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Women in Water: An Interpretative Phenomenological Analysis of Women's Lived Experience as Water and Wastewater Professionals

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Women in Water: An Interpretative Phenomenological Analysis of Women's Lived Experience as Water and Wastewater Professionals

by

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Abstract

The purpose of this interpretative phenomenological analysis was to explore the lived experiences of women water and wastewater professionals in California. A qualitative methodology and semi-structured interviews provided detail and a rich understanding of women's occupational choices, pursuits, and roles as told from their own perspectives. The results revealed that while working in water promoted a sense of pride, accomplishment, and empowerment, women continued to fight for equal access and full participation in lucrative water treatment careers. Key issues the women indicated were lack of knowledge of the industry, the necessity of mentorship, access to technical information, and the male-centered environment of water operations.

Chapter 1:

Introduction

Water is not a luxury. While many Americans have grown accustomed to its ready availability, more than two million Americans currently lack access to running water and basic sanitation (Jagannathan, 2019). Poorly managed infrastructure can result in a lack of water quality and quantity, and human capital shortages can threaten the nation's ability to provide clean, safe water (National Rural Water Association [NRWA], 2018a). Technical occupations within the water industry are male-dominated, and half of the workforce teeters on the brink of retirement (Kane & Tomer, 2018). Despite years of research that stressed the importance of women's participation in water management, women's involvement has continued to be minimal (Buchler & Hanson, 2015).

Since the early 1960s, considerable change has occurred to ensure women's equality and access to opportunities in the American workforce. Occupational segregation has declined in recent decades as women increasingly integrated into historically masculine careers, such as lawyers, physicians, and, to an extent, engineering occupations (Addati et al., 2016). This integration, however, has been confined to professional occupations; women's presence in blue-collar, male-dominated jobs, like water and wastewater treatment, has continued to be low (Torre, 2019).

Although women make up nearly 47% of the American workforce, they have been primarily represented in conventional fields designated as "women's work," such as health

services, personal care, medical office support, and education (U.S. Department of Labor [DOL], 2018). Conversely, 98% of workers in the construction industry are men (DOL, 2018). Other male-dominated fields include computer programming and mining occupations requiring science, math, and technology expertise, which have been traditionally attributed to men (Weeden et al., 2018). Occupational segregation, a prevalent feature of all labor markets, has been particularly troublesome in the water and wastewater treatment sectors (Weeden et al., 2018).

Regulated by each state, technical certifications for water and wastewater professionals are required for water treatment, water distribution, wastewater collection, wastewater treatment, laboratory analysis, environmental compliance, and electrical and mechanical instrumentalists. These occupations are necessary to operate water and wastewater systems (Addati et al., 2016). Certified and licensed operators perform a critical role in providing safe and adequate supplies of water and in protecting the environment (Weeden et al., 2018).

Water and wastewater professionals require added training in addition to high school degrees (NRWA, 2018a). They must be successful in passing a state certification examination indicating their competence in operating water treatment facilities, wastewater treatment facilities, wastewater collection systems, and drinking water distribution systems (NRWA, 2018a). The required certification makes them legally responsible for the proper operation of treatment facilities and for the protection of environmental and public health (Kane & Tomer, 2018). Operators under these rules are responsible for completing tasks focused on maintaining and operating treatment plants and systems as they were designed (NRWA, 2018a).

Certified and licensed operators have the opportunity to make a positive impact on society and to allow communities to enjoy clean and safe water resources (Kane & Tomer,

2018). Career operators experience stability and satisfaction in their jobs as well as higher than average salaries and benefits (Kane & Tomer, 2018; NRWA, 2018a). Jobs in the water sector are relatively free of adverse changes in the economy and are seen as foundational components to their communities (Kane & Tomer, 2018).

This qualitative interpretative phenomenological analysis involved a deep investigation of the lived experiences of women water and wastewater treatment professionals (defined as water and wastewater treatment operators, water distribution system operators, and environmental compliance officers) who pursued technical certifications and employment in male-dominated water and wastewater occupations across California.

Chapter 1 includes a background of the problem, the purpose and significance of the study, and the significance to water utilities and organizations. The chapter also contains an overview of the research methodology and design, the theoretical framework, a discussion concerning the importance of women in water treatment professions, and current findings. The later sections include definitions of terms, assumptions, limitations, and scope of the research. A summary of significant points and an introduction to Chapter 2 conclude the chapter.

Background of the Problem

The American water industry currently faces significant workforce challenges compounded by a number of causes. First, ready availability to clean and safe drinking water is an expectation for many Americans. With a network of hidden pipes and infrastructure, water and wastewater treatment processes remain out of sight and out of mind. Water treatment is a hidden industry, and many people are unacquainted with the job opportunities associated with the complex processes of its production and delivery (Kane & Tomer, 2018). Additionally, as college enrollment soars to an all-time high, more and more blue-collar jobs, including those jobs

in the water industry, remained unfilled (Torre, 2019). A record number of retirements has further stressed the water workforce (Kane & Tomer, 2018).

The American water industry workforce employs 1.7 million people who work in more than 212 occupations to design, construct, operate, maintain, and oversee the nation's water treatment processes and water transmission systems (Kane & Tomer, 2018). However, the workforce is not diversified, and women are underrepresented in certain jobs and overrepresented in others (DOL, 2018; Kane & Tomer, 2018). Women comprise 46.8% of workers across all occupations nationally, but account for only 14.9% of the water workforce (DOL, 2018). While women make up a majority of water industry workers in administrative positions, including 95% in secretarial positions, women only account for a fraction of higher-paid, technical water occupations, including plumbers (1.4 %) and water treatment operators (5.2%) (DOL, 2018; Kane & Tomer, 2018). In the United States, more than 90% of water treatment operators are male (DOL, 2018).

Underutilization of women's talent has been problematic both nationally and globally (Kemp, 2018). Worldwide, women make up less than 17% of the water, sanitation, and hygiene labor force, and they represent a smaller percentage of management personnel and policymakers (Kemp, 2018; Thompson et al., 2017). Research has indicated that women have invaluable insights concerning the design, operations, and maintenance of water systems (International Water Association, 2014; Roth et al., 2014; Thompson et al., 2017). Yet, in America and across the globe, their participation in all aspects of water management has been limited (Aureli & Brelet, 1995; Bennett et al., 2008; Jalal, 2014; Johansson, 2016).

The water industry must attract, recruit, and retain women along with men to operate and maintain water and wastewater systems (Roller, 2019). Recruiting women into water occupations

can help fill existing workforce gaps where critical shortages exist (International Water Association, 2016; Kane & Tomer, 2018). In the United States, utilities must meet workforce needs to comply with the Safe Drinking Water and Clean Water Acts (EPA, 2018; GAO, 2018). Safe operation of the nation's drinking water and wastewater utilities depends partly on continuous access to a qualified workforce, particularly sufficient numbers of certified operators (GAO, 2018; Kane & Tomer, 2018). Implementing recruitment strategies targeting women not only provides accessible, well-paying opportunities but also ensures safe water supplies for all Americans (United Nations World Water Assessment Programme, 2016). Increasing opportunities for women in water industry occupations provides a more robust pipeline of skilled workers who can fill the workforce capacity gap in water management occupations (International Water Association, 2016).

In addition, numerous studies have illustrated the benefits of a diverse water workforce (Bouman-Dentener, 2015; Gender and Water Alliance, 2006; Grant, 2017; Jalal, 2014; International Water Association, 2016; United Nations World Water Assessment Programme, 2016). A water workforce that included women increased the effectiveness and efficiency of water projects and improved the likelihood of water resource sustainability (CAP-NET, 2014; Jalal, 2014). Jalal's (2014) study found that women's participation in water resources management increased the sustainability of assets due to improved operation and maintenance. The World Bank's evaluation of 122 water projects found that operational effectiveness increased six to seven times when women were involved, and that gender diversity increased discussion concerning operational approaches to water management (International Water Association, 2016). Gender diversity provided a better representation of the customer base, a

greater combination of skills across the workforce, and a broader interpretation of water resource sustainability (International Water Association, 2016).

While the benefits of women's increased participation in the water industry have been clearly recognized, the literature concerning women's involvement in the water sector has neglected to explain the experiences of women who enter and persist in water occupations (International Water Alliance, 2014). This phenomenological study contributed to a body of work aimed at understanding the lived experiences of women in water. The results should assist in the recruitment efforts of women to fill current workforce gaps and contribute to improved water sustainability.

Statement of the Problem

America is prioritizing infrastructure investments in drinking water, storm water, and wastewater, and the many jobs that support the ongoing operation and maintenance of that water treatment and conveyance infrastructure (Kane & Tomer, 2018). The influx of infrastructure work is projected to generate billions of dollars in economic activity and create job opportunities across the country (Kane & Tomer, 2018).

These increased investments and heightened focus on water sustainability, however, have occurred in the midst of an American water workforce crisis (Kane & Tomer, 2018; National Rural Water Association [NRWA], 2018a). Workers capable of operating existing and new technology in the water industry are in demand (Kane & Tomer, 2018; NRWA, 2018a; U.S. Government Accounting Office [GAO], 2018; Wilson, 2019). An aging workforce eligible for retirement and a lack of a pipeline of new talent mean that the American water industry has a leaky conduit in its effort to build labor force capacity (GAO, 2018; Kane & Tomer, 2018; NRWA, 2018a; Wilson, 2019). Despite lower educational barriers and stable, good-paying jobs,

not enough people, including women, have pursued water industry jobs nor acquired the necessary skills or training to obtain careers in the water sector (Kane & Tomer, 2018; Saltzman, 2018). In an era when water and sanitation challenges abound, communities with a lack of certified operators and an insufficient supply of operators to monitor and control public water systems adequately has already occurred (Meko, 2019).

The water industry remains hyper-segregated (Addati et al., 2016; Roller, 2019). High-paying technical jobs are held by men, while women continue to work in sectors paying much less than their male counterparts (Cohen, 2013; Game & Pringle, 1983). Technical occupations like water and wastewater treatment offer higher salaries and more opportunities than traditional service or care-oriented jobs that have often been apportioned to women (Kane & Tomer, 2018).

The American water industry has long struggled with diversity and has attempted to address labor inequities in different ways, such as gender mainstreaming and integrated water management plans (International Water Association, 2016; Kane & Tomer, 2018). Even with these efforts, substantial change is required to overcome continued gender inequities and imbalances that distort water management professional representation and can lead to ineffective planning in the water resource industry (Bennett et al., 2008).

Significance of the Problem

The current interpretative phenomenological analysis was salient because the study involved a thorough analysis of the lived experiences of women who pursued technical certifications and employment in the water industry. While substantial literature on the importance of women's involvement in all aspects of water management existed, no previous studies included an exploration of the lived experiences of women water and wastewater professionals.

Research has demonstrated that the underrepresentation of women in water resources management undermines progress, impedes socioeconomic development, and threatens water resource quality, quantity, and sustainability (Adams et al., 2018; International Water Association, 2014). Both national and international studies reported that the involvement of women improved water supply and sustainability (CAP-NET, 2014; Jalal, 2014; Thompson et al., 2017; United Nations World Water Assessment Programme, 2016). Because sustainable water management impacts the lives of both genders, it follows that women and men should share the work in keeping water resources safe and reliable (United Nations World Water Assessment Programme, 2016).

American water utilities and organizations have recognized the workforce homogeneity of water and wastewater professions and increased efforts to attract and retain a diverse workforce (Kane & Tomer, 2018). These efforts have fallen short, however, and men continue to dominate water and wastewater occupations (Kane & Tomer, 2018). Attracting, retaining, and developing diverse talent is crucial to achieving effective and sustainable water management goals (Rocheleau et al., 1996).

This study detailed the perspectives of women water and wastewater professionals and revealed common motivational themes in addition to particulars of the shared successes and challenges women faced in entering and remaining in the water workforce. The research results should be considered in the development of equitable opportunities designed to attract, recruit, and retain women in water.

Research Question

This research aimed to understand the meaning that women who work as water or wastewater treatment operators make of their lived experiences in entering and remaining in

water treatment occupations. The primary research question was, “How do women water and wastewater professionals experience their occupational choices, pursuits, and roles?” The research question was divided into two aims: to understand the meaning women water or wastewater professionals attribute to their experiences in entering and remaining in these occupations, and to gain insight in the successes and challenges they faced in entering and persisting in the water industry.

The research question guided the study. The goal was to explore the lived experiences of women who pursued technical certifications and employment in the male-dominated technical fields of water and wastewater treatment. A review of the literature indicated no prior studies using this approach to examine women’s lived experiences working in water.

Purpose of the Study

The purpose of this qualitative phenomenological analysis was to explore the lived experiences of women water and wastewater professionals. A qualitative methodology provided a detailed and rich understanding of the experiences of women who work in water and wastewater occupations. An interpretative phenomenological analysis was appropriate for this investigation because it attempted to describe and analyze specific details within the lived experiences of women who choose to enter and remain in water occupations (Smith et al., 2009).

The design was selected specifically to reveal, from interviews, the understandings of the phenomenon of women who work in water and wastewater occupations from the perceptions and experiences of the women who enter and remain in them. Exploring how women experience their occupational choices, pursuits, and roles provided an understanding of the successes and challenges they faced in the water workforce. The resulting themes provided additional insight into the important factors in attracting, recruiting, and retaining women in water.

The specific sample for the study was five women who hold technical certification and employment as water and wastewater professionals in California. Women water and wastewater professionals demonstrated great interest in participating in the study, and the sample of five participants was reached within two days of the invitation. Data collection for the phenomenological inquiry was in-depth semi-structured interviews.

The NVivo 12 qualitative data analysis software was utilized to help classify, sort, and arrange the data obtained in the interviews. Thematic analysis enabled an exploration of common themes. A review of these themes provided insight that may reduce the challenge of attracting, recruiting, and retaining a qualified and diverse water workforce.

Theoretical Framework

All qualitative research takes place within an interpretative framework that guides the researcher and shapes the research plan and activities (Creswell, 2014). This research was structured within an interpretative paradigm. The philosophical underpinnings of interpretative research were informed by hermeneutics and phenomenology. Interpretative ontological assumptions hold that multiple, socially constructed realities exist. In the interpretative paradigm, the nature of knowledge is recognized to be subjective and idiographic, and truth is dependent on context. Interpretative paradigms utilize qualitative and phenomenological methods, and researchers collect data by interacting with subjects through interviews (Creswell, 2014).

Phenomenology is a participatory research method that emphasizes attempting to get to the truth of matters and to describe phenomena as they appear to the experiencer (Smith et al., 2009; Moran, 2008). Phenomenological designs rely on interviews and researcher descriptions of the lived experiences of individuals who have experienced the phenomenon under investigation (Smith et al., 2009).

In this research, an interpretative paradigm was used to understand occupational segregation, which has been defined as the sorting of individuals across occupations based on social, ethnic, or gender identity (Pothier, 2018). The study of occupational segregation involved numerous perspectives and theories (England, 2010; Hakim, 2016; Levanon & Grusky, 2016; Pothier, 2018; Torre, 2019; Weeden et al., 2018). A lack of consensus between several disciplines has resulted in the emergence of various theories to explain the gendered nature of work (England, 2010; Hakim, 2016; Levanon & Grusky, 2016; Pothier, 2018; Torre, 2019).

Paula England (2010) has theorized that although the popular notion of gender egalitarianism has promoted women's equal access to upward mobility, schooling, and jobs, it has been offset by the reality of gender essentialism, in which most people follow gender-typical paths. Gender essentialism, also known as horizontal segregation, posits that men and women are fundamentally different in their skills and interests; as such, gender guides occupational choice (England, 2010; Levanon & Grusky, 2016). Essentialist models have attributed social, expressive, and nurturing characteristics to women, which makes them "suited to" occupations requiring these qualities. Similarly, men possess strength, mathematical, analytical, and technical skills. Consequently, they are suited to occupations requiring these traits (Levanon & Grusky, 2016). Essentialist beliefs have been represented as biologically rooted, and they are a core mechanism underlying segregation (Levanon & Grusky, 2016). Occupational segregation based on essentialist beliefs is known to be highly resistant to change (Levan & Grusky, 2016).

Although the gender composition of male-dominated trades has been an international phenomenon, the persistently low participation of women in male-dominated trades, like water and wastewater, has not attracted a high level of public attention and policy (Equitable Growth,

2017). Gender essentialism has been embedded in all cultures and served to deter women from careers in male-dominated trades like water and wastewater (Equitable Growth, 2017).

The intention of this research was to gather data regarding the lived experiences and perspectives of women research participants concerning the phenomenon of participating in the male-dominated water industry workforce. A feminist approach embodied gender as the key category in the descriptions of lived subjectivity (Fisher & Embree, 2000). The subjective nature of qualitative methodology gave voice to these underrepresented women and enabled a rich understanding of the phenomenon (Mirriam, 2009). Interpretation of the data led to the discovery of common themes interwoven among the participants, and from this data and information, meaning was constructed by identifying common themes that were used to create a detailed and descriptive report outlining recurrent threads across all participants (Creswell, 2014).

An interpretative phenomenological analysis allowed for an examination of the similarities in the lived experiences of women water and wastewater professionals. Interpretative phenomenological analysis (IPA) was informed by two philosophies: 1) phenomenology, a focus on what it is like to experience a phenomena, and 2) hermeneutics, an interpretation of the experience (Smith et al., 2013). A central focus was the shared knowledge of a group of women who have experienced the same phenomenon (Durdella, 2019), which allowed a comparison of the experiences of a homogenous group. The similarly lived experiences of the research participants enabled a better understanding of the overall perceptions among the women water and wastewater professionals (Creswell, 2014).

