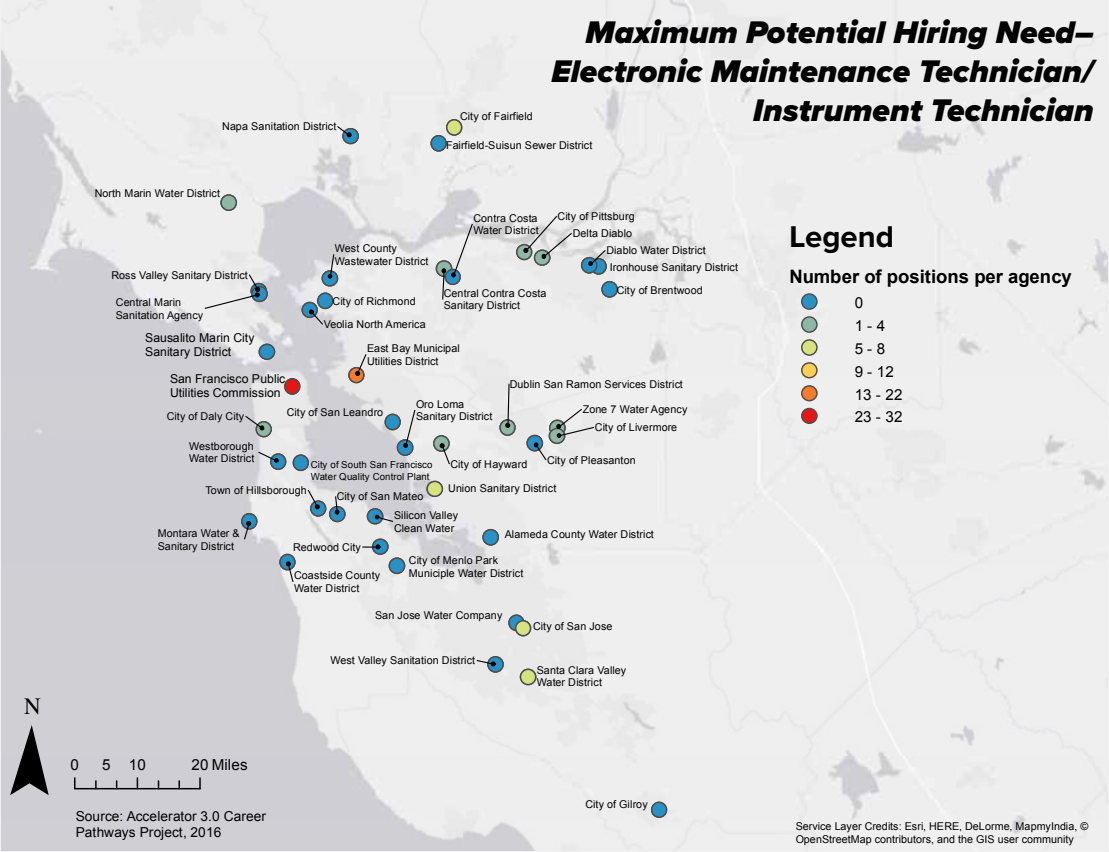
Mission-Critical:
A mission-critical factor of a system is any factor (component, equipment, personnel, process, procedure, software, etc.) that is essential to business operation or to an organization. Mission-critical job categories in water/wastewater utilities are those considered essential to operational reliability. Bay Area water/wastewater agencies have identified engineering and nine skilled trades positions discussed in this report as essential to their ability to protect public health and the environment. This report focuses on the skilled trades positions.

Skilled Trades:
A tradesman, tradesperson or skilled tradesman refers to a worker who specializes in a particular occupation that requires work experience, on-the-job training, and formal vocational education, but often not a bachelor's degree.

Workforce Reliability:
Having both sufficient staffing in mission-critical classifications and staff who are sufficiently prepared to do their work to ensure the operational reliability of water and wastewater infrastructure.

Appendix A: Maps of Maximum Potential Hiring Need By Agency

Maximum Hiring Need is the number of maximum potential open positions in the next three years, based on current employees eligible to retire in three years and current vacancies.