Unlike interpretative approaches, feminist approaches view the world through a critical lens. Feminist phenomenology is a subfield within the phenomenological school of thought; phenomenology is feminist when it poses questions and seeks answers related to gendered

experiences (Simms & Stawarska, 2013). Feminist phenomenology utilizes research as a catalyst for change to benefit marginalized members of society oppressed through social power structures (Denzin & Lincoln, 2018). The ontology of a critical worldview suggests that human interactions are based on power struggles, which lead to positions of domination and oppression based on gender and other factors (Denzin & Lincoln, 2018). The epistemology is that the knowledge produced by research can change these structures and remove oppression through the empowerment of marginalized groups (Denzin & Lincoln, 2018). Feminist phenomenological research utilizes participatory methods to seek knowledge that supports social transformation and revolution (Denzin & Lincoln, 2018). The integration of both critical feminist and interpretative phenomenological approaches provided a sensitive, gender-specific framework of women's experiences in androcentric occupations (Denzin & Lincoln, 2018).

This research relied on phenomenological assumptions to analyze human behavior, which provided a greater understanding of the phenomenon. The research questions focused on conscious experiences. Phenomenology and feminist theory intersected to strengthen the philosophical foundation and to gain an understanding of women's experience working as water and wastewater treatment operators. This phenomenological process assisted in providing subjective data to answer the research questions through an analysis of participants' lived exeriences (Littlejohn & Foss, 2009; Smith et al., 2009).

Feminist Political Ecology

Feminist political ecology examines the place of gender in the political ecological landscape; feminist political ecologists suggest gender is a crucial variable in continuing access to, control over, and knowledge of natural resources (Buechler & Hanson, 2016; Nightingale, 2006; Rocheleau et al., 1996). Feminist research encompasses gender as a determinant of social

status; men are considered dominant, privileged, and powerful compared to women (Buechler & Hanson, 2016).

Gender is multidimensional and encompasses more than biological sex differences; it is also the social usage and social meanings attributed to sex differences (Roth et al., 2014). Social processes inscribe masculine and feminine gender identities through institutions, codes, and taboo. This inscription occurs in a hierarchical manner, with all things masculine having higher value and resulting in more power and authority (Roth et al., 2014).

Gender is also a political term because it raises questions of diversity, sameness, equity, and justice (Roth et al., 2014). Gender structures social life by providing the basis for the fundamental division between paid "productive" labor and unpaid "reproductive" and domestic labor, also defined as "women's work" (Roth et al., 2014). Gender is an implicit criterion of allocating rights and powers in water management, and it shapes who controls knowledge and authority over water through associations of masculinity or femininity (Roth et al., 2014).

Feminist political ecologists have recognized that knowledge is gender-specific, meaning some knowledge comes from men and is meant for men. As a result, knowledge production privileges the masculine over the feminine (Rocheleau et al., 1996). Men often have more access to knowledge associated with science, while women have experiential knowledge, often from their role as household subsistence providers (Rocheleau et al., 1996).

Water resources management is androcentric and an inherently political process (Buechler & Hansen, 2016). Water experts and managers of hydrocracies hold significant power and, therefore, construct social norms to maintain control (Wegerich & Warner, 2014). The power in water politics is implicitly gendered by allocating water rights and control, which are used to legitimize or delegitimize water knowledge and authority by associating those rights and

power with masculinity or femininity (Roth et al., 2014). Through the lens of feminist gender politics in water resources management, researchers can identify, uncover, and challenge the mechanisms and processes through which this allocation procedure occurs (Roth et al., 2014).

The allocation, distribution, utilization, and control of resources reflect gender relations embedded in ideology and practice; unequal power and access to choices and resources are generally associated with gender (Peter, 2006). Women and men as water users or managers are differential stakeholders in water demand policies and procedures (Peter, 2006). It is imperative to examine gendered dimensions in access and use of water resources and to enact procedures to ensure the effective representation of the needs of both genders (CAP-NET, 2014; Gender and Water Alliance, 2006; Peter, 2006).

The historically male-dominated world of water provision has been based on the technological skills that men possess, yet a relationship exists between the political, social, and ecological systems that control these processes. As more and more people depend on increasingly limited water resources, a greater need exists for attention to the systems that manage it (Buechler & Hanson, 2016). Feminist scholars argue that the best way to correct the skewed perception of reality based on male experiences is to take women's experiences into account in water management (Parpart, Connelly, & Barriteau, 2014).

Integrated Water Resources Management

Integrated water resource management (IWRM) is a framework designed to improve the management of water resources. This approach to managing water resources is based on the four key principles articulated at the 1992 Dublin Conference on Water as well as the Rio de Janeiro Summit on Sustainable Development that was also held in 1992 (International Conference on Water & the Environment, 1992). These principles hold that freshwater is a vulnerable resource

that is finite and essential to sustaining the environment, economic development, and life, and that water management and development should be based on an approach that involves policymakers, planners, educators, women, and water users at all levels (Regional Water Management Group, 2012).

The key principles of IWRM are environmental sustainability, economic efficiency, social equity, and water governance (CAP-NET, 2014; Muller & Lenton, 2009). These principles recognize water as a finite and vulnerable resource essential to human life; recommend a participatory approach to water development and management; recognize the central role of women in the provision, management, and safeguarding of water resources; and identify the economic value of water. Integrated water resources management necessitates positive policies that empower women to participate at all levels in water resources programs (United Nations International Conference on Water and the Environment, 1992). The application of IWRM provides a scaffolding to address gender and social disparities in terms of equitable access to water resources and control over resources, benefits, costs, and decision making between men and women concerning water resources (Gender and Water Alliance, 2006).

The Global Water Partnership (2018) has defined IWRM as a process that promotes the coordinated development and management of water, land, and related resources to maximize the resulting economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. A wide cross section of sectors have recognized and adopted the principles of IRWM (Hassing et al., 2009).

Integrated water resource management has led to an increased awareness of the importance of sustainable development and the incorporation of environmental and social considerations into water management; the framework also placed an increasing emphasis on

stakeholder collaboration and the involvement of local communities and women in decision-making (Biswas, 2008; Kings Basin Authority, 2012).

In contrast to IRWM principles, uncoordinated and sectoral approaches to water management have resulted in environmental degradation due to the overexploitation of water resources, inappropriate resource allocation, and inequitable distribution of benefits and burdens. Inadequate involvement of either gender has hindered programs and projects aimed at addressing sustainability (Gender and Water Alliance, 2006). Gender perspectives aided in ensuring sustainability and in meeting the needs of women and other marginalized groups (Gender and Water Alliance, 2006). The Dublin Principles called for positive policies to empower women, ensure their participation, and benefit from women's involvement (International Conference on Water and the Environment, 1992).

The United Nations World Water Assessment Programme's (2009) Millennium Development Goals (MDGs) addressed women and water issues in two of their eight goals: goal three aims to promote gender equality and to empower women, and goal seven aims to ensure environmental sustainability. Other goals, such as the eradication of diseases, improved maternal health, and reduced child mortality, are also grounded in access to clean water supplies. Building on the success of these goals, seventeen new Sustainable Development Goals (2016) were introduced and include goals for clean water and sanitation (goal six) and reduced inequalities (goal ten). The focus on women's role in water management improves the social capital of women and provides more time for productive endeavors, adult education, empowerment activities, and leisure (United Nations, 2016).

Components of integrated water resource management plans have included principles of economic efficiency, equity, and environmental sustainability through policies and legislation

(Hassing et al., 2009). Integrated water resources management has challenged conventional water management systems emphasized an integrated approach with participation by men and women as equal partners (Elias, 2016). According to the Global Water Partnership (2018), a principal component of IWRM is the involvement of women in water activities due to their invaluable role in water management practices.

The literature contained many documents that stressed the importance of women in efforts to improve water management (Bennett et al., 2008; Bouman-Dentener, 2015; CAP-NET, 2014; Grant, 2017; Jalal, 2014; Johansson, 2016; Maphosa, 2010; Peter, 2006; United Nations World Water Assessment Programme, 2016). However, the implementation of IWRM has remained an institutional challenge because of entrenched social barriers revolving around the separation of domains of knowledge and the separation of "formal" and "informal" knowledge (Rocheleau et al., 1996).

More specifically, this research followed theories of feminist political ecology and water resources management. Feminist political ecology has identified gender as a key variable in establishing access to, control over, and knowledge of natural resources (Rocheleau et al., 1996). The framework combined ecological concerns, such as environmental sustainability, with feminist concerns, such as equal access to opportunities. The framework addressed environmental degradation and conflict, marginalization of groups, and conservation and control of resources (Buchler & Hanson, 2016; Nightingale, 2006; Robbins, 2004). A convergence of feminist political ecology and integrated water management paradigms added to the body of knowledge concerning how gender, understood as culturally defined masculine-feminine roles, structures access to and control over environmental knowledge and resources (Nightingale, 2006). The conceptual framework outlined how gender perspectives and water management

intersect and contribute to water resource sustainability (International Water Association, 2014; Ravitch & Riggan, 2017).

A number of international organizations have developed guidelines concerning gender and water resources management in an attempt to increase sustainability through more equitable division of water-related work (Aureli & Brelet, 1995; CAP-NET, 2014; Gender and Water Alliance, 2006; Global Water Partnership, 2004; Zonde-Kachambwa, 2012). Gender considerations can enhance equitable access to information, participation, and control over water resources (Zonde-Kachambwa, 2012). The conceptual framework outlines how gender perspectives and IWRM intersect and contribute to water resources sustainability. Figure 1 illustrates the synthesis between feminist political ecology and IWRM.

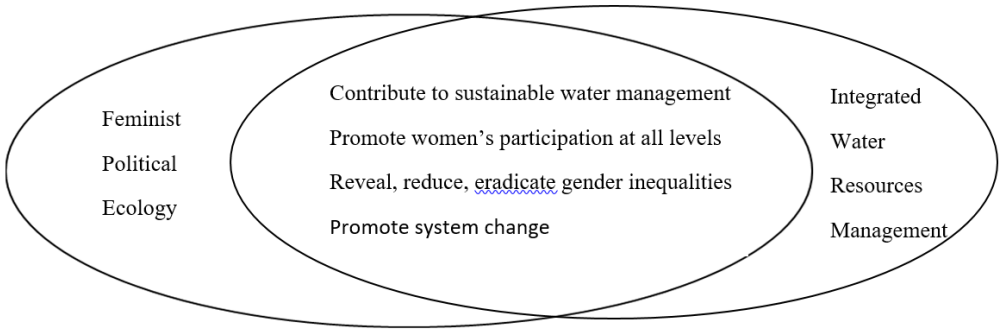

Figure 1: *Synthesis of feminist political ecology and integrated water resources management*

Definitions of Key Terminology

The following definitions clarify the occupations, certifications, and processes discussed in this study:

Environmental compliance — the act of conforming to federal and state environmental laws, regulations, and standards. Environmental compliance *officers* ensure that water and wastewater systems operate effectively and efficiently.

Occupational segregation—the sorting of individuals across occupations based on social, ethnic, or gender identity.

Water distribution – the processes of delivering potable (drinkable) water to businesses, homes, and industries that are connected to a water system.

Wastewater treatment – the processes involved in treating used water and releasing it back to the environment.

Water treatment – the processes involved in converting non-potable (raw) water to potable (safe for human consumption) water.

Researcher Assumptions

The first assumption for the research was the ability to obtain the support of women water and wastewater professionals who met the criteria of the study. Recruitment of participants was one of the first steps; study participants were recruited from the researcher's professional network of colleagues and peers.

The second assumption was that women's participation in water or wastewater occupations was a significant experience in their lives, and that the study sample provided sufficient representation of women in water. Since the general population of the sample pool was small, efforts were made to ensure that participants were selected from different male-dominated occupations within the water industry.

A third assumption was that since the participants included women holding technical certifications and employment in water and wastewater professions, similarities existed in their

experiences. Purposeful sampling ensured differences among their shared experiences, and categorization of their responses led to new themes.

A final assumption was that respondents would openly and honestly provide answers to all interview questions. The assumption was that the women water and wastewater professionals would have no preconceived opinions concerning the outcome of the study.

Limitations

Limitations of a study consisted of the constraints on generalizability and weaknesses of the design. Several limitations of the research existed regarding women in water. The main limitation was the sample size of five women water and wastewater professionals. As a qualitative method, IPA sampling has limited the generalization of findings to broader populations (Smith et al., 2009). The limitation can be accounted for because the intent of qualitative inquiry is the development of an in-depth exploration of a central phenomenon and not generalizability to a population (Creswell, 2014; Smith et al., 2009).

A second limitation of the study was the perceptual accounts of women's experiences as told by the women participants. Qualitative researchers use participant words and phrases to explain and interpret participant experiences. The subjective nature of qualitative research makes findings idiosyncratic and challenging to apply to situations outside of the research context (Creswell, 2014; Smith et al., 2009).

Accuracy of coding was a third limitation. Researcher bias was inherent and inevitable in the coding process. In the IPA tradition, bias was systematically acknowledged and documented throughout the research process by maintaining a reflexive journal in the NVivo 12 data analysis software program. Thematic analysis was utilized as another method of ensuring accuracy of coding.

Finally, interview data presented a fourth limitation. The participants' emotional states influenced the interview. Data limitations included possible vague responses due to the interviewee's personal bias, anxiety, or stress during the interview (Creswell, 2014). Reactivity between the researcher and the participant may have also affected the interview data (Creswell, 2014).

Scope of Study

The qualitative study involved a thorough analysis of the experiences of five women who hold technical certifications and employment in water and wastewater occupations. An exploration of the women's experiences rather than the structure of water management resulted in a deep understanding of how women experienced their occupational choices, pursuits, and roles in male-dominated water occupations. A qualitative interpretative phenomenological analysis was the research design.

The scope of the study restricted it to a manageable size, enabled a thorough analysis, and allowed the data collection process to be done in a timely manner. The scope of the study did not extend to all women in all water organizations. The specific focus was on women who hold water and wastewater certifications and occupations. The scope did not apply to women water and wastewater professionals outside of California. The scope did not apply to women in water who do not hold technical certifications.

Interviews were conducted by phone and in person. Interviews were the most effective data collection method because the women did not live or work in the same area as the interviewer. An interview pretest involved two women who matched the sample criteria but who did not participate in the study. The pretest study led to minor modifications of the interview questions.

In addition, researchers have recognized that gender does not act alone; both race and gender interact to shape dimensions of women's experiences in water and wastewater professions (Mollett & Faria, 2013). Narrowing this research focus to gender provided a one-dimensional understanding and necessitated additional study and elaboration into the racial and ethnic division within the water labor force (Mollett & Faria, 2013).

The study resulted in descriptions, the development of codes and themes, and a detailed analysis to assist water industry leaders in attracting, recruiting, and retaining women in water.

Summary

Considerable attention has been given to the recruitment and diversification of the water workforce. Despite progress in equal rights and opportunities for women, higher-paid technical occupations in water management have remained male-dominated (Kane & Tomer, 2018). Although nothing inherent in water management jobs makes them appropriately feminine or masculine, the male power relation exists through the segregation of "women's work" and "men's work" (Game & Pringle, 1983). Understanding women's struggles within a social order maintained by a dominant group assisted in understanding women's work choices in the male-dominated water industry. Directly studying women's lived experiences allowed an examination of the power relationships and interactions of women in these male-dominated occupations (Andersen, 1983; Game & Pringle, 1983).

The research questions guided this study. The central phenomenon was that although women represent 46.8% of workers across all occupations nationally, women account for only 14.9% of the water workforce, and a mere 5.2% of water and wastewater treatment operators (DOL, 2018; Kane & Tomer, 2018). Water utilities and organizations have begun to understand

the importance of recruiting and retaining women in water as a way to address the current water workforce and sustainability challenges facing the industry (Kane & Tomer, 2018).

Chapter 1 presented an introduction to the problem of the underrepresentation of women in water (defined in this study as water and wastewater treatment operators, water distribution operators, and environmental compliance officers). Included in the chapter was the background of the problem, the general and specific problems, and the purpose and significance of the study. Also included in Chapter 1 was the research methodology and design, the theoretical framework, the importance of women in water, and a conclusion.

Chapter 2 includes a detailed literature review and history of water and wastewater in the United States. The chapter explains the gaps in literature regarding women in water and wastewater treatment jobs and the provisions and requirements of the Clean Water Act and Safe Drinking Water Act.

Chapter 2:

Literature Review

The purpose of this qualitative phenomenological analysis was to conduct a thorough investigation of the lived experiences of women water and wastewater treatment professionals. The research question sought to answer, "How do women water and wastewater professionals experience their occupational choices, pursuits, and roles?" The research was divided into two aims. One aim was to understand the meaning women water or wastewater professionals make of their experiences in entering and remaining in water and wastewater occupations. The second aim was to gain insight on the successes and challenges women faced in entering and persisting as women in water.

Chapter 2 includes the results of the related search for literature pertaining to the need for recruitment and retention of women in water. The aim of this chapter was to document the lack of women in American water and wastewater treatment occupations and provide context for why that is a concern. The first section provides a historical background of urban water and wastewater systems and the professionalization of the industry. Part two reviews theoretical underpinnings of occupational segregation and the essential role of women in the implementation of water sustainability plans. The presentation of literature includes a historical overview of water systems, a discussion of the benefits of workforce diversity, an overview of water and wastewater jobs and certifications, a review of occupational segregation in blue-collar jobs, and a summary of the chapter.

The literature described a masculine domination of water resources management occupations and outlined the importance of women's participation in the planning and management of water resources. The existing research and the literature provided context for the concern over the reasons behind the segregation of water and wastewater management occupations (Zonde-Kachambwa, 2012; Thompson et al., 2017).

Title Search

The literature review strategies for this research included accessing books, reports, and journal articles through a variety of modern techniques. Many of the journal articles were obtained by searching the University of South Florida (USF) library's academic database. Articles were accessed in the USF electronic databases that offered full-text, from journals that were held by the library. Internet search engines, including Google and Google Scholar, provided current reports addressing the water industry workforce. Occupational data was accessed through the U.S. Department of Labor, O'Net, and the Occupational Outlook Handbook websites. Various keywords used in searches included: water and wastewater operators, water workforce, water training, women and water, water resources management, occupational segregation, feminism, feminist political ecology, and interpretative phenomenological analysis. Textbook content was accessed electronically through VitalSource e-textbook provider and library services at USF.

Literature Gap

The underrepresentation of women in technical occupations has generated much debate and research (England, 2010; Hakim, 2016; Levanon et al., 2016; Maphosa, 2010; Peter, 2006; Pother, 2018; Pringle & Game, 1986; Torre, 2019). The crucial role women play in the day-to-day use of water resources at all levels has been well-documented (Adams et al., 2018; Alda-

Vidal et al., 2017; Aureli & Brelet, 1995; Bennett et al., 2008; Bourman-Dentener, 2015; CAP-NET, 2014; Gender and Water Alliance, 2006; Global Water Partnership, 2018; International Water Association, 2014; Jalal, 2014; Kane & Tomer, 2018). While the active participation of women has been deemed essential to water resource development goals and necessary for the sustainable use of water resources, the literature reported that women should also play significant roles in the technical aspects of water management (Tortajada, 2003).

Existing literature was relatively silent on gender issues relating to water industry employment (Buechler & Hanson, 2015; Johansson, 2016). Only recently has research begun to focus on women and water industry employment, and the connections between women, water, and environmental change remain understudied and frequently undervalued in academia, policy making, and developing literature (Buechler & Hanson, 2015; Johansson, 2016).

Several studies indicated that continued research is necessary for women in the water industry in order to determine the factors that compelled them to enter and persist in water resources management fields (Global Water Alliance, 2006; Johansson, 2016). Because research is the conduit for government, industry, and educational institutions to address human resources gaps, the International Water Association (2014) recommended additional investigation into the motivation and incentives that attract and retain women in the water management and treatment professions. With an emphasis on women in water resources management, the literature suggested that the water industry identify the institutional barriers and bottlenecks that hinder women's workforce participation (Johansson, 2016).

Minimal empirical studies have detailed women in technical and male-dominated occupations in the water sector, and existing studies focused on resistance factors and barriers to women's entry into the water resource management field (Buechler & Hanson, 2016; Zonde-

Kachambwa, 2012). These studies were concentrated in the context of Latin America and Africa, and considerably less research was available in the American context (International Water Association, 2016; Jalal, 2014; Maphosa, 2010; Orr, 2001; United Nations World Water Assessment Programme, 2016).

Historical Overview of Water and Wastewater Systems

"Water is the beginning of all," wrote the early Greek philosopher Thales. Water supports all life, and efforts to provide a clean and safe supply date back to the beginnings of civilization (Rosen, 1993). Ancient Greeks practiced sand filtration and purification before humans knew about chemical or biological contamination. Egyptians used alum to coagulate and settle particles from water. Hippocrates invented the first bag filter to remove sediments that gave water a bad taste or smell, and Roman aqueducts supplied the Empire with 250 million gallons of water a day. Antonie van Leeuwenhoek introduced charcoal water filters after he observed aquatic microorganisms through the lens of the world's first microscope, and John Snow used chlorine for purification at the turn of the century when epidemics of cholera resulted from water contamination (Hempel, 2007).

Wastewater systems date back more than 4,500 years. Excavation of the city of Lothal in the ancient Indus Valley circa 1700 B.C. revealed homes equipped with toilets, baths, and drains that led to a system of airtight drainage pipes (Kenoyer, 1998). The Minoan Palace at Knossos in modern-day Crete had water management systems for supply, runoff, and drainage of wastewater (Gorokhovich et al., 2011). Romans constructed the Cloaca Maxima, one of the world's earliest sewage systems, to remove the waste of one of the world's most populous cities, Rome, where they venerated Venus Cloacina as goddess and overseer (Hopkins, 2012).

Knowledge of water and sanitation has been an important aspect of societal development, and these skills flowed with the tide of history. When little thought of clean water, sanitation, and hygiene existed, as during the Dark and Middle Ages, disease was an expected part of life. Concern for public health mounted during the periods of Enlightenment and Scientific Revolution as people began to understand the association between waterborne diseases and bacteria in epidemics (Koloski-Ostrow, 2015). Industrialization brought huge numbers of people together in cities and increased the need for public water and wastewater systems. European settlers brought their rudimentary understanding of water, public heath, and water use technologies to the New World and settled in areas with ample clean drinking water supplies (Kempe, 2006).

For centuries, private wells and toilets were the primary technologies and contributors to the betterment of American society, and their use continues in rural communities today. As the agricultural sector industrialized, people crowded into cities. For example, the population of Philadelphia, Pennsylvania, was 4,400 in 1700 and soared to 1.5 million by 1910 (Kempe, 2006). Epidemics of disease and concern for public health transferred responsibility for water provision from the individual household to centralized public water and sanitation services (Juuti et al., 2007).

The first American public water works was established in Bethlehem, Pennsylvania in 1755 (Kempe, 2006; National Research Council, 2002). For 100 years, growth remained gradual; America had 83 water systems in 1850. Public health concerns, along with the need to fight the fires that ravaged many cities, increased the spread of public water systems. By the turn of the century, the number of water systems had soared to 3,000 (Kempe, 2006; National Research Council, 2002).

Colonial wastewater systems originally involved cesspools or sewers that percolated water into the ground, a practice that often contaminated drinking water (Juuti et al., 2007). Philadelphia utilized sewers as early as 1762 before the population surge. However, they were inadequate for handling the waste of a million residents. Local governments, embracing the philosophy that "dilution is the solution to pollution," installed infrastructure that funneled wastewater into the nearest waterbody. This practice contaminated the receiving waters, which served as food and water sources to burgeoning city populations, as well as recreation areas (Karvonen, 2011). Between 1850 and 1911, every major city had constructed a wastewater system to remove wastewater and discharge it, usually untreated, into nearby watercourses (Karvonen, 2011). Only after severe outbreaks of typhoid in downstream cities did engineers begin to understand the inadequacies of the "dilution solution." New and improved processes of water treatment introduced filtration plants and the chemical treatment of wastewater before discharging it to receiving waters (Juuti et al., 2007; National Research Council, 2002). By the early twentieth century, urban water supplies and wastewater management were common public services (Karvonen, 2011).

The new practices of supplying urban water and disposing of wastewater coupled with the increasing attention to public health during the turn of the 19th century supported professionalization of water treatment as an occupation that required specialized knowledge. Trade journals, professional organizations, and education opportunities served to regulate and control knowledge of water treatment technologies (Kempe, 2006).

Today, most Americans are accustomed to receiving clean water when they turn on a tap, and they expect used water to disappear down the pipe. The ready availability and easy disposal of water has created limited public understanding of the complicated and expensive systems

behind public utilities (Bartlett et al., 2017). For example, the United States has 1.2 million miles of water-supply mains and an equal number of sewer pipes. Translated, for every mile of interstate highway, 26 miles of water mains exist (Bartlett et al., 2017). Aging water systems and infrastructure include source water facilities to intake and treat drinking water; distribution networks to deliver clean water to customers; and treatment facilities to collect and clean used water to an acceptable level of water quality before returning it to the environment (Quinn et al., 2014). The operational reliability of these water and wastewater utilities depends not only on infrastructure but also on having both sufficient staffing in mission-critical classifications and staff who are sufficiently prepared to perform their work effectively and efficiently (Baywork, 2017; GAO, 2018; Kane & Tomer, 2018).

As evidenced throughout history, and more recently in places like Flint, Michigan and Fort Lauderdale, Florida, inadequate water systems and services, water resource mismanagement, and lack of oversight has presented dangerous threats to public health and wellness. While the crisis in Flint exemplified the dangers of lead contamination, water systems face other water quality concerns, including myriad other contaminants, system failures, and sewer overflows, all of which present environmental and health risks (EPA, 2016). The EPA (2016) estimated that up to 3.5 million people per year have contracted illness from contaminated water, and the American Society of Civil Engineers (2011) has estimated that aging pipes and inadequate capacity resulted in the discharge of 900 billion gallons of untreated sewage into U.S. waterways every year. Most recently, the underground sewer system in Ft. Lauderdale, Florida has failed 11 times in the past 10 weeks (Bryan, 2020). Exploitation and mismanagement of water resources has done irreparable harm to humans and the environment (American Association of Civil Engineers, 2011).

Clean Water Act and Safe Drinking Water Act

Historical progress in water and wastewater treatment has included the development of new approaches, technologies, and regulations to ensure and protect water supplies. Organic chemicals used heavily during World War II became common and made their way into the nation's surface waters, prompting Rachel Carson's 1962 book *Silent Spring* (National Research Council, 2002). In 1969, the Cayahoga River, saturated with sewage and industrial waste, was engulfed in flames for the twelfth time. Carson's book and the flaming Cuyahoga River captured national attention and served to magnify the need for wide-ranging reforms in managing water treatment processes and wastewater discharges (Latson, 2015; National Research Council, 2002). The public clamored for federal standards to protect water supplies, and in the early 1970s, Congress responded by enacting the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), and by creating the U.S. Environmental Protection Agency (EPA).

The rules outlined in the Clean Water Act (1972) regulate water discharges into the environment, and the SDWA (1974) focus on the production of water that is safe to drink. The EPA serves as the regulatory and enforcement agency and has granted each state primacy, or the authority to administer laws governing water and wastewater treatment (Lewis & Kähler, 2018). Regulatory compliance is a universally recognized goal for utilities, and all utilities are tasked with similar regulations under the SDWA (Switzer et al., 2016).

The Clean Water Act (CWA) establishes the structure for regulating discharges of pollutants into the waters of the United States and regulates quality standards for surface waters (EPA, 2018). The Act outlines performance levels for municipal sewage treatment plants to prevent the discharge of harmful wastes into surface waters. States require wastewater operator certification to ensure the effective operation of wastewater treatment plants and compliance

with national discharge limits set forth by the CWA (EPA, 2018). Every person employed in the operation of a public wastewater treatment plant is required to have a valid operator certificate.

Mandates through the CWA and the SWDA spurred federal grants for the expansion of wastewater treatment plants and water treatment facilities in the early 1970s and 80s. To staff the new wastewater treatment plants, as well as public drinking water supplies, a correlated increase in the number of people hired in this sector occurred (Snow & Mutschler, 2012). Ironically, the success of the massive state and federal programs means that most Americans now take the safety of the water they drink and the water in the environment for granted (Moore et al., 2013). Wastewater and drinking water facilities, and the people working in them, are invisible unless a mishaps occurs (Snow & Mutschler, 2012).

Though largely unseen by the general public, drinking water and wastewater operators do have the attention of state agencies responsible for ensuring safe water supplies. The SDWA mandates the training and certification for operators of water systems, and each state produces guidelines for certification (EPA, 2018). By establishing minimum professional standards for the operation and maintenance of public water systems, operator certification is an important step in promoting SDWA compliance (EPA, 2018).

New approaches to water sustainability have affected the skill and certification requirements for water and wastewater treatment operators, which are currently separate, distinct, and managed under different sets of regulations. Modern technologies have blurred the lines between the duties of water and wastewater operators, as in the case of direct potable reuse systems, which bypass environmental buffers and treat wastewater for use as drinking water. The process is becoming more common as cities look for ways to provide a sustainable water source, and industry leaders have collaborated to create standards for a new operator certification that

bridges the boundary between water and wastewater operators (CA-NV AWWA, 2016; Moore et al., 2013).

California Water and Wastewater Operator Certifications

The water industry includes a myriad of middle-skill jobs, including treatment plant operator, lab technician, environmental compliance officer, machinist, mechanic, and electrician, all of which require technical certifications available from various organizations. Other certifications available within and related to the water industry include confined space entry, backflow prevention, cross connection specialist, safety office, hazard materials handler, and maintenance technician.

In California and across the nation, water treatment plant operators deliver a clean, safe water supply to the public. Operators are charged with monitoring water quality and removing harmful contaminants from the water supply. Because of the importance of safe water, operators in California are required to earn a state certification to operate and work in water treatment facilities. Potential operators prepare for water treatment careers by completing a certification process that includes on-the-job training and water treatment experience (California Water Boards, 2019).

State certification is a necessary process mandated by the EPA. Different certification levels exist in California and in most states, and these levels are based on experience and education. Entry-level positions in California require at a minimum a high school diploma, although an associate degree can increase job opportunities (California Water Boards, 2019).

Many states offer four levels of licensure or certification, but California utilizes a five-grade system. These grades indicate the water facility size, the operator's experience, and the amount of education a candidate has completed in the sciences. Entry-level operators begin at the

first levels of certification, which require a high school diploma and a passing score on the California state certification examination. Higher levels of certification require increasing hours of experience and education (California Water Boards, 2019).

Formal education is not obligatory for entering a career as a water treatment operator in California other than a high school diploma; however, employers may favor candidates with an associate degree or certificates in water technology because they need less on-the-job training experience for certification. Formal education and training prepare candidates for careers in the water industry; however, it does not provide state certification in California. California requires a potential operator to successfully pass a state certification examination by scoring at least a 70% on the test along with sufficient training and experience in order to earn a level of operator certification (California Water Boards, 2019).

Since California operators maintain and control plant equipment and machinery, water treatment operators must be familiar with mechanics, laboratory analyses, and process control techniques that guide the safe operation of treatment facilities. The position also requires computer proficiency and skills in data analysis, math, biological processes, and chemistry. Water treatment operators must be healthy and physically capable because their position is physically demanding, and the work can require handling toxic chemicals in loud, odorous, and dirty environments. Water treatment facilities operate on a 24-hour basis, meaning water treatment operators must be willing to work long hours and flexible schedules including holidays, evenings, weekends, and overtime (California Water Boards, 2019).

Environmental compliance officers are part of the wastewater industry and are responsible for ensuring that industries comply with laws and regulations related wastewater and storm water discharge. Job responsibilities include environmental investigations and waste

acceptance programs, coordination with regulatory agencies, and on-site inspections. Environmental compliance officers also train employees and business owners in compliance requirements and practices, including techniques for handling hazardous materials, chemicals, and toxins in view of existing standards (CWEA, 2020).

There are no experience or education requirements for Grade I Environmental Compliance certification. However, it is recommended that Grade I candidates have at least one year of experience working as an Environmental Compliance Inspector because many candidates without the recommended experience have difficulty successfully completing the computer-based test (CWEA, 2020).

The basic requirement for Environmental Compliance Inspector Grade II is four years of full-time work in Environmental Compliance Inspection. Operators may also qualify in a number of other ways, such as having two years of experience as a wastewater operator and holding an Environmental Compliance Inspector Grade I certificate for one year, or having two years of full-time experience and holding an Associate's degree in a related field, or having one year of full-time experience and holding a Bachelor's, or higher, degree in a related field (CWEA, 2020). Advanced certifications require additional combinations of education and work experience.

Laboratory analysis is another job in the water and wastewater field. Analysts are responsible for analyzing the flow to optimize the treatment process and meet regulatory requirements. Wastewater lab professionals monitor the quality of biological activity within the treatment process and the treatment plant's final effluent. Lab professionals ensure the treatment plant is producing good quality water that meets regulatory requirements and can be safely returned to a local river or into the ocean. This is accomplished by collecting daily, and

sometimes hourly, samples from the treatment plant. After tests are run, data is recorded in official treatment plant performance reports. Those reports are formatted and submitted to local health departments, State regulators and Federal regulators. Water quality and treatment plant performance are also summarized and made available to the general public in annual water quality reports (CWEA, 2020).

Although voluntary rather than state-mandated, the newest certification, Advanced Water Treatment Operator (AWTO), was developed to ensure that water and wastewater treatment operators are prepared and knowledgeable about advanced water treatment technologies and related control processes, such as membranes and advanced oxidation used to purify wastewater and other challenging source water. The certification program dovetails with the water sector's move toward the "One Water" concept which stresses that all water — wastewater, stormwater, and drinking water — has value and should be managed as a resource. As Direct Potable Reuse water becomes a reality, this certification will enhance California's advancement of direct potable reuse (DPR) builds momentum for making One Water a reality (CWEA, 2020). The exam launched in 2019 and validates knowledge of operators who will be charged with conducting stringent operations, maintenance and monitoring programs at complex DPR plants as well as other facilities such as those treating brackish or difficult source water such as stormwater. The certification requires at least a grade level 3 or higher in both drinking water and wastewater treatment operations (CWEA, 2020).

As outlined in Table 1, three California water agencies offer various water-related industry certifications: the California Water Environment Association (CWEA), California-Nevada Section American Water Works Association (CA-NVAWWA), and the State of California Operator Certification Program. Education and experience requirements vary by

certification, but most require a combination of experience and/or education in the vocation to qualify for the test (CWEA, 2020).

Table 1

Certifications available by California agencies.

Certifying Agency	Certifications	Grade Levels
California Water Environment Association (CWEA)	Collection System Maintenance	1–4
	Laboratory Analyst	1–4
	Environmental Compliance Inspector	1–4
	Mechanical Technologist	1–4
	Electrical/Instrumentation Technologist	1–4
California–Nevada Section American Water Works Association (CA-NV AWWA)	Water Quality Laboratory Analyst	1–4
	Water Use Efficiency Practitioner	1–3
	Advanced Water Treatment Operator	3–5
	Water Treatment Operator	1–4
	Water Distribution Operator	1–4
State of California Operator Certification Program	Water Treatment Operator	1–5
	Water Distribution Operator	1–5
	Wastewater Treatment Operator	1–5

The Role of Water Utilities

The hydrologic cycle of condensation, precipitation, transpiration, and evaporation occur on a global scale; the processes are common in all natural environments. However, half of the Earth's population now lives in cities, and the urban water cycle dominates these engineered environments (Karamouz et al., 2010; Maxwell, 2015; Sowby, 2014). About 94% of Americans receive their drinking water from a community water system, and 76% connect to publicly owned treatment works (POTWs) (Bartlett et. al, 2017).

In the urban water cycle, utilities procure, treat, and distribute water to homes, businesses, and industries. When customers use the water for cooking, washing, landscaping, restrooms, and industrial and manufacturing processes, they generate wastewater. Utilities then collect, treat, and discharge this used water back to the environment. Utilities in larger cities may also collect, treat, and return storm water back to the environment (Quinn et al., 2014). Water utilities manage the urban water cycle through water supply, wastewater treatment, and storm water management (Wood et al., 2018).