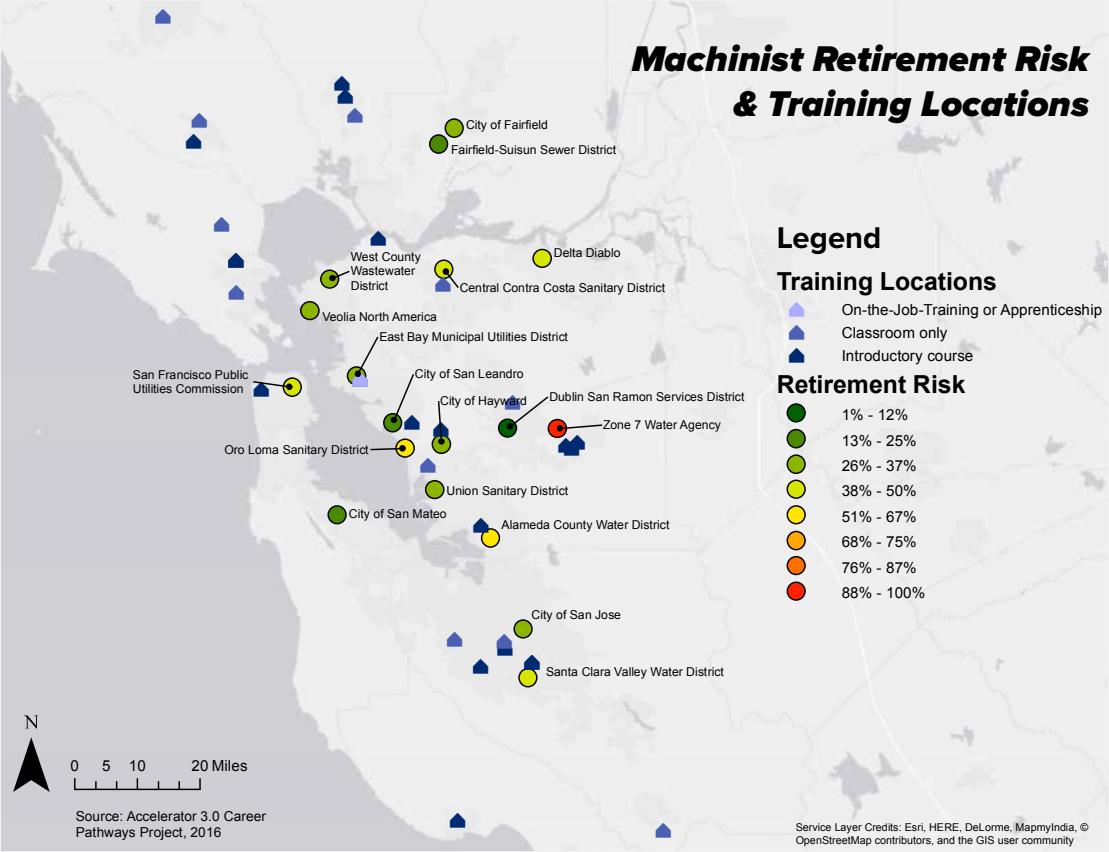


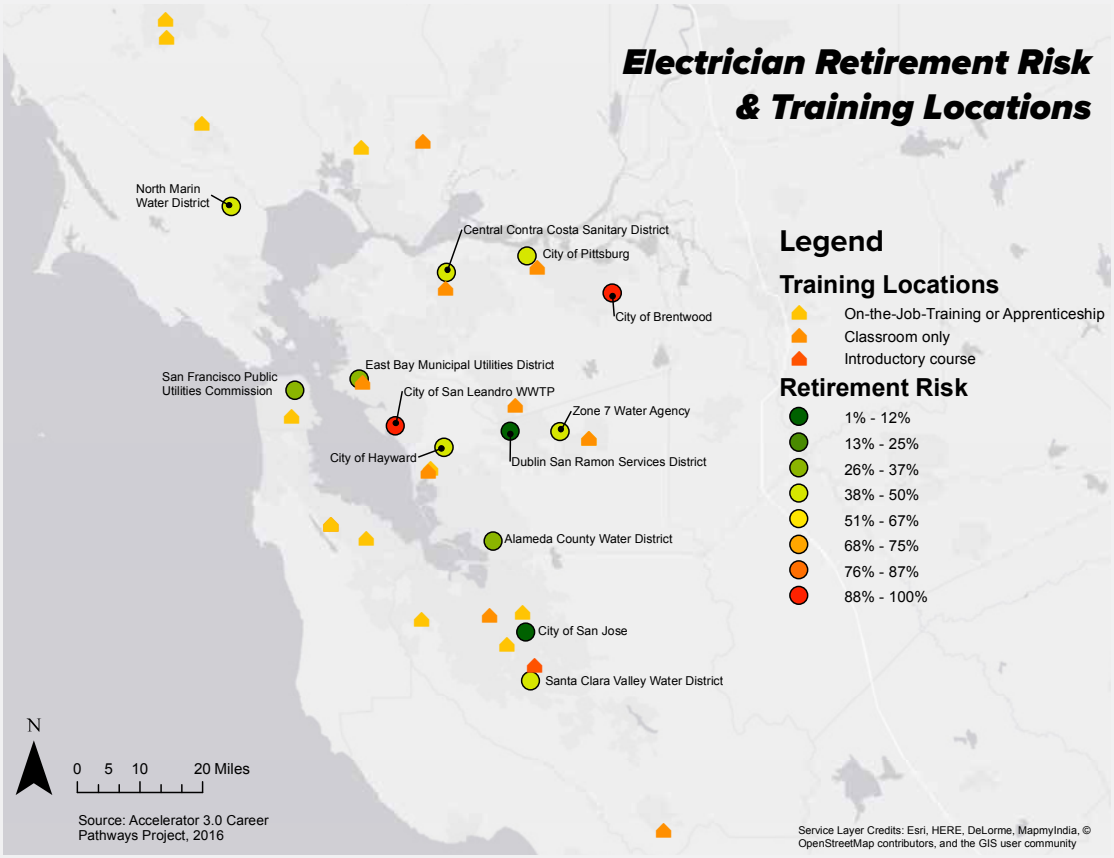
Maximum Potential Hiring Need–
Mechanic/Machinist
Napa Sanitation District
City of Fairfield
Fairfield-Suisun Sewer District
North Marin Water District
Contra Costa Water District
City of Pittsburg
Delta Diablo
Diablo Water District
Ironhouse Sanitary District
City of Brentwood
West County Wastewater District
Ross Valley Sanitary District
Central Marin Sanitation Agency
City of Richmond
Veolia North America
Central Contra Costa Sanitary District
Sausalito Marin City Sanitary District
East Bay Municipal Utilities District
San Francisco Public Utilities Commission
Dublin San Ramon Services District
City of Daly City
City of San Leandro WWTP
Oro Loma Sanitary District
Zone 7 Water Agency
City of Livermore
Westborough Water District
City of South San Francisco Water Quality Control Plant
City of Hayward
City of Pleasanton
Town of Hillsborough
City of San Mateo
Union Sanitary District
Silicon Valley Clean Water
Montara Water & Sanitary District
Alameda County Water District
Redwood City
City of Menlo Park Municiple Water District
Coastside County Water District
San Jose Water Company
City of San Jose
West Valley Sanitation District
Santa Clara Valley Water District
City of Gilroy
Legend
Number of positions per agency
0
1 - 4
5 - 8
9 - 12
13 - 22
23 - 32
N
0 5 10 20 Miles
Source: Accelerator 3.0 Career Pathways Project, 2016
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