An emerging approach to water management has recognized that all water has value. Managing water sustainably includes managing it in an inclusive and integrated manner (U.S. Water Alliance, 2016). Currently, groundwater is subject to a different set of legal and regulatory requirements than surface waters, even though they connect and interact (Maxwell, 2015). A holistic approach has recognized the relationship between drinking water, wastewater, storm water, gray water, produced water, and recycled water. The emerging approach has been referred to as "One Water."

The American Water Workforce

Water management has been defined as a career field that requires knowledge of science, math, technology, engineering, communication, economics, management, and law to ensure water quality and to sustainably manage water as a resource to protect public health and the environment (Advanced Technology Environmental and Energy Center, 2013). Water professionals perform scientific, technical, managerial, regulatory, and communication tasks and take responsibility for water treatment (Advance Technology Environmental and Energy Center, 2013).

Although nature provides water, it takes pipes, pumps, reservoirs, treatment plants, and people working around the clock to deliver clean water to homes and businesses, and to remove and treat wastewater for safe reuse or return to the environment (U.S. Water Alliance, 2016). Effective water management requires the work of planners, managers, professionals, specialists, technicians, and operators whose work ranges from environmental protection to building infrastructure (United Nations World Water Assessment Programme, 2016). Water sector jobs encompass technical and skilled occupations in water resource management, infrastructure, and provisions for water services, including water supply, wastewater treatment, waste management, and remediation activities (Advanced Technology Environmental and Energy Center, 2013). The majority of utility workers are water and wastewater treatment plant and systems operators and managers, as listed in Table 2. Water utilities encompass 82.3% of water occupations, with the remaining 17.4% of employment in engineering and related occupations (Kane & Tomer, 2018).

Workforce Challenges

Just as a utility must find a source of water supply and financial resources, it also must have a source of high-quality workers to succeed (Switzer et al., 2016). The water sector has recently faced significant workforce challenges in recruiting, retaining, and developing a prepared workforce to deliver the critical services that protect public health and support the vitality of the nation's communities, natural environment, and economy (Kane & Tomer, 2018). With major water and wastewater regulations like the CWA and SDWA turning 50 years old, the initial workforce who entered the profession in the 1970s has now reached and surpassed retirement age. Workforce projections have estimated that nearly half of the top-level water and wastewater operators will retire over the next 12–18 months (NRWA, 2017). This "silver tsunami" has diminished the pool of skilled, qualified water workers, and a large portion of

treatment and institutional knowledge has been lost as high-level employees retire (NRWA, 2017).

Table 2

Largest occupations across utilities, 2016.

Water Utility Occupations	Share of Utility Employment
Water and Wastewater Treatment Plant and System Operators	34.4%
Meter Readers	5.9%
Electricians	5.0%
Plumbers, Pipefitters, and Steamfitters	4.3%
Pipelayers	3.3%
Industrial Machinery Mechanics	3.3%
Office Clerks	3.2%
Maintenance and Repair Workers	2.6%
Septic Tank and Sewer Pipe Cleaners	2.5%
Secretaries and Administrative Assistants	2.4%
General and Operations Managers	1.5%
Bookkeeping, Accounting, and Auditing Clerks	1.4%
First Line Supervisors of Office and Administrative Support	1.2%
Landscaping and Grounds-keeping	1.2%
Customer Service Representatives	1.1%

Note: Brookings analysis of BLS Occupational Employment Statistics and CPS data adapted from Kane & Tomer (2018).

In addition to looming retirements, another factor in the shortage of American water workers has been the invisibility of the industry. While crucial for public health and environmental and economic wellbeing, the water sector and the people who work in it are not well known and are often not respected (Snow & Mutschler, 2012). The water industry has hidden infrastructure, and this lack of visibility means that many people are unaware of the industry and the jobs required to supply water (Kane & Tomer, 2018).

An American shortage of middle skilled workers has added to the water workforce crisis. Even as job seekers increasingly have college degrees, one in four employers has reported an

inability to fill positions because they have been unable to find applicants with the necessary skills required in the workplace of today (Fleming, 2016). The water industry demands a complex breadth of ever-increasing technical skills, creating a gap between the supply of and demand for those skilled workers. Changing regulations and a changing environment mean that water workers have new types of work.

Increasing women's representation in the utility workforce could ease the shortage of technically skilled utility workers (Adams et al., 2018; Alda-Vidal et al., 2017; Aureli & Brelet, 1995; Thompson et al., 2017; Tortajada, 2003). To take advantage of this untapped resource, the water industry must work to engage with women to understand what their challenges to employment are and address the gender imbalance and lack of diversity.

Occupational Segregation in the Water Industry

The unequal distribution of men and women in certain jobs has been defined as occupational segregation (Equitable Growth, 2017). Feminist theory posits that occupational activities have been ascribed masculine or feminine identities, with technical occupations perceived as masculine, and caring occupations characterized as feminine (Alda-Vidal et al., 2017; DiDonato & Strough, 2013; Game & Pringle, 1986; Hakim, 2016).

Societal mechanisms have contributed to women's exclusion from the development of water and wastewater infrastructure and operations. A common theme is an essentialist, socially constructed belief that women have social, expressive, and nurturing traits and are thus more suitable to jobs engaging these skills (Levanon & Grusky, 2016). Essentialism posits that men and women are fundamentally different in interests and skills, and most people follow gender-typical paths (Hakim, 2016). Gender socialization begins early in life, and women become indoctrinated to accept the sexual division of labor that assigns them to motherhood and

domestic roles (Lasonen et al., 1991). Essentialism explains why women intentionally cluster into fields such as teaching, childcare, and nursing (England, 2010) and men typically engage in occupations that require strength and mathematical and analytic skills, and where they can exercise authority. In this way, labor markets limit opportunities for women (Torre, 2019).

Feminist theories have recognized sexual division of labor as a means of social control and a structural feature of modern capitalism (Pringle & Game, 1983). Occupational divisions have been polarized and gendered into masculine/feminine categories such as skilled/unskilled, heavy/light, dangerous/safe, and dirty/clean (Pringle & Game, 1983). De facto, or indirect, segregation may result from of a variety of subtle, indirect, or exclusionary processes; sociological perspectives have questioned if women have access to a particular profession (Hakim, 2016).

Although gender segregation has decreased in recent decades, sex segregation in many blue collar occupations, including those occupations in water and wastewater treatment, has not changed appreciably (Torre, 2019). This gender gap has negative consequences not only in terms of pay equality, but it also affects the sustainability of water supplies (Thompson et al., 2017). The blue-collar job sector includes a variety of manual labor positions (Torre, 2019), including water and wastewater treatment operators. In recent years, legislation has made a positive contribution toward ensuring equal opportunities and an overall decrease in occupational segregation, but this trend has not impacted blue-collar occupations at the same rate (Torre, 2019). Table 3 illustrates the phenomenon of women clustering into lower-paid and unskilled positions while men dominate higher-paid, skilled positions.

Table 3

Selected occupations with high and low shares of women workers, 2016.

Water Occupation	Share of Women Workers
Secretaries and Administrative Assistants	94.6%
Receptionists and Information Clerks	90.1%
Billing and Posting Clerks	88.5%
Plumbers, Pipefitter, and Steamfitters	1.4%
Water and Wastewater Treatment Operators	5.2%

Note: Adapted from Renewing the Water Workforce, Kane & Tomer, 2018.

Conclusion

Women's scarcity in water resource management has pointed to multiple elements that keep women at the margins of leadership (Jalal, 2014). Entrenched cultural and social attitudes; gender stereotyping; perceptions that women lack managerial and technical skills; and a lack of women in STEM programs have contributed to the absence of women water managers (Jalal, 2014; United Nations World Water Assessment Programme, 2016). Recent studies have illustrated a disproportion between men and women's participation in the water sector, and they outlined the detrimental effect the absence of women in the industry has on water resource sustainability (Tortajada, 2003; Henwood, 1996; Orr, 2001).

Integrated water resources management highlighted the need for participatory water management and the inclusion of women in water-related activities (Elias, 2016; Jalal, 2014). Women are major users and managers of household water, and their involvement in community water management decisions has proven vital to sustainability and the improved operation and maintenance of water resources (Elias, 2016; Jalal, 2014; CAP-NET, 2014). Gender equality means that women and men, and boys and girls, have the same opportunities to participate fully in the development of their societies, and this equality is a key to sustainable development (Aureli & Brelet, 1995).

Feminist political ecology strives to achieve the social equity goals of IWRM (Global Water Alliance, 2014). Research showed that powerful groups in society can systematically abuse resources on a large scale and create a significant potential for damage and exploitation (Global Water Alliance, 2014). Increased participation empowers women and achieves gender equity goals by embracing differing points of view. Men and women should be equally involved in all stages of IWRM (CAP-NET, 2014).

Research has shown that women leaders should have a presence in water management in communities, utilities, and government agencies as well as at the level of international policy making (International Water Association, 2014; Jalal, 2014). In addition to recommendations for robust research, the policy recommendations of the Asian Development Bank included building the technical and managerial skills of women as professionals and technicians in the water sector by developing their competency and expertise, as well as mechanisms for women to pursue technical careers (Jalal, 2014). The Water Environment Foundation (2008) recommended that more women and minorities join in the water field, and Kane and Tomer (2018) recommend strengthening the water workforce by enacting local hiring preferences in support of more minorities and women business enterprises (M/WBEs). The International Water Association (2014) recommended strengthening the role of women in water resources management, capturing women's involvement in providing services, promoting technical careers to women, designing recruitment procedures aimed at increasing the number of women employed in technical fields, and encouraging women to enter the water industry through scholarships and increased education and training opportunities.

The literature identified a gap in the documentation of the perspectives of women working as water professionals. An examination of the experiences of women water and

wastewater professionals is missing from the present literature. This research project was created to answer the question about how women water and wastewater professionals experience their occupational choices, pursuits, and roles.

Summary

A review of literature revealed the need for water organizations to invest in the recruitment, training, and retention of women water and wastewater professionals. Despite the number of women in water management, the findings revealed that women remain underrepresented in high-skill, high-pay technical occupations. Numerous studies addressed the benefits that women bring to blue-collar water occupations, but the historical increase of women in the labor market has not transferred to the water industry. Technical occupations in water remain highly segregated (DOL, 2018; Kane & Tomer, 2018).

Chapter 2 included an in-depth analysis of the literature, including a historical overview of water and wastewater systems in America. The chapter also included a discussion on the implications of the lack of women in water management and the workforce crisis currently threatening the water industry. Chapter 3 provides a detailed description of the research methodology, design, participants, instruments, data collection procedures, and data analysis methods for the qualitative interpretative phenomenological analysis.

Chapter 3:

Methodology

The purpose of this interpretative phenomenological analysis was to conduct a thorough examination of the lived experiences of women who pursued technical certifications and occupations in water and wastewater treatment. The research question was, "How do women water and wastewater professionals experience their occupational choices, pursuits, and roles?" The research question was divided into two aims: to understand the meaning women water or wastewater professionals attribute to their experiences in entering and remaining in these occupations, and to gain insight on the successes and challenges they faced in entering and persisting in the water industry.

Included in chapter 3 is a description of the methodology used in the study and an explanation of why a qualitative study was the most appropriate design. Chapter 3 outlines the research design, participants, sample size, and also describes the data collection and analysis processes.

Researcher Background

The researcher's background as an educator who works in the water industry influenced this study. The professional role of developing education programs for water and wastewater professionals necessitated personal involvement and contact with women water professionals. Prolonged engagement with women in water was the fundamental driver of the choice of research topic, questions, methodology, and paradigm. Attendance at conferences and professional events enabled extensive contact with numerous women water and wastewater

professionals who energetically shared their experiences. The effect of these accounts was profound and highlighted the need for research aimed at examining them more closely in an effort to improve water workforce recruitment and diversity efforts. During the research process, interpreting and sharing the women's experiences became deeply emotional and personal. The influence of background and closeness to the subject was documented in a reflexive journal kept throughout the research process.

Research Methods

Researchers employ various types of methodologies when conducting research; the research question drives the choice of appropriate methodology (Denzin & Lincoln, 2018; Neuman, 2018). Qualitative research is used to study human behavior, and the results are dependent on the perspective of the research participants (Denzin & Lincoln, 2018; Durdella, 2019; Neuman, 2018). Qualitative researchers ask broad, general questions, collect data from participant responses, and analyze words and statements for themes (Durdella, 2019; Neuman, 2018). Descriptive research provides details to create a highly accurate picture of a topic, which means that subjectivity is an important facet of qualitative studies. The nominalist epistemology of qualitative research is that reality is not universal but consists of particulars; the findings are informative because they provide an understanding based the subjective accounts of participants (Neuman, 2018). A qualitative methodology in this investigation was appropriate because these methods assisted in understanding experiences as participants' own concepts and creations (Neuman, 2018).

Qualitative methodologies support that reality is based on perception. Each person is different, and their reality changes over time. Meaning, then, is derived from context (Neuman, 2018). Various methodologies exist for conducting qualitative research, but the interpretation of

lived experiences and human perceptions is best understood through phenomenological study (Neuman, 2018). Phenomenology promotes an understanding of human experience as a lived process that is unique to each person and situated by their relationship to the world (Smith et al., 2009).

Phenomenology is described as a philosophical approach to the study of experience (Smith et al., 2009). Phenomenological research attempts to gain knowledge and understanding by exploring individual experiences in detail (Littlejohn & Foss, 2009; Moran, 2008). A central focus is the shared knowledge of a group of people who have experienced the same phenomenon (Littlejohn & Foss, 2009; Moran, 2008). Phenomenology allows researchers to explore the meaning that individuals attribute to their experiences and emphasizes the lived experiences of those human interactions (Littlejohn & Foss, 2009; Moran, 2008).

Because phenomenologists seek to find the meaning of lived experience, the only reliable source for this information is the person (Littlejohn & Foss, 2009). A phenomenological study is appropriate when exploring how a specific group experiences a phenomenon, such as women who work as water and wastewater professionals (Littlejohn & Foss, 2009).

More specifically, interpretative phenomenological analysis (IPA) is a qualitative phenomenological approach that focuses on how individuals experience a phenomenon that holds particular significance to the person (Alase, 2017; Smith et al., 2009). With roots in psychology, IPA began as a way to capture individual experiences and the meaning participants brought to these experiences as interpreted by the researcher (Alase, 2017; Smith et al., 2009). Making sense of what is said requires close interpretative engagement on the part of the researcher (Alase, 2017; Smith et al., 2009). As such, researchers may be unaware of their

preconceptions in advance, so reflective practices and a cyclical approach to bracketing are required (Alase, 2017; Smith et al., 2009).

The contextual nature of phenomenological research means that the background of the researcher influences the selection of the problem to be investigated, data collection process, and interpretation of the findings (Lincoln et al., 2018). A reflective stance is used to insert the researcher into the research context and reveal the different "selves" that researchers bring to the project (Lincoln et al., 2018).

In IPA research, the researcher attempts to understand and interpret participants' relationship to the world. Therefore, IPA is informed by hermeneutics, or the theory of interpretation (Smith et al., 2009). Hermeneutics recognizes that the part cannot be comprehended outside of the whole, referred to as the hermeneutic circle (Smith et al., 2009). Interpretation is made within the context of the event, and interpretation changes with context (Smith et al., 2009). Rather than a traditional linear analysis, the IPA analysis process is iterative, and researchers shift their ways of thinking as they interact with the data (Smith, et al., 2009).

As sense-making creatures, humans attempt to make meaning of their experiences; access to these experiences depends on what information the participants choose to share (Smith et al., 2009). The researcher's job is to interpret the account from the participants in order to understand it (Smith et al., 2009). In this way, the IPA researcher engages in a double-hermeneutic of the researcher trying to make sense of the participant trying to make sense of their experience (Smith et al., 2009). Interpretative research acknowledges that the researcher has entrenched biases and assumptions and that these are a necessary part of the research (Smith et al., 2009). It holds that engagement with the participant is more important than the process of

bracketing prior concerns because the researcher's attendance to the former inevitably facilitates the latter (Smith et al., 2009).

Subjectivity of the participant and the researcher contributed to the appropriateness of an interpretative phenomenological design for this research. The study involved experiences of a single phenomenon of women who work as water professionals, which allowed exploration of their understandings of their personal occupational choices and the challenges and successes they encountered.

Interpretive phenomenological analysis has gained popularity as a way to understand the experiences of individual participants and the meanings that these experiences unlock (Smith et al., 2009). The approach aims to provide a framework for in-depth exploration and interpretation of how participants view and make sense of their social environment and experiences (Smith et al., 2009). This analysis can be used to explore an individual's perception of a phenomenon, and this first-person point of view is an essential theoretical underpinning associated with the methodology (Smith et al., 2009).

The research question served as a foundation for the methodological choices utilized in this study. The research question was best approached through a qualitative phenomenological investigation within both interpretive and critical feminist paradigms. Thematic analysis guided the steps of data analysis and interpretation.

Subjectivity of the participant and the researcher contributed to the appropriateness of an interpretative phenomenological design for this research. The study involved experiences of a single phenomenon of women who work as water professionals, which allowed exploration of their understandings of their personal occupational choices and the challenges and successes they encountered.

Paradigm

Triangulation of theory and methods allowed multiple theoretical perspectives to be used in data analysis and interpretation (Neuman, 2018). A combination of interpretative and critical paradigms contributed to the understanding of women's experiences. Neuman (2018) based the interpretative paradigm on the German concept of "verstehen," or an empathetic understanding of the everyday lived experience of people. The interpretative stance acknowledged that "knowing" was constructed in light of a person's culture, history, and subjectivity (Neuman, 2018). Through an interpretive lens, the scientific process was recognized to be fluid, partial, and subjective (Neuman, 2018).

The research also employed elements of critical social science. The critical feminist worldview recognized that gender could not be isolated from research. The investigation was conducted through collaboration and interaction with the participants using flexible research techniques (Neuman, 2018).

A synthesis of integrated water resources management and feminist political ecology framed the research and results. Feminist political ecology described water resources in the light of gender and power-struggles, while the integrated water resource management framework acknowledged the importance of women in water and outlined policies to increase their participation.

Triangulation of theory facilitated an examination of the data through multiple perspectives aimed at not only understating the lived experiences of water and wastewater professionals, but also at examining their occupational choices, pursuits, and roles.

Appropriateness of Design

A qualitative, interpretative phenomenological analysis design was appropriate for this study because of its uniqueness and suitability to investigate and interpret the lived experiences

of women water and wastewater operators (Alase, 2017). The women's experiences were subjective, unique and significant to each person, and situated by their relationship to the world. The interpretative, interpersonal, and interactive nature of IPA contributed to its suitability as the most appropriate method to provide insight into the research question (Alase, 2017). The ability to interpret and connect similar experiences within the group of women water and wastewater treatment operators contributed to the suitability of interpretative phenomenological analysis as the most appropriate method for this research.

The researcher's personal connection to the water industry contributed to the appropriateness of the research design. The study was conducted with curiosity, empathy, and a willingness to enter into and respond to the participant's world (Smith et al., 2009).

Population

The population for this study included women water and wastewater professionals, defined as women who hold technical certifications and employment as water treatment operator, water distribution operator, wastewater treatment operator, and/or environmental compliance officer. Technical certifications were defined as those required for water treatment, water distribution, wastewater collection, wastewater treatment, laboratory analysis, environmental compliance, or electrical and mechanical instrumentalists necessary to operate water and wastewater systems.

The study sample consisted of five women participants between the ages of 28–56. Participants held between one to five certifications and were employed by water or wastewater utilities from three months to nine years. A range of experience levels provided varying perspectives from women who have recently entered the industry to women who have experienced it over many years. Various experience levels facilitated an understanding of the prevalence and persistence of patterns within the industry. Although participants had a wide

range of experiences levels, they reported similar experiences on the job, and this is elaborated on in chapter four.

Sampling

The study utilized a purposive, emergent, homogenous sampling technique. Purposeful sampling was used to identify and select information-rich cases for the most effective use of limited resources (Creswell, 2014; Smith et al., 2009). Individuals and sites for this study were selected because they were able to thoughtfully foster an understanding of the research problem and the central phenomenon (Creswell, 2014). Emergent or opportunistic sampling was used to create a participant pool from the researcher's contact list, and the participants were selected according to their shared similarities. Sample homogeneity enabled comparison and connections to be made between the women's experiences (Smith et al., 2009).

Purposive sampling was utilized to select women who hold technical certifications and are employed as water or wastewater professionals in California. Because certification and employment requirements vary by state, limiting the sample to women who hold technical certifications and work in California ensured group homogeneity as well as consistency in experiences. The participant pool was also created through opportunistic sampling, as all participants were known to the researcher and were easily accessed from a professional contact list.

The sample size was theoretically consistent with the paradigm and with the orientation of IPA (Alase, 2017; Smith et al., 2009). Data collection focused on quality rather than quantity, so a small concentrated focus within a small number of cases was sufficient (Smith et al., 2009). In order to collect deep, rich, and meaningful data, a manageable sample size was determined to be five.

From a list of personal and professional contacts, invitations to participate were emailed to a list of fifteen women who hold technical certifications and were employed in the water or wastewater treatment field in California. In the context of the study, water and wastewater treatment professionals referred to women employed in occupations requiring California certifications in the fields of water treatment, water distribution, wastewater treatment, or environmental compliance.

The same invitation to participle was emailed to all fifteen women simultaneously using a blind carbon copy (BCC) email to protect identity. Informed consent and a list of the research questions were attached to the email, and the researcher's contact email address and phone number were provided in the email. These documents are available in the appendix of this report.

Informed Consent

Informed consent was critical to the research process. The job of the researcher was to educate potential participants on all aspects of the study so that participants could evaluate whether or not to participate. Participants had a clear understanding of what participating in the research required before accepting (Office for Human Research Protections, 2016).

Participants were emailed an invitation to participate wherein they were asked to review the attached informed consent document and interview questions before responding. Each potential participant received an electronic version of the introduction letter, a list of research questions, and a consent form through email (See Appendix D). The research sample was composed of the first five women who accepted the invitation.

Prior to commencing the interview, the researcher read the informed consent document to the individual participants. After the digital voice recorder was activated, participants gave their verbal consent to take part in the study.

Confidentiality

All documents and files containing the identity of the participants remained confidential. Paper documents and interview notes were sealed and sent by certified mail to the advising professor for secure storage. Electronic files were stored on the researcher's private and password-protected computer. All files will remain secured for a period of three years, after which they will be destroyed. Prior to data collection, participants received assurance that their identity and personal information would remain confidential. Each participant was assigned a unique participant number and identified by their unique number for the remainder of the study. The names of individuals and their organizations were not divulged anywhere in this study.

Geographic Location

Participants were recruited from throughout California. A number of factors influenced the location rationale. Water and wastewater certification requirements vary by state; a localized, homogenous group represented one set of certifications and criteria rather than fifty. The homogenous sample allowed a close comparison of participant experience. In addition, the researcher's professional affiliation with the California water and wastewater industry facilitated a large sampling pool. The purposive, homogenous, emergent sampling technique produced the required five water and wastewater professionals.

Interview Questions

This interpretative phenomenological analysis utilized open-ended questions posed during semi-structured interviews. The interview questions were developed collaboratively between the researcher and with the input of two additional water and wastewater professionals who were colleagues. After reviewing and discussing the research question, the group brainstormed a list of possible interview questions aimed to both answer the research question and garner rich responses from the participants. The selection criteria were that the questions

were likely to provide insight into the lived experiences of water and wastewater professionals. Twenty open-ended interview questions that addressed the research question and enabled data-rich responses were selected for field-testing.

After the initial interview questions were developed, they were tested to reveal any deficiencies in the design (Larkin et al., 2006; Smith et al., 2009). A purposeful sampling technique was used to select two women who agreed to answer the interview questions and provide feedback. The two women in the population subset were excluded from the sample used in the study. The women were professionals in the water treatment industry and personally acquainted with the researcher. After agreeing to review and provide input, the participants received the questions by email, responded to them in writing, and noted any concerns.

Interview questions were revised according to participants' input, and a revised survey instrument with seventeen interview questions was created. A mock interview based on the revised questions was then conducted with the same two participants to estimate time and to gain additional input. Both women approved the interview revisions, which were used in the actual interview document and is included in Appendix D. This preliminary analysis helped to determine whether the wording, order, and timing of the questions presented challenges to the interviewees. The test procedure involved noting the length of time the interview lasted and any questions about the intent and wording of the questions. Both participants approved the survey instrument and methods.

Data Collection

A sequential data collection process began prior to actual data collection. Steps in the initial process included creating the interview questions and testing the data collection instrument (Creswell, 2014).

Next, the initial five volunteers for the study were identified through the researcher's professional contact list of women water and wastewater professionals with varying levels of experience. Emails were used to initiate contact and to confirm their interest in participating in the study. The sampling technique was inexpensive, but it introduced bias by leading to a reduced likelihood that the sample was representative of a cross section of the population (Creswell, 2014). By including all women water professionals within the contact list and across the state, the bias was controlled. The diverse group represented women of all ages, certification levels, and levels of experience.

Data collection was in the form of semi-structured interviews that aimed to elicit a rich, detailed, first-person account of participant experiences. Interviews were the best way to collect this data (Smith et al., 2009). The collection of "rich" data meant that participants had the opportunity to tell their stores, to speak freely and reflectively, and express their concerns at length (Smith et al., 2009). In the IPA tradition, semi-structured, one-on-one interviews were the preferred means to collect participant details, stories, thoughts, and feelings (Smith et al., 2009). The benefits of these one-on-one interviews were that they were easy to manage, allowed a rapport to be developed, and allowed in-depth and personal discussion between the researcher and participant (Smith et al., 2009).

To meet the mandates set forth by the Federal Policy for the Protection of Human Subjects, none of the women interviewed were under 18 years old, mentally handicapped, or incarcerated (Office for Human Research Protection, 2016).

The interview was initiated by restating the purpose and the nature of the research by reading aloud the informed consent document, which also informed the participants of their right to withdraw at any time. To provide an assurance of privacy, a participant identification number

was assigned and explained. Participants verbally acknowledged understanding of the identifier's purpose in all further data analysis and collection. After obtaining verbal consent to utilize a digital recorder, background questions (see Appendix D) were asked regarding the participant's age, certifications held, occupational title, and time in the water industry. The semi-structured interview questions were open-ended and designed to elicit detailed information about the experiences of the women water and wastewater professionals. Open-ended questions ensured that participants had a chance to relax, talk more freely, and provide details, comments, and insights about their experiences beyond the constraints of the interview questions (Smith et al., 2009).

The semi-structured interview consisted of seventeen questions posed to five women water and wastewater professionals. The researcher initiated four telephone interviews, which were scheduled and conducted at the participant's convenience. One participant who requested a face to face interview was interviewed in a private room at the researcher's place of work. The length of each interview was one hour. Participants received an electronic copy of the transcribed interview to verify the accuracy of information, and all changes suggested by the participant were made (Creswell, 2014). All documentation of participants' confidential information will remain secure for three years, after which it will be destroyed.

The interpretative phenomenological analysis involved collecting information via four digitally recorded telephone interviews and one face-to-face interview. Open-ended questions regarding the experiences of the study participants in water and wastewater occupations were composed to elicit content-rich responses. The survey instrument was developed, peer-reviewed, and field tested prior to the interview. The standardized, open-ended approach facilitated efficient interviews that were easier to analyze and compare (Smith et al., 2009).

Data Analysis

Data analysis was a complex process that required many steps to move from raw data to interpretation (Smith et al., 2009). This research utilized a hybrid approach that integrated methods of both IPA analysis and traditional thematic analysis. The data analysis processes in IPA are not linear, and no clear right or wrong way exists to conduct the analysis (Pietkiewicz & Smith, 2012; Smith et al., 2009). IPA recommends specific steps of establishing familiarity through 1) reading and re-reading, 2) identifying descriptive comments, 3) developing a list of emergent themes, and 4) searching for connections across themes and cases (Alase, 2017; Smith, et al, 2009).

Qualitative coding was a systematic, subjective, and transparent process of reducing data to meaning and credible concepts (Adu, 2019). Participant statements were first broken down into meaningful and manageable chunks, which revealed keywords and phrases that were repeated by the participants. The statements were then reduced to a few words that moved closer to the core essence of these experiences. Finally, categorization captured the core essence of the meaning unit (Alase, 2017). Utilizing this method allowed a meticulous and methodological breakdown of participant responses without diminishing or misrepresenting their experiences (Alase, 2017).

The data was approached through a systematic process that involved choosing relevant information from the data, labeling the selected information, and grouping the labels (codes) into abstract concepts which then informed the final categories and themes (Adu, 2019). Consistency was maintained by adhering to the philosophical assumptions of interpretative phenomenological analysis (Smith et al., 2009). To promote repeatability, detailed descriptions of actions and decisions taken in the study were recorded and are described in the remainder of this chapter.

In qualitative research, subjectivity is recognized as the main instrument used to produce codes, categories, and themes (Adu, 2019). The researcher's personal experiences of working with women in water provided a unique lens from which to view the data. Previous conversations and knowledge of their stories solidified relationships and enhanced interpretation and communication methods. Although conducting a subjective inquiry could be seen as a methodological weakness, it is in fact the best method of examining complex and unique issues that are difficult to quantify (Adu, 2019).

The ability to replicate the study was considered in all phases of the research. A detailed overview of the analysis process created a transparent data analysis methodology to facilitate future researchers in comparing findings (Adu, 2019). An interpretative and phenomenological tactic guided the data analysis and was aided through a NVivo 12 Qualitative Data Analysis program. NVivo software removed many manual tasks associated with data analysis and allowed more time to explore trends, themes, connections, and responses concerning the research questions (Adu, 2019).

After creating a project file entitled "Women in Water," the NVivo 12 program was structured to record all user actions to an event log, which enabled documentation to be constructed during the analysis phase. Constructing documentation supported the analytic process and produced richer contextual information (Corti et al., 2019). Next, the five interview transcripts were loaded into the NVivo 12 software followed by a participant classification sheet containing demographic and certification data. Finally, cases were created and connected to each interview and classification within the program (Adu, 2019; Corti et al., 2019).

Since empirical indicators often require interpretation, data was coded using interpretative methods (Abu, 2019). Initial exploration of the data included word frequency

searches, word clouds, mind maps, and cluster analysis. This early exploration of the data revealed common words and stems and connections between the interviews (Adu, 2019). Building on the previous textual reading and transcription, the exploration activities created familiarity, provided a broad overview of the data, and aided in the coding process by generating a deeper understanding and connection to the content.

Data reduction began with the individual case with close, line-by-line coding of the responses of each participant (Larkin & Thompson, 2012). Initial coding involved identifying explicit empirical indicators that addressed each research question. The NVivo software utilized nodes, which act as codes. First, a node was created manually for each research question; the initial research nodes consisted of codes developed from keywords in the research question. Since all of the women addressed setbacks only in the context of education and certification, research questions five and seven were combined into one node. A close reading and line-by-line coding of each transcript followed, and each reference was catalogued within the appropriate node. Each specific reference to a topic was dropped into a node. The number of references indicated frequency of a topic and served as a basis for thematic development.

In addition to IPA analysis, the six phases of thematic analysis were incorporated in the data analysis process (Nowell et al., 2017). These processes were performed in concert, and elements of IPA data analysis generally coincided with thematic analysis. In phase one, the researcher established familiarity with the data. The study involved collecting data from the participants and gathering information from digitally recorded interviews. After each interview, the digital recording was uploaded to the researcher's computer and saved using the participants' unique identifier and the date of the interview. The recording was converted to an MP3 file and

uploaded onto the Nvivo 12 transcription platform. Each recording was automatically transcribed using NVivo 12 software.

After written files of each transcript were returned, the transcript was compared line-by-line with the audio recording, and changes were made to reflect the recorded interview. The process required simultaneous immersion in both visual and recorded data and enabled an informaal search for patterns and meanings in the initial stage. Repeated review and interaction with the text and written word created familiarty with and closeness to the data. All records of raw data were archived, which created an audit trail and benchmarks against which later intrepretations could be checked for accuracy (Nowell, et al., 2017). After transcription, each participant was emailed a copy of her transcript to validate and review for accuracy.

Thematic analysis utilized both inductive and deductive approaches to systematically identify, organize, and offer insight into patterns of meaning found within the data (Braun & Clarke, 2012). An inductive approach was used to build ideas and generalizations from the data. Induction began with specific observations of empirical evidence and moved to generalization of participant experiences (Neuman, 2918). Data was first categorized in a coding framework constructed from the interview questions. A deductive approach provided the structure from which to organize initial data. An inductive approach was used to build ideas and generalizations from the initial themes.

In the NVivo 12 qualitative data analysis software, interview transcripts were analyzed and line-by-line and references were coded within the initial framework, which yielded a numerical count of responses. Data was reduced by selecting the five codes with the highest number of references to serve as initial themes. An inductive approach was used to build ideas and generalizations from the initial five themes. Analysis began with specific observations of

empirical evidence and moved to generalization of participant experiences to answer the research question concerning how women water and wastewater operators experience their occupational choices, pursuits, and roles (Neuman, 2918).

Phase two involved generating initial codes. An initial coding framework was developed by creating a one-word code for each of the interview questions; each interview question was reduced to a one-word code. Based on combining similar codes and seminments, the seventeen codes representing the interview questions were condensed to fifteen and programmed into the Nvivo 12 software as parent codes. Written transcripts were then analyzed line-by-line, and each sentence with reference to a specific code was dropped into the parent code.

After initial codes were generated and populated, phase three involved searching for themes. Thematic analysis from inductive approaches were strongly linked to the data, so the analysis was data-driven (Nowell et al., 2017). Themes were developed by sorting the codes according to the number of references housed within each code. Of the fifteen parent codes, those codes with the most number of references indicated the most often mentioned topics during the interview. Using a hierarchal structure, the five codes with the highest number of references were identified as themes.

In thematic analysis, stage four involved reviewing the themes to search for patterns. The coded data extracts were reviewed for each theme within the research question to determine whether the themes accurately reflected the meaning evident in the data set (Nowell et al., 2017). The process to refine the themes was organic and directed the researcher back to the original research question, "How do women experience their occupational choices, pursuits, and roles?" The five thematic codes were reduced to encompass the goals of the research question. New codes were developed based on the research question, new parent nodes were created in NVivo,

and data from the initial themes were re-coded into the new nodes. An interactive and iterative process enhanced understanding of the data. All steps were recorded in NVivo12 software.

Defining and narrating the themes was accomplished in the fifth stage of thematic analysis. The data points contained in each of the new themes was reviewed multiple times. The original transcripts were reviewed and any additional statements supporting each theme were added to the new thematic codes. The themes revealed a narrative of the ways women water and wastewater professionals experience their occupational choices, pursuits, and roles.

Thematic analysis concluded with the sixth step of producing the report. The results of IPA and thematic analysis are outlined in the next chapter.

Trustworthiness

The issue of trustworthiness was addressed throughout the research process. Transparency was ensured by clearly recording all steps in a reflexive journal and the NVivo 12 qualitative data analysis software program. Thematic analysis was conducted in a systematic six-step process. All information has been disclosed and clearly articulated in the research report.

Credibility was established through prolonged engagement and theory triangulation as outlined by Lincoln & Guba (1986). The researchers' previous years and familiarity in the water industry facilitated understanding of the various aspects of water and wastewater treatment occupations as well as enabled a rapport with the participants. Knowledge of the industry and trust from the participants created a conversational tone and willingness to share during the interviews. Triangulation of theory occurred by viewing the information from both an interpretative as well as critical feminist lens (Lincoln & Guba, 1986).