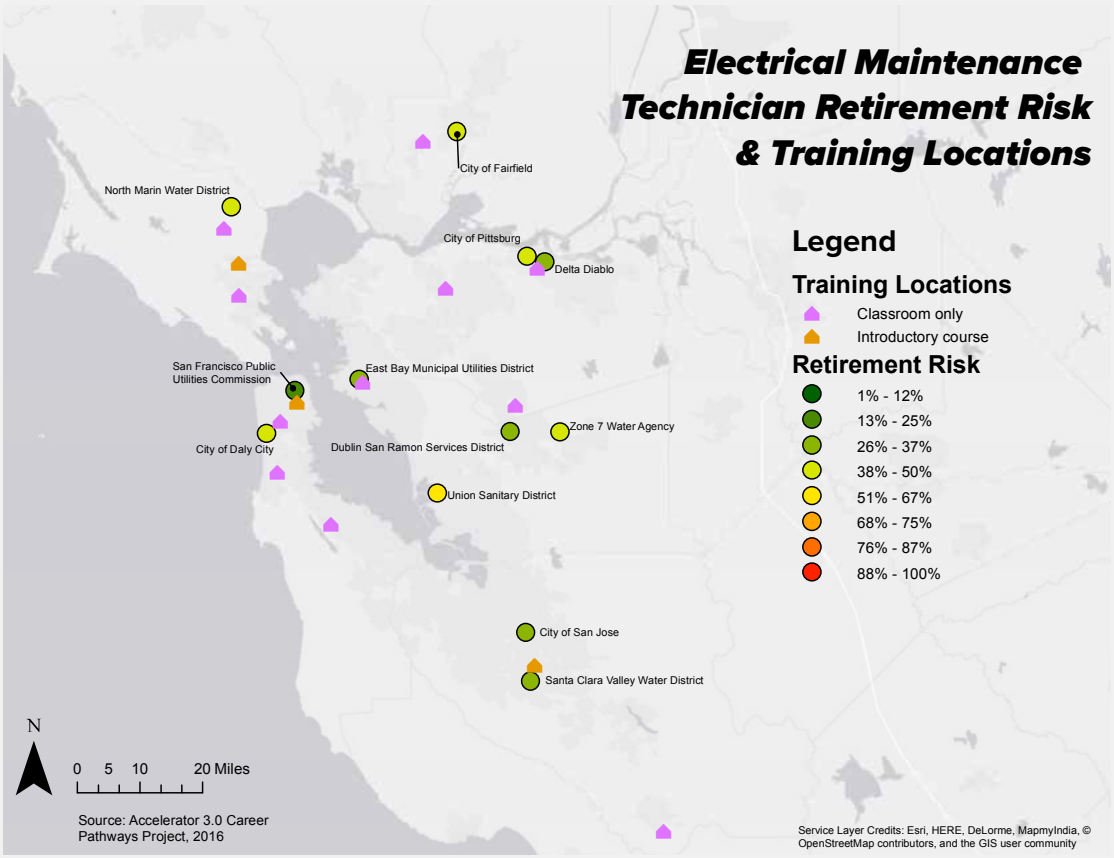
Maximum Potential Hiring Need–
Electrician
Napa Sanitation District
City of Fairfield
Fairfield-Suisun Sewer District
North Marin Water District
Contra Costa Water District
City of Pittsburg
Delta Diablo
Diablo Water District
Ironhouse Sanitary District
City of Brentwood
West County Wastewater District
Ross Valley Sanitary District
Central Marin Sanitation Agency
City of Richmond
Veolia North America
Central Contra Costa Sanitary District
Sausalito Marin City Sanitary District
East Bay Municipal Utilities District
San Francisco Public Utilities Commission
Dublin San Ramon Services District
City of Daly City
City of San Leandro
Oro Loma Sanitary District
Zone 7 Water Agency
City of Livermore
Westborough Water District
City of South San Francisco Water Quality Control Plant
City of Hayward
City of Pleasanton
Town of Hillsborough
City of San Mateo
Union Sanitary District
Silicon Valley Clean Water
Montara Water & Sanitary District
Alameda County Water District
Redwood City
City of Menlo Park Municiple Water District
Coastside County Water District
San Jose Water Company
City of San Jose
West Valley Sanitation District
Santa Clara Valley Water District
City of Gilroy
Legend
Number of positions per agency
0
1 - 4
5 - 8
9 - 10
11 - 14
15 - 17
NOTE: Maximum replacement rate is the maximum potential open positions in the next 3 years based on current employees eligible to retire in 3 years and current vacancies
N
0 5 10 20 Miles
Source: Accelerator 3.0 Career Pathways Project, 2016
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Appendix B: Maps of Retirement Risk and Training Locations

Retirement risk is the portion of employees eligible to retire in three years. Training locations include Apprenticeships, Community Colleges, Adult Schools and High Schools offering On-the-Job Training, Introductory Courses or comprehensive Classroom Training.