Validity was achieved by ensuring transferable findings. The phenomenon was described in sufficient detail that enabled other researchers to evaluate the extent to which conclusions are

transferrable to other times, settings, and situations (Lincoln & Guba, 1986). The researcher maintained and described detailed accounts and notes throughout the research process and outlined each step of methodology, data collection, and data analysis.

Dependability was established by providing a traceable and clearly documented research process. Detailed notes were maintained in NVivo 12 in the form of a reflexive journal and a project log. NVivo 12 software was programmed to write all user actions to a project event log. The project event log recorded and stored all commands in the sequence they occurred. The NVivo 12 Notes function was utilized to create a reflexive journal.

Confirmability was addressed by acknowledging the researcher's possible bias and preconceptions in the reflexive journal. Biases were bracketed during the interview. Researcher motivation was addressed in the informed consent document, and participants were made aware that the research was of a personal nature and unrelated to the researcher's occupation.

Trustworthiness was also evaluated by IPA criteria of four additional criteria: sensitivity to context, commitment and rigor, transparency and coherence, and impact and importance (Smith, et al., 2009).

Sensitivity to context began in the early stages of research (Smith et al., 2009). Close engagement with women who work in water management occupations directed the choice of IPA as a research method. Personal connections with participants elicited an appreciation of and empathy for their unique experiences, and this familiarity eased interaction during the interview. Previously established bonds ensured that the interview was extension of prior conversations. Sensitivity to context extended through the analysis process. A considerable number of verbatim extracts were used in the analysis to give voice to the participants. These methods enable the reader to check the researcher's interpretations (Smith et al., 2009).

Commitment and rigor, demonstrated in a variety of ways, was a second method of ensuring validity and reliability (Smith et al., 2009). Commitment was ensured by the investment of attention and care in participant–researcher interactions. Comradery ensured the participants' comfort during the research and interview processes. Awareness of current and relevant literature also demonstrated commitment to the purpose of the study (Smith et al., 2009). Rigor was addressed in the thoroughness of the study (Smith et al., 2009). The selection process was conducted carefully and with integrity to ensure that the participants were able to provide insight into the research questions and their lived experiences as water and wastewater professionals (Alase, 2017). A thorough and systematic thematic analysis was used to develop an evidence-based interpretation of each theme (Smith et al., 2009).

Transparency and coherence were achieved by clearly describing each stage of the research process, including descriptions of how the participants were selected, how the interview process was constructed and conducted, and the steps in analysis (Smith et al., 2009). Ambiguities and contradictions were addressed through careful writing and multiple drafts, and the double-hermeneutic inherent in IPA was acknowledged and explained (Smith et al., 2009). More importantly, the research carefully followed the principles of IPA as a creative process (Smith et al., 2009).

In the IPA tradition, the final test of validity was in whether the research informed the reader of something important, interesting, or useful. The underrepresentation of women in water resource management has threatened the quality and quantity of water supplies both nationally and globally. As evidenced throughout history, and recently in our own back yards, water resource mismanagement and lack of oversight can be a dangerous threat to public health and wellness. Today, more than one million Californians and two million Americans lack access to

clean drinking water at home, work or school, which negatively impacts their everyday lives. "The fact that more than a million Californians can't rely on clean water to drink or bathe in is a moral disgrace," said Governor Newsom (California, 2019; Jagannathan, 2019). This situation, then, is the real test of validity. If we want to keep lead out of our water and wastewater out of our streets, women must be fully integrated and trained in all aspects water resource management, especially technical positions (Maphosa, 2010).

A hypothetical, virtual independent audit was a part of this research. All data was filed in such a way that someone could follow the chain of evidence from initial notes, proposal, interview schedule, interview tapes and transcripts, tables of themes, drafts, and final report to reconstruct the research (Smith et al., 2009).

Summary

As a qualitative research method, IPA is an in-depth analysis of a particular significant event experienced by all participants. IPA was used to provide detailed examinations of the personal lived experiences of women water and wastewater professionals. The purpose of this qualitative interpretative phenomenological analysis was to examine the lived experiences of women who work in water or wastewater occupations. The overarching goal was to explain the meaning they make of their experiences in entering and remaining in these occupations and to gain insight on the successes and challenges that they faced in entering and persisting in California's water and wastewater industries.

The IPA method was most suited to achieve the goals of the qualitative study (Alase, 2017). Uncovering the details of the phenomenon from the participant perspective and in their own words helped to best explore what is common and pervasive among women who work in water.

An interview field test provided a review of the questions in the data collection instrument and the interview protocol. The pretest involved interviewing two women who are water and wastewater professionals to determine if any flaws existed in the design of the interview questions. Participant feedback from the pretest process identified any vague or leading questions and assisted with organizing the interview.

Participants received the informed consent form by email, and it was read aloud to them prior to the interview. Interviews using open-ended questions allowed for rich data collection in the form of participant responses. Interview transcripts were transcribed automatically using NVivo 12 transcription software and verified through a line-by-line reading along with the audio file. Data analysis was conducted using the qualitative data analysis tool, NVivo 12.

Chapter 3 detailed the research methodology and design, population, data collection process, and data analysis. Chapter 4 outlines the emerging themes and patterns discovered during the data analysis.

Chapter 4:

Data Presentation and Analysis

The purpose of this interpretative phenomenological study was to conduct an analysis of the motivations and experiences of women who pursued technical certifications and occupations in water and wastewater treatment industry. Interviews were conducted with five women employed in technical occupations requiring a California water or wastewater treatment certification.

A small sample size yielded rich meaning, differing responses, and quality data that supported the research claims (Smith et al., 2009). Data collection was in the form of digitally recorded semi-structured telephone and face-to-face interviews using open-ended questions to search for emerging themes (Smith et al., 2009). The five women participants hold a water or wastewater treatment certificate in the state of California and are currently employed as a water treatment operator, water distribution operator, wastewater treatment operator, or environmental compliance officer. A small, homogenous participant pool allowed the researcher to examine the convergence and divergence of the individual accounts of the participants (Alase, 2017).

Chapter 1 presented an introduction to the need for the study, the theoretical framework, and the importance of the research to the water industry. Chapter 2 contained an analysis of the literature, including a history of water and wastewater treatment systems, a discussion of water and wastewater processes, an explanation of California certification requirements, an examination of occupational segregation in the water industry, and an outline of the need for diversity in the industry. Chapter 3 contained a description of the methodology, including the

design, methodology, participants, data collection instruments and procedures, and the steps taken in interpreting and analyzing data. Chapter 4 outlines the research findings and results.

Research Questions

Exploratory research questions were generated through interactions and conversations with women water and wastewater professionals who were consistently and remarkably willing to relate their work experiences in vivid detail. Learning about these women and the struggles and triumphs they experienced inspired the research questions and methodology. The study involved collecting and analyzing data to answer the primary research question, "How do women water and wastewater operators experience their occupational choices, pursuits, and roles?" The research question was divided into two aims: to understand the meaning that women water or wastewater treatment operators attribute to their experiences in entering and remaining in water and wastewater occupations, and to gain insight into their successes and understand the challenges they faced in entering and persisting in these water operator roles.

Research Timeline

The data collection process transpired over a 4-week period beginning November 1, 2019 and ending on December 2, 2019. Semi-structured, digitally recorded interviews took place over the phone and face-to-face for approximately one hour per interview.

Demographics

Participant ages ranged from 28–56 years, and levels of experience ranged from 3 months to nine years. Each participant held one to five California State Certifications for water treatment processes. A range of age and experience levels facilitated exploration of new as well as enduring phenomenon. All participants were employed in public sector water utilities. Ethnographic data was not collected.

Participant education and levels were varied and distributed among the women. In addition to their industry certifications, two women had high school diplomas, one woman had an associate's degree, and two women earned bachelor degrees. The wide variation of educational levels were equalized though certifications. One participant noted that rather than considering an employee's education level, supervisors instead considered the most recent industry certification as a basis for additional pay or advancement.

Table 4

Participant number, job title, years in industry, and certifications held (n = 5).

ID	Age	Industry Experience	Current Job Title	Number of Certifications	Current Certifications
P1	28	3 months	Utilities Worker Apprentice	1	Water Distribution Grade 2
P2	47	8 years	Regulatory Compliance Officer	5	Water Distribution Grade 1 Water Treatment Grade 1 Wastewater Treatment Grade 2 Environmental Compliance Grade 2 Qualified Industrial Stormwater Practitioner
P3	35	4 years	Regulatory Compliance Officer	3	Water Distribution Grade 3 Water Treatment Grade 3 Wastewater Treatment Grade 1
P4	56	9 years	Water Treatment Operator	2	Water Distribution Grade 1 Water Treatment Grade 4
P5	48	3 years	Wastewater Treatment Operator	1	Wastewater Treatment Grade 2

Although all of the women participants had previous work experience, none had any experience working in a male-dominated, blue-collar field. Previous occupational backgrounds

included real estate, the financial industry, and bicycle delivery; all women were unemployed when they entered the water industry. Because the world of women water professionals is small, some data has been disaggregated to protect confidentiality.

Thematic Analysis

Data coding was a systematic, subjective, and transparent process of reducing data to meaning and credible concepts (Adu, 2019). Thematic analysis provided a process that strengthened familiarity with the data, assisted with generation of initial codes, and aided in searching for, reviewing, and defining themes.

The first step of thematic analysis established familiarity with the data. After recorded data was automatically transcribed with the NVivo 12 software, accuracy of the draft was verified by listening to the recording while simultaneously reading the initial transcription. This was a slow process that involved repeatedly stopping and rewinding audio in order to make necessary changes to the written document. The interactive and reiterative nature of the transcription process ensured that the text was read and heard multiple times, which established familiarity with the data.

Familiarity with the data was also enhanced by efforts to more completely understand the functions and capabilities of the NVivo 12 software program. Early interactions within the program included experimental word frequency searches and word clouds to reveal common words and stems within the data. Building on the previous textual reading and transcription, the exploration activities created familiarity, provided a broad overview of the data, and aided in the coding process by generating a deeper understanding and connection to the content.

Initial codes were generated in phase two. A preliminary coding framework was developed by combining and reducing the interview questions to a one or two-word phrase; the resulting fifteen phrases served as the initial codes. Interview questions five and seven (setbacks

and education/certification process) were combined into one code because all references to setbacks were in reference to the certification process. Next, individual interview transcripts were analyzed line-by-line, and relevant participant statements were assigned into one of the fifteen codes. The conclusion of this phase produced a numerical response value as outlined in Table 5. A total of 295 reference statements were coded in the fifteen initial categories.

Table 5

NVivo 12 initial interview codes and number of references.

Interview Question (IQ)	Code	Number of References
IQ 1	Aspirations	8
IQ 2	Awareness, Prior Knowledge, Mentor	26
IQ 3	Motivation	36
IQ 4	Likes/Dislikes	12
IQ 5 + 7	Setbacks; education and certification process	48
IQ 6	Job tasks	5
IQ 8	Specific Experiences	33
IQ 9	Modifications Required	24
IQ 10	Pushback / Support	9
IQ 11	Advantages / Disadvantages	7
IQ 12	Respect	12
IQ 13	Traits	23
IQ 14	Accomplishments	37
IQ 15	Advice	15
TOTAL		295

The third step of thematic analysis consisted of participant statements that formed the foundation for general themes (Smith et al., 2009). By numerical ranking, the five codes with the most numbers of references were identified as the emerging themes. The rationale was that because they contained the most number of references, participants discussed and elaborated on these topics more than others. The five most-mentioned topics included twenty-six references to awareness, thirty-six references to motivation, forty-eight references to education, thirty-three

references to experiences, and thirty-seven references to accomplishments. These five themes were coded as dominant codes. The remaining ten codes were reviewed and condensed by relative topic into one of the five themes, which created a total combined reference number. Thus, interview question two, awareness, initially contained twenty-six references. After adding the additional statements that were not included as a major theme, the total combined number of references was 34. No related references were identified in two categories, motivation and education, and these total references remained the same. In combining nodes, some overlap between categories was experienced. In cases where a statement could fit in two or more categories the choice was made deductively and placed in the most logical category based on the researcher's judgement and experience.

Table 6

Identifying themes in NVivo 12.

Theme #	Interview Question (IQ)	General Theme	Total Initial References	Total Combined References
1	IQ 2	Awareness	26	34
2	IQ 3	Motivation	36	36
3	IQ 5 + 7	Education	48	48
4	IQ 8	Experiences	33	83
5	IQ 14	Job Satisfaction	37	94

Phase four of thematic analysis involved a review of each emerging theme. The review enabled deeper familiarity with the data and formed the basis for defining and naming major themes. The results of the data are discussed here.

Initial Theme 1 – Women have no prior knowledge of the water industry

Prior to encountering a challenging life-situation, all research participants identified a lack of prior knowledge of water and wastewater treatment as a process or viable career. The data included thirty-four references to this fact. Prior to their entry into the workforce,

participants had a wide range of career aspirations, such as veterinarian, advertiser, commercial artist, lawyer, and Olympic champion. They learned about water occupations through an industry professional and/or family member. These friends and family members served as mentors and guided the women through the steps of obtaining education materials, the certification process, and securing a job. Verbatim statements supporting this theme are summarized in Table 7.

Table 7

Theme 1: Participant quotes addressing awareness.

Participant ID	Specific Statement
P1	"I didn't know anything about water until 6 months ago. I literally knew nothing."
P2	"I definitely did not think about water or wastewater—didn't even know that that field existed."
P3	"I had no idea that water treatment was even a thing. No one ever talked about it in elementary or high school or anything. I probably would have got started sooner if I had known about it."
P4	"I never thought of being a water treatment operator. This guy who was a retired operator got me into it."
P5	"Getting [into] wastewater was a total accident, an absolute accident. In no way did I ever think that I would be in the wastewater industry whatsoever."

Initial Theme 2: Entry into the water sector is mentor-driven and influenced by life circumstances

The second theme that emerged from the qualitative study was motivation to enter the industry. Research data indicated that women's entry into the water sector was influenced by a desire to improve their lives, as indicated by thirty-six textual references. All participants faced a

challenging life situation and were introduced to the water industry by a supportive friend or family member. Financial benefits, job stability, and opportunities for advancement motivated participants to earn the certification necessary for employment. All participants cited money or a stable income as a driving factor. Benefits of working in the industry were often cited as a way to overcome and improve the women's current life situations. Table 8 outlines participant statements regarding the phenomenon.

Table 8

Theme 2: Participant quotes addressing motivation.

Participant ID	Specific Statement
P1	"But mostly I wanted a good, stable job where I could make some money."
P2	"I was unemployed at the time, and a single mom, and money was tight. I had a lot of aspirations of breaking that barrier and getting back into making more money for income."
P3	"I needed something that paid well and that would be around for a long time."
P4	"I was on food stamps. There were times when I was at the food pantry, my house was in foreclosure. I was a single mother out in a teeny little town where there was no work, trying to hold it together so my kid could get to fifth grade in the one school. I didn't want to move her. I wanted a place where I could work and not worry about money again. And be at peace, you know, because I was decimated. I had nothing."
P5	"I was just tired of customer service. In water, you will make a living wage, you'll have security."

Initial Theme 3: Education and training are self-directed and mentor-driven

Education emerged as the third theme. The research data indicated that the educational pursuits and certification attainment of women in water were self-directed and facilitated by a mentor. Preparation techniques for various state certification exams included a combination of self-study, coursework at a local community college, and weekend-long intensive review seminars. One participant drove one-hundred miles to attend a face-to-face training session designed to help her pass the next level exam. She described her instructor and experience as, "He's kind of weird and obscure. He would come, and there'd be a hotel, and you'd stay at the hotel and you go to the conference room and there would be 40 people there taking his class." Another women who attended class at a local community college benefitted from the guidance of her teacher. She quoted, "The teacher, he kind of told us which website to go to. The one that I had found was the actual certification application, and so he's like, no, no, that's the wrong one. And so he helped me get that one." All women utilized the guidance of a teacher or mentor-figure to guide them through the certification process.

One hundred percent of the participants utilized training materials from the Office of Water Programs at Sacramento State. The training manuals are also known within the industry as the Ken Kerri and/or Sacramento books, although one participant referred to the manual as "the big book" and another referenced it as "the Holy Grail." Both participants who enrolled in a class at their local community college opted to prepare for advanced certification by studying the Office of Water Programs manuals.

Participants learned about the training manuals and courses from a mentor who guided them to the correct source and answered questions they had. One participant related that she knew so little about the industry that she accidently purchased a wastewater manual rather than a water manual. Student and mentor realized the mistake several months later after she posed a

question about anaerobic digestion, which is a process in wastewater treatment but unrelated to water. Since the participant had invested time and money, she chose to continue studying wastewater and has been a wastewater treatment operator for three years.

Participants cited availability, ease of access, affordability, and technical expertise of the training materials as the main reasons for choosing this source. Although the time commitment and effort of study varied between the women, all participants passed the state exam on their first attempt. Specific participant comments are included in Table 9.

Table 9

Theme 3: Participant quotes regarding education.

Participant ID	Specific Statement
P1	"I took an online class at Sac State, which also gave the basics of the water system, so that way I could just go straight to D2 and T2. You have to sign up, buy the books, go through each chapter. And there is a test that you have to make higher than 70%. There are maybe 12 tests and after you turn all those in you have a college course. You get a certificate. I turned in that certificate with my money, and I applied for the T2 and D2. I did it in a weekend. And I passed both tests on my first try."
P2	"I read the Ken Kerri books. All those books that are geared towards that exam. I read all those books more than once. I did all the chapter exams and things like that. I studied really really really really hard. I studied for months. I studied lots of material. I did not take it lightly." "I passed every exam on the first try."
P3	"The convenience of the correspondence course through Sac State was just incredible. On my lunch break, I'd read a chapter and do part of a test and send it all off. It just made things so much simpler. I was able to complete it faster than sitting in a classroom." "I really liked the self-study part of reading the manuals. It was really your pace, which was really beneficial, and you get it done fast or you get it done slow and then it's done. You know, the book was 50 bucks and the class was 50 bucks, you can't beat it."

Table 9. (Continued)

P4	"I did the courses with the big book, the Ken Kerri books."
P5	"My sister told me to start out with the Sacramento books. That's the Holy Grail. That's where you want to start out."

Initial Theme 4: Regardless of experience levels, women experience similar challenges throughout the industry

The fourth theme illuminated the numerous challenges that women in water treatment industry face. The challenges varied little in context but greatly in extremes. Generally, the water industry was tailored for men in size, equipment, and context. For example, participant uniform options consisted of ill-fitting, man-centered cuts and sizes. Two participants found the relaxed cuts more comfortable than women's clothing, and one woman was motivated to hide her feminine features in the men's uniform to receive fewer body-related comments. Rather than wear an ill-fitting uniform, another woman "struck up a deal" with her supervisor to purchase and be reimbursed for her work clothes.

Access to restrooms was another consistent issue. One bathroom lacked a door, another was insufficient for the number of women employed on the site, and one participant refused to "pee" in a bucket at work. Her request for a portable toilet had not been granted at the time of the interview.

Four women experienced direct and open hostility from male coworkers to varying degrees and indicated that men are unaccustomed to "taking directives from a woman." A lack of women as role-models and women on the job created feelings of isolation, as participants expressed having no one to talk to about employee relations and gender issues related to the work environment. One woman said, "There aren't any women supervisors Sometimes I feel like I don't know if I can do something, and it would just be nice to see a woman there saying

yeah, you can." Participant quotes regarding challenges are listed in Table 10. Despite these challenges, participants have maintained employment in the water industry ranging from three months to nine years, indicating that women are willing to overcome significant challenges in order to continue working in these jobs.

Table 10

Theme 4: Participant quotes addressing challenges.

Participant ID	Specific Statement
P1	"They do not provide a 'porta potty.' Sometimes I have to hold it for a couple of hours. If you're pioneering the way, you got to speak up and say you know, this is bullsh**. *I'm not peeing in a bucket at work."*
P2	"We sometimes have to fit ourselves to a man's world. I can't see over the toolbox in my truck. I prop myself up when I'm going to turn the vehicle around. You learn to work with what you have." "The restroom has one stall for women, and there's not just one woman working at our facility. We have lab personnel and supervisors. So we all have to be very careful who drinks too much coffee in the morning. You just don't have that luxury. You go to the men and they have five stalls and five showers, and we have one shower and one toilet."
P3	"They just needed that little push of getting a bathroom door. I just kind of laughed at it. I don't think it was special for me."
P4	"I am surrounded by men. It's kind of lonely. It can be a little cold, and I like to communicate and talk to people."
P5	"I do believe for women a higher bar has to be set in order for women to be taken seriously, and definitely in the trades. "They will defer or ask advice from a male operator, regardless if that operator has more or less experience than I do. And that is just blatant." "Comments like are you PMS-ing?"

Initial Theme 5: Women feel a sense of pride and accomplishment in their work.

The final theme was job satisfaction. The women enjoy working in the water industry. They expressed a sense of pride and fulfillment about their contributions to society. Protecting the environment, responsibility, and the impact on human life, health, and the environment were all important issues. They feel accomplished, empowered, and respected in their respective fields. One participant described herself as a pioneer, paving the way for future women operators. The challenges they face do not dissuade them from remaining in the profession and encouraging and recruiting girls and women to consider water treatment as a viable career option.

Women also acknowledge that being a woman in the industry has benefits. Water industry leaders and organizations have acknowledged a need for diversity. One woman said, "I'm pretty much told it's a really good time to be a woman in water because they want more women. And so I feel like I kind of have an unfair advantage because they're going to want to promote women. Even the old timers are saying that I have an advantage because I'm a woman. I think that's great." Another woman expressed that a woman could "soften the situation because of her demeanor or mothering nature." She said, "The smile of a woman can take you a long way sometimes."

Women who work in the technical, male-dominated fields of water and wastewater management recognize their accomplishments and plan to remain in the industry as they pursue additional and higher-level certifications. Providing women with knowledge of the industry and pathways into these well-paying jobs creates equitable opportunities for work, integrates diversity into the workplace, and contributes to sustainable water supplies.

Table 11

Initial theme 5: Participant statements addressing job satisfaction.

Participant ID	Specific Statement
P1	"It's just really important to provide safe drinking water for people, and even though the skills are really basic, they're still really important."
	"I kind of feel like a pioneer."
	"I feel like I'm really paving the way for women in the future."
P2	"It's very empowering."
	"I really enjoy the public education aspect of my job; leading people into compliance and protecting the environment."
	"There's such a huge responsibility that I take it very seriously."
	"It's a tough profession to get into as a woman, and I think that is a great accomplishment."
P3	"I love everything about my job. It keeps me nice and busy, but I also have a kind of like a routine. I love coming to work and all the guys are great."
	"I spent maybe 300 bucks on school and I'm in a career that I'm going to be in the rest of my life."
P4	"I like everything about my job. The work I do impacts a lot of lives."
	"This job is very important because every community needs it and can't survive without it. So I think I'm doing a service for people, and it's an important thing that not a lot of people think about."
P5	"I truly believe in what I do, because I want my son to have a safe clean environment for his kids."
	"I feel respected because I am invited to work with other guys on projects. That makes me feel really, really good. And again I think that that comes from respecting yourself and doing the homework."

Discovering the five initial themes provided a framework from which to examine the research question. The fifth phase of thematic analysis involved reviewing the initial themes to discover patterns and provide insight to answer the research question, "How do women water and wastewater treatment professionals experience their occupational choices, pursuits, and roles?" Similarities were examined inductively in light of the research question. Initial themes were then reduced to address the research question. The initial themes were combined as illustrated in Figure 2.

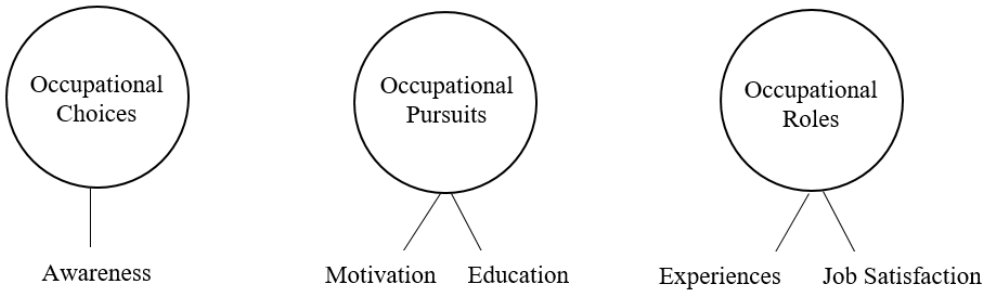

Figure 2: *Reducing initial themes to answer the research question.*

Occupational *choices* logically encompassed awareness of an occupation. In order to choose an occupation, one must first be aware that it exists. A mentor was valuable in increasing women's knowledge of water opportunities and was a necessity in providing direction for the initial steps.

Occupational *pursuit* was most logically associated with education and motivation. After learning about the opportunities available in the water industry, women were motivated to pursue the required education and certification, but they required the guidance of a mentor in order to successfully understand the steps in navigating the system.

Occupational *roles* were best explained by women's statements about their experiences in their roles as water and wastewater professionals, including situations that elicited either frustration or satisfaction. Although they faced many barriers and sometimes outright harassment and hostility, women were satisfied and content with their choices to enter the water industry.

Summary

This interpretative phenomenological analysis involved an exploration into the lived experiences of five women water and wastewater treatment operators who hold technical certifications and employment in the male-dominated water treatment industry. Sampling for this investigation was purposeful, and semi-structured interviews were used to collect data. A reflexive journal was maintained throughout the study. The study utilized a phenomenological design with systematic data analysis approaches, which were appropriate due to the subjective nature of the research.

Chapter 4 contained a detailed description of the data gathered, which facilitated an approach answer the research question. Also included was a presentation of the data collection procedures, the five categories that emerged from an analysis of the information, and the most frequently cited codes in the amalgamation of the material that was gathered. The five most-referenced ideas that emerged from the interviews were 1) awareness, 2) motivation, 3) education, 4) experiences, and 5) accomplishments. The identification of emerging themes evolved through a process of analyzing and grouping all the codes based on similar sentiments and references. The five generalizations that emerged were:

- Women had little or no prior knowledge of the water industry as a viable career option, and their entry into the water treatment industry was mentor-driven.

- Women were motivated to enter and work in water treatment through a desire to improve their lives.
- Education was self-directed and facilitated by mentorship. Access to training materials facilitated self-study
- Women in the water treatment industry experience challenges working in a "man's world."
- Women find pride and fulfillment working in water treatment.

The initial themes emerged by verifying the transcribed data for accuracy and through a line-by-line analysis of each interview.

The lived experiences of the women working in the water treatment industry represented the importance of understanding the motivations of women who pursue technical certifications and occupations in the male-dominated water industry. As stated by the women, their lack of knowledge about opportunities in water was a significant factor in not pursuing technical certifications and occupations. A pressing life experience propelled them into the water treatment field, and mentorship was indispensable in this process.

Chapter 5 provides a discussion how women experience their occupational choices, pursuits, and roles. It includes interpretations of the themes that emerged in the study, suggestions of how organizations might use this data, and recommendations for further investigation.

Chapter 5:

Conclusions and Recommendations

The lack of women in blue-collar trades is not unique to the water industry; the blue collar sector includes a variety of manual positions, such as craft workers, plant and machine operators, and mechanics. Understanding women's invisibility in male, blue-collar trades is crucial to designing policies that improve women's access to these occupations (Torre, 2019). The controversy in literature is that women either have a preference for certain kinds of work or that the labor market limits opportunity for women (Torre, 2019). Further study has been recommended in order to understand the individual and structural constraints to women's integration into blue-collar occupations (Torre, 2019).

Water industry leaders have expressed a need and desire for gender diversity; yet they often declare an inability to attract women applicants to the water resource industry. The literature indicated that additional research was necessary to unpack women's motivations to enter and persist in the androcentric water workforce (Buchler & Hanson, 2015). Because the roles of masculinity and femininity persist in the water industry, addressing meaningful participation of women in the technical aspects of water treatment was important to ensure that the management, operations, and maintenance of water resources and infrastructure are overseen by all of the stakeholders involved in the industry rather than just men (Maphosa, 2010).

The purpose of this qualitative interpretative phenomenological analysis was to explore the lived experiences of five women water and wastewater treatment professionals who hold technical certifications and employment in water and wastewater treatment occupations in

California. The research question was, “How do women water and wastewater professionals experience their occupational choice, pursuits, and roles?” A qualitative methodology delivered a detailed and rich understanding of the experiences of women in water occupations from the perspectives of women who have experienced it. An interpretative phenomenological design was appropriate because it illuminated the details within women’s experiences and allowed an in-depth interpretation of their experiences (Smith et al., 2009).

Sampling was purposeful in this investigation, and semi-structured interviews were used to collect the data, and a reflective diary was kept throughout the study. Phenomenological methodology from a feminist paradigm guided the interpretation of the information gleaned from the research project. The study utilized a systematic thematic approach to data analysis, which was appropriate due to the subjective nature of the research (Smith et al., 2009).

Chapter 1 introduced the need for research into the lived experiences of women water and wastewater treatment operators, the theoretical framework, current workforce issues in the water industry, and research illuminating the importance of women’s participation in the operation and management of water resources. Chapter 2 contained an in-depth analysis and review of the literature concerning women working in the water treatment industry, a history of water and wastewater systems, a discussion of water and wastewater certification requirements, and an examination of occupational segregation. Chapter 3 included a detailed description of the methodology used in the research project, the research design, research participants, instruments, data collection procedures, and the data analysis methods that were applied for a qualitative interpretative phenomenological study from a feminist standpoint.

Chapter 4 contained a detailed description of data gathered during the research project, which provided insight into the research question of how women water and wastewater operators experience their occupational choices, pursuits, and roles in the water industry.

A discussion of the interpretation and findings of the study is presented in Chapter 5. This chapter includes an interpretation of the data results, implications of findings, and recommendations.

Summary of Data Results

This interpretative phenomenological analysis guided by the primary research question, "How do women water and wastewater professionals experience their occupational choice, pursuits, and roles?" The research question was divided into two aims: to understand the meanings that women water or wastewater professionals make of their experiences in entering and remaining in these technical occupations, and to gain insight concerning the successes and challenges they faced in entering and persisting in the water industry.

Data from the interview questions were analyzed and grouped into similar themes, and the highest response number identified the core themes chosen for analysis. An analysis of the data revealed five categories that emerged from the most frequently cited codes during analytical organization of the information collected from the participants. The five categories that developed from the interviews with the five women were 1) awareness, 2) motivation, 3) education, 4) experiences, and 5) job satisfaction. These evolving themes were identified through analyzing and grouping all the codes based on similar sentiments and references.

The first theme was awareness. The research findings indicated that women had little or no prior knowledge of the water industry as a viable career option, and their entry was primarily

mentor-driven. Women may remain concentrated in traditionally women-oriented occupations because they are unaware of certain higher paying, male-dominated, blue-collar jobs. This finding supports conclusions from earlier research that indicated that social processes lead to occupational segregation (Weeden et al., 2018). Entrenched essentialist views sustain beliefs that women and men have different tastes and proclivities and are suited to different types of occupations (Levanon & Grusky, 2016). Because these ideas are socially constructed and reinforced, women are taught from an early age to see themselves in stereotypical ways and make stereotypical career choices (Levanon & Grusky, 2016). Long-term exposure to these stereotypes affect occupational choices and contribute to highly segregated workforces (Senate Office of Research, 2017). Participant 1 said that she did not know anything about water until about six months ago. Participant 3 had no idea that water treatment was "even a thing." She went on to say that she probably would have gotten started sooner if she had known about it.

The second theme was concerned with women entering the water industry. The research revealed that women were motivated to enter and work in the water industry by a desire to improve their lives. A challenging life circumstance propelled participants to become water or wastewater treatment professionals, and the profession was viewed as a means to overcome these challenges. Participant 1 shared that she mostly wanted a good, stable job where she could make some money. With two children, Participant 3 cited that with the rising cost of childcare, she needed something that paid well. Participant 5 related her experiences of being a single mother on food stamps and utilizing the local food bank to provide meals for her daughter. She quoted her motivation to enter the industry as, "Money. Money, money, money."

All types of segregation indicate inequality (Weeden et al., 2018). Occupational segregation is a major contributor to the gender pay gap; the average woman worker loses more

than $530,000 over the course of her lifetime because of income disparities (Blau & Kahn, 2016; Cohen, 2013; England, 2010; Gould et al., 2016). The experiences related through the research participants reinforced the idea that women are most likely to challenge gender boundaries when no path toward upward mobility exists without doing so (England, 2010). Desegregation in the water industry has largely occurred due to the economic benefits offered in water treatment occupations.

The third theme indicated that education and technical preparation was self-directed and facilitated by mentorship. Women depended on a mentor to direct them to the necessary resources; however, pursing the required knowledge was an individual and personal endeavor. Women benefitted from having a knowledgeable mentor who assisted them with technical questions and provided support and encouragement. Women expressed preference for training manuals that were affordable, accessible, convenient, and had a reputation for quality. Participant 3 stated that she enjoyed the self-study part of reading the manuals. She benefitted from learning at her own pace and enjoyed the affordability of the training manual and course.

Participant statements directly contradicted explanations of occupational segregation as an inevitable consequence of "natural differences" in skills between women and men, as posited by traditional economic theory and perpetuated by embedded cultural beliefs (Levanon & Grusky, 2016; McGrew, 2016). Participants expressed an affinity for technical content and were highly motivated to invest time and effort into learning the concepts required for water and wastewater treatment certification. Although three women found the material and subject matter challenging, none were hindered by the large amount of science, technology, and math knowledge necessary for water and wastewater operators to be able to perform. As a result, all of

the women were successful in their first attempt to pass the California State Certification Examination.

Although financial benefits motivated the women to pursue technical certifications and male-dominated occupations, their success in accessing and gaining entry into those fields was a direct result of 1) their knowledge of the training manuals as related by a mentor 2) availability, access, and affordability of the training manuals, 3) the independent, self-paced format of the learning process, and 4) the support of a mentor who was able to direct them and provide assistance with difficult concepts. Through such access and opportunity, the participants experienced much greater influences on job selection than gender in their pursuit of technical certifications and water treatment occupations.

The fourth theme revealed challenges that women experience working in a man's world. Negative experiences increased proportionately with the time women spent working in water; participants with the most years in the field experienced overt hostility from men. Participant 2 detailed working in the boiler room for an entire day under extreme conditions because her male coworkers did not think she would make it through the work day. Participant 5 described specific instances of sexual harassment and a hostile work environment and explained her silence by saying, "I was so poor and so scared that I couldn't ever say this is not acceptable."

As related in the literature review, gender discrimination is an embedded cultural issue in many societies (International Water Association, 2014). Recommendations from the International Water Association (2014) included additional research designed to identify the institutional enablers and bottlenecks to increasing the number of women working in the water sector.

Despite these challenges, the participants in this investigation maintained employment in the water treatment industry ranging from three months to nine years, which indicated that they are willing to overcome significant challenges in order to continue working in the water treatment industry.

Theme five, job satisfaction, revealed that the women found pride and fulfillment working in the water industry. These women recognized that the work they do impacts a lot of lives. Participant 2 described her role as empowering and a huge responsibility that she takes very seriously. Participant 1 described herself as a pioneer leading the way for other women.

Women who work in the technical, male-dominated fields in water and wastewater plan to remain in the industry as they pursue additional water management jobs and higher levels of certification. Providing women with the knowledge of the industry and revealing the pathways into these well-paying jobs creates equitable opportunities for work and contributes to sustainable water supplies (United Nations General Assembly, 2016).