Electrician Retirement Risk & Training Locations
North Marin Water District
Central Contra Costa Sanitary District
City of Pittsburg
City of Brentwood
San Francisco Public Utilities Commission
East Bay Municipal Utilities District
City of San Leandro WWTP
Zone 7 Water Agency
City of Hayward
Dublin San Ramon Services District
Alameda County Water District
City of San Jose
Santa Clara Valley Water District
Legend
Training Locations
On-the-Job-Training or Apprenticeship
Classroom only
Introductory course
Retirement Risk
1% - 12%
13% - 25%
26% - 37%
38% - 50%
51% - 67%
68% - 75%
76% - 87%
88% - 100%
N
0 5 10 20 Miles
Source: Accelerator 3.0 Career Pathways Project, 2016
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community


Electrical Maintenance Technician Retirement Risk & Training Locations
City of Fairfield
North Marin Water District
City of Pittsburg
Delta Diablo
San Francisco Public Utilities Commission
East Bay Municipal Utilities District
City of Daly City
Dublin San Ramon Services District
Zone 7 Water Agency
Union Sanitary District
City of San Jose
Santa Clara Valley Water District
Legend
Training Locations
Classroom only
Introductory course
Retirement Risk
1% - 12%
13% - 25%
26% - 37%
38% - 50%
51% - 67%
68% - 75%
76% - 87%
88% - 100%
N
0 5 10 20 Miles
Source: Accelerator 3.0 Career Pathways Project, 2016
Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Sub-Region	North Bay				East Bay				Mid-Peninsula		Silicon Valley			
College	Marin	Napa	Santa Rosa	Solano	Chabot	Diablo Valley	Laney	Los Medanos	San Francisco	San Mateo	DeAnza	Gavilan	San Jose	West Valley
Water Treatment Operator			Degree & Cert	Degree & Cert								Degree & Cert		
Water Distribution Operator			Degree & Cert	Degree & Cert								Degree & Cert		
Wastewater Treatment Operator			Degree & Cert	Degree & Cert								Degree & Cert		
Wastewater Collections Operator			Degree & Cert	Degree & Cert								Degree & Cert		
Mechanics/ Machinist	Cert	Degree & Cert	Degree & Cert		Degree & Cert		Degree & Cert	Degree & Cert			Degree & Cert		Degree & Cert	
Electrician			Degree & Cert		Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert				Cert
Electronics Maintenance Technician/ Instrument Technician			Degree & Cert		Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert	Degree & Cert				Cert
High Voltage Electrician														
Heavy Equipment Operator/Operating Engineer														
Program Area[15]	095630	095630	095800 095630	095800	093400 095630	093400	093440	093400	Sustain-ability & 093400 095220	093400 095220	095630			

095630—Machining and Machine Tools
095800—Water and Wastewater Technology
093400—Electronics and Electric Technology
095220—Electrical

Appendix D: Community Colleges with Relevant Programs and Estimated Supply

Occupation	Community Colleges Contributing to Supply	Annual Average No. of College Awards	Annual Skill Builder[15] Students
Water Treatment Operator	Santa Rosa, Solano, Gavilan	11	28
Water Distribution Operator	Santa Rosa, Solano, Gavilan	10	29
Wastewater Treatment Operator	Santa Rosa, Solano, Gavilan	10	28
Wastewater Collections Operator	Santa Rosa, Solano, Gavilan	10	29
Mechanics / Machinist	Santa Rosa, Chabot, DeAnza, Laney, Marin, Napa, San Jose City	138	432
Electrician	Santa Rosa, Chabot, CCSF, Laney, San Mateo, Diablo Valley, Los Medanos,	116	173
Electronics Maintenance Technician/ Instrument Technician	Santa Rosa, Chabot, CCSF, Laney, San Mateo, Diablo Valley, Los Medanos	117	174

16 Skills-builders are typically workers who are maintaining and adding to skill-sets required for ongoing employment and career advancement. Skills-builders successfully complete a limited number of courses, but do not earn a certificate or degree, or transfer to a four-year college.

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