The ability of women to enter the water treatment workforce was dependent on their access to knowledge of the industry and opportunities for entry into the field. Existing research supported the notion that although women's roles in water management were recognized and acknowledged, implementation of methods and strategies to move beyond gender-based obstacles to ensure their equal participation was vague (Sülün, 2018). A prevailing assumption is that women are disadvantaged and subordinated in their relations with men. Incorporating gender needs in water management recognized that the differences in roles and expectations are socially constructed (Sülün, 2018). Access to information, work, and pay is essential for a balanced division of labor between men and women in water treatment (Sülün, 2018).

Interpretation of Data

Recruiting women into the water industry requires more than posting a job vacancy announcement. Existing literature stresses the significance of creating programs that promote women's empowerment and equality and that recognize the central role that women play in the management and safeguarding of water resources (United Nations, 2005). To address the research question, the five initial themes were reduced to three that focused on the main intent to discover how other industry segments that utilize the middle skills workers experience similar shortages of women works (Addati et al., 2016). Utility districts have implemented initiatives to attract, recruit, and retain women in the water industry (United Nations, 2005). These districts employ in some instances diversity and inclusion officers to spear-head initiatives, and these officials report that "not enough" is presently being implement in the process of making utility workforces reflect the community that they serve (Addati et al., 2016).

Some organizations have already enacted strategies to attract, recruit, and retain women in skilled trades, and organizations exist to promote women's participation. Tradeswomen.inc was established in 1979 by advocates and women in the trades. The organization supports women in the skilled trades through outreach, recruitment, retention, and leadership development. They provide direct services for women entering and moving through careers in the trades as well as technical assistance to contractors, unions and apprenticeship programs. In addition, the organization supports local, state and national policy to increase the success of women in these high wage blue-collar careers. In their efforts to improve opportunities for women in construction, the organization has been working to include policies and funding for women in pre-apprenticeship and new California equal employment opportunity policies for construction apprenticeship programs. They also work directly with contractors, apprenticeship

programs and unions as well as with policy makers to improve construction worksite culture for men and women.

Organizations are currently implementing initiatives like Environmental Scan for Trades which is designed to evaluate workforce diversity (Addati et al., 2016). The goals of these programs are to evaluate where the organization's diversity plans are currently and to develop action plans that will accelerate diversification aspirations (Addati et al., 2016). The programs are federal affirmative action initiatives, and they are driven by internal and external factors that outline goals for minorities and women representation in their respective workforces (United Nations, 2005).

Presently organizations are utilizing resources to recruit women into the water industry (Addati et al., 2016). This area, recruiting women, of workforce diversification is recognized as an underdeveloped component in most organizations (United Nations, 2005). Utilities are creating steps to diversification by participating in projects that are found in other middle skill industries. Some organizations are turning to worker outreach programs, such as Women in Manufacturing Day (Addati et al., 2016). At events such as this one, utilities offer panelists and guest speakers, and organizations participate in discussions surrounding recruiting and retaining women in their workforces (United Nations, 2005.

The representation of women in skilled water treatment trades is skewed toward men. Utilities refer to this under representation of women as a Skilled Trades Gap. Industries report that the underlying problem in these efforts is that women have no prior knowledge of skilled trades, which includes water treatment skills (Addati et al., 2016).

Women in these Skilled Trades Gap industries often do not fit into the culture surrounding the jobs according to the findings of other initiatives and in this research exploring women participating in middle skilled jobs (Addati et al., 2016). When women enter into utility workforces they find that the work culture is established, and they feel unwelcomed. This report emphasizes that women are "otherized" in their workplaces, and women convey that "if I wasn't' the only other [in the workplace], it wouldn't feel so isolating". Industries' study groups also articulate that women in skilled trades, like construction, manufacturing, energy, utilities, and oil and gas have similar feelings of being isolated. This phenomenon is not regulated to the water industry only (United Nations, 2005).

Most industries that are participating in evaluation and outreach to women experience difficulty in enticing women to participate in environmental scans of their workforces. Organizations report that women do not participate in these workforce evaluations because women feel that they are "otherized" further through their participation in these studies. For this reason, they are not fully contributing to these organizational initiatives (Addati et al., 2016).

Study groups also have suggested targeting job vacancies to sites dedicated to women working in skilled trades. In California in particular, study groups suggest that organizations join and participate in the Association of Women in Water, Environment, and Energy (AWWEE) (Addati et al., 2016).

AWWEE is a non-profit organization of women throughout California. The association provides networking, resources, and leadership opportunities for women water professionals. AWWEE organizes educational events like presentations and panel discussions featuring leading experts in the water, energy, and environmental fields; behind-the-scenes tours; professional development workshops; community volunteer events; and networking mixers (Addati et al.,

2016). They also have an annual conference, and they feature a mentoring program that has facilitated over 90 partnerships with utilities in the past three years (Addati et al., 2016).

Most organizations have no women mentors or mentors for women working as water treatment operators, and industry focus groups have found that mentors are an important piece of the puzzle in the effort to retain women water treatment operators (Addati et al., 2016). This investigation pointed out the importance of having mentors for women in water operator jobs. Utilities also have adopted goals to "normalize' work spaces where women are filling middle skill jobs and especially in water utility workplaces (Addati et al., 2016).

Utilities are studying women in their workplace and implementing Women employee resource groups, which are dedicated to retaining women workers in their workforces (Addati et al., 2016). The women's groups have collaborative events, speakers, leadership teams, and leadership programs to promote women advancements within the utility. One of the primary organizational goals is for men and women to see women in non-traditional roles of employment and not to "otherize" women in these workplaces (Addati et al., 2016).

Occupational Choices

What attracts women to these male-dominated careers? How can water utilities and professional organizations attract more women? Barriers include entrenched social norms and practices that are culturally embedded and reinforced, occupational segregation, and a lack of role models (World Bank, 2019). Participant statements such as, "I never even knew that water was a thing," indicated a barrier in attracting women to the water industry. Women cannot be what they cannot see. All participants indicated that they had no knowledge of the industry prior to contact with a mentor-figure who informed them of the opportunities available in water

treatment professions. One woman said, “She kept telling me how awesome water treatment was and giving me advice, so I just did what she said.”

Attracting more women into water utilities can be approached in a variety of ways. Organizations might provide outreach and education designed to break gender stereotypes and offer training to women who want to enter non-traditional fields (Addati et al., 2016). Jalal (2014) recommended that mechanisms be established for women to learn about and pursue technical skills in water resource management. Ensuring that women are knowledgeable about career possibilities in water should contribute to safe and sustainable water supplies (United Nations General Assembly, 2016). Encouraging women who currently work as water and wastewater professionals to present their work could provide role models as well as information about opportunities and the suitability of the jobs for women (World Bank, 2019).

Women, in this investigation, noted the need for outreach and voiced their willingness to promote the water treatment jobs to other women. Participant 3 said,

> “I really think that reaching out to the younger crowd, getting in touch with high schools and career fairs, and just putting it out there that this is a career that's in desperate need of operators, especially with everyone retiring within the next 10 years. We need the fresh blood coming in, and we need to learn from those people retiring or people that could pass down their knowledge, their experiences. I'd love to see more books written by operators of just things that they've gone through things that you know that they've accomplished or overcome and just have that available to kids and younger crowds. “

Participants acknowledged their willingness to teach or be a mentor to increase women’s participation in the field. Participant four stated, “I actually love educating people. I would love

to be a mentor. If I could have my perfect job, it would be mentoring young water treatment operators. It would be a pay hit, though." Making mentorship an option for women who work in water could provide a resource that would not only educate a younger generation, but also serve as role models to encourage young women to enter STEM fields.

Attracting more women into the water industry can also be enhanced through scholarships, work-based learning opportunities, and exchange programs designed to increase exposure for girls and women to technical fields in water and wastewater occupations. (World Bank, 2019). Multiple approaches can be aimed to address women's occupational choice.

Occupational Pursuits

What factors motivate women to pursue jobs in water and wastewater? What recruitment practices may help attract women to seek water-related certifications? After learning about water occupations from a mentor, all of the participants utilized independent study to familiarize themselves with the fundamental technical aspects of water and wastewater treatment. Availability, affordability, convenience, and reputability were the primary factors in the selection of study materials. Investment in study time was a significant factor for women. Four of the five participants devoted a great deal of time and effort to understand the content, while one woman "studied over the weekend" and researched concepts on YouTube. All of the women passed the exam on their first attempt.

Contrary to essentialist beliefs, in no case, did any of the women water and wastewater treatment professionals indicate that the science, math, or technology concepts were too difficult to learn. Although they put forth varying levels of effort, all of the women were capable and competent in science and math related work. Considering that the success rate on state water exams across the country borders at or below fifty-percent, all of the women participants

outperformed many of their male counterparts and passed the state exam on their first attempt. This finding flies in the face of essentialist views that men are more suited to mechanical types of jobs. Women who have been exposed and trained in these subjects have proven that they are capable of doing comparable work to men in the water treatment field.

All participants attributed financial benefits as their primary motivation to seek certification and employment as water or wastewater treatment professionals. Money, job stability, and fringe benefits, such as retirement, were cited as critical factors in women's choices to pursue certification and employment in water occupations. One participant's emphatic motivation for entering the water workforce was, "Money. Money, money, money." She shared her recruitment experience as, "And so that summer I went and I did work exchange at my daughter's camp so that she could go to camp. I was doing maintenance at the camp, and while I was there the water treatment operator in town quit, and I ended up getting his job."

Water jobs can not only help fill the workforce gap, but they also bring equitable opportunities for women to earn a living wage. Recommended solutions to addresses the barriers in attracting women to the water industry are to target female graduates as candidates for water vacancies, to eliminate all gender-bias in the hiring process, and to create inclusive job advertisements (World Bank, 2019) Advertising the economic benefits and stability of water and wastewater jobs might motivate and attract more women into the industry. Removing gender references on job applications has also been cited as a strategy to remove male-bias in attracting and recruiting women to the water treatment profession (World Bank, 2019).

Occupational Roles

How do women water and wastewater professionals experience their occupational roles? What steps can water utilities take to retain the women who are already there? All participants

reported a sense of pride in their jobs and all indicated that they planned to remain in the industry. However, all participants also detailed challenges in an androcentric work environment.

Barriers to retaining women in water included unsupportive workplace environments, lack of gender-sensitive policies, and sexual harassment. Ill-fitting uniforms tailored to men, oversized equipment, and lack of restroom facilities were named as physical challenges. Participant one said, "I have to tell the lead worker when I want to go to the bathroom. They just drive me to a restroom. Sometimes I have to hold it for a couple of hours, sometimes they drive me back to the yard." A lack of basic facilities can drive away the women who do enter the water workforce. Facilities that cater to women are an imperative for water utilities.

Four of the five women experienced subtle and/or open hostility and derogatory comments from some male coworkers. Four of the five participants also expressed feelings of isolation in their male-dominated work environment. One woman shared her experience with sexual harassment, which was never reported because she was afraid of repercussions. She said,

> I was so poor and so scared that I couldn't ever say this is not acceptable. I was always like, well, I'm going to pay my dues here and deal with this. I can't get fired. I'll do whatever it takes.

Hostile, isolated, or harassing work environments are symptoms of workplace facilities that do not cater to women. Water utilities may attract and retain more women water operators by prioritizing basic amenities such as gender-friendly restrooms with locking doors and running water, lactation rooms, family friendly policies, and workplace codes of conduct. "Paying your dues" must not be defined as tolerating harassment or hostility in the workplace.

Significance of the Study to the Water Industry

This investigation contributed to the understanding of women's experiences as water and wastewater professionals. Insight concerning the factors that motivated women to pursue these roles and the successes and challenges that they faced in entering and persisting in water occupations will increase the industry's ability to develop programs and policies aimed at attracting and retaining women in water treatment occupations, diversifying the workforce, filling critical workforce gaps, and contributing to sustainable water supplies.

Participation of women alongside men in the design, maintenance, and management of water infrastructure has brought distinct benefits to the functioning and use of water treatment and conveyance systems and has created more equality surrounding opportunities for women to obtain training. However, true gender balance, in which control is shared equitably, has yet to be achieved (van Wijk-Sigbesma, 1998). Effective water management requires attention to gender, which should be recognized as not just women and men, but also as a result of socialization process that assign attributes, roles, and responsibilities to women and men. Recognizing and attending to these social constructions can change them over time (van Wijk-Sigbesma, 1998).

Countless gender and inclusion strategies have been developed within the water management sector (Grant, 2017). Women have been excluded from water management as a result of perceived deficiencies in technological skills, restricted career paths, lack of transparency, and informal male networks that exclude women's membership (Grant, 2017). This research provided insight into the factors that have contributed to the exclusion and marginalization of women in water treatment professions.

Associated research concerning water and gender explored the advantages of women's involvement in all aspects of water management. If women are to have an equal opportunity to

participate and succeed in managing water resources, targeted education and training programs are necessary. Understanding women's invisibility in male, blue-collar trades is crucial to designing policies that increase access to these occupations for women (Torre, 2019). Policymakers must investigate the individual and structural constraints to women's full integration into technical water occupations (Torre, 2019).

Half a century of gender revolution, women's movements, equal rights, and affirmative action have done much to advance women's place in society. However, women and men continue to work in extremely segregated occupations, and today's workplace, including water treatment, can still be characterized as hyper-segregated (Levanon & Grusky, 2016). Attention is required to understand why segregation is extreme and what makes it more extreme in some occupations rather than in other fields. Investigation is needed to determine the reasons that women moved to professional and managerial jobs in droves but not to blue-collar jobs like water treatment (Levanon & Grusky, 2016). These questions serve to drive further investigation into the full integration of women in all occupations, including water resources.

Integrated Water Resources Management theory is an overarching theory that supports the sustainability of water resources into the future. Integrated Water Resources Management focuses on the use of water resources, water quality and quantity, environmental health, and economic development. The theory is a proven protector of public health, environmental health, and trade and industrial sustainability.

The theory is ultimately involved with community sustainability, and it outlines that sustainable water resources is the driver behind the triple bottom line and success of communities and societies. Within the purview of the theory are the institutions that maintain water resources and the social managerial groups that are involved in creating water policy. The

theory addresses workforce development in that it adheres to the belief that the water management and treatment workforce should reflect the community that the water utility serves. The theory outlines that water resource management must be a collaborative and participatory scheme where all users and stakeholders associated with a particular water resource should have a voice and a role in the management of the resource.

Under the umbrella of Integrated Water Management is the notion that women's participation in the policy-making, water resource management, water treatment, and water conservation is an essential ingredient in its sustainability. The theory purports that women must be recruited and retained in every aspect of water resource manipulation including the conveyance, treatment processes, and inspection of facilities, and this participation is a foundational pillar in the successful and sustainable use of water resources.

Integrated Water Resources Management theory maintains that women must be involved in the water treatment workforce in order for the resource to be utilized appropriately and sustainably. The voice of women workers in the operational delivery of water to communities and water conservation is a critical component to the sustainability of water resources (IRWM, 2018). Integrated Water Resources Management theory and practice champions the participation of women in the governance of water resources and in the treatment of water, and the theory requires that women are recruited and maintained in these roles in order for water to be available to future generations and for communities to thrive.

Reflections on the Study

The intent of this research was to obtain a better understanding of the experiences of women who work in water and wastewater treatment occupations and to explore their motivations for pursing technical certifications and jobs in this male-dominated industry. Researching the lived experiences of women resulted in a clearer understanding of the factors

that motivated them to pursue and persist as water and wastewater professionals and the challenges that they faced in doing so. The information they shared concerning their experiences as water and wastewater treatment professionals could be useful for women and organizational leaders to understand the parts of recruitment and diversification efforts that are not successful and what might be done to improve the processes.

The research findings indicated that although water entities are attempting to recruit, train, and retain women with the necessary technical skills to succeed in the operation and maintenance of water systems, additional work is necessary to make these initiatives successful and more effective for women. A dialogue is essential between women and their water organizations regarding the issues women face in the workplace. Talent development takes years, and water industry leaders must ensure that no gaps exist in the talent pipeline. Talent management and succession planning are critical to the success of water organizations over the long-term. Even more critical is the necessity for the preparation of women to assume technical positions in the water industry and to ensure their success in these positions.

From a personal perspective, the stories told by these women in water and wastewater treatment were profound and impactful. The knowledge gained as a result of interactions with these remarkable women provided confirmation that continued work is necessary to diversify the water workforce. Some issues that were confirmed in the study are that 1) women continue to face obstacles, harassment, and hostility in water and wastewater treatment workplaces, 2) a lack of knowledge of the industry inhibits women's full participation in the industry, and 3) mentorship is a necessary component to ensuring the success of women in water treatment. A surprising discovery from the study was the level of hardship that women faced before and during their time in the water industry; yet, their motivation, passion, and love for the industry

overcame these obstacles. Women in water are strong, persistent, and overwhelmingly resilient. They are difference-makers in an unseen and uncelebrated workforce.

Summary

The purpose of this qualitative interpretative phenomenological analysis was to conduct a thorough exploration of the motivations of women who pursue technical certification and employment in water occupations and understand their successes and challenges in remaining in these occupations. A qualitative methodology provided a detailed and rich understanding of the experiences of women water and wastewater professionals. An interpretative phenomenological analysis was appropriate for this investigation because the creative process involved describing, detailing, and analyzing the experiences of women in water treatment jobs. The research design was selected specifically to reveal, from the interviews, the meanings and understandings of the phenomenon of women in working in water treatment from the perceptions and lived experiences of women water and wastewater professionals.

The central research question was broad in nature and expressed the focus of the study. The intent of the study was to answer the research question, "How do women water and wastewater professionals experience their occupational choices, pursuits, and roles?" The research question was divided into two aims: to understand the meaning women water or wastewater professionals give to their experiences in entering and remaining in these occupations, and to gain insight concerning the successes and challenges they faced in entering and persisting in the water industry. The research questions served to focus and guide the research process.

Purposeful selection of participants was followed by data collection in the form of interviews, in which participants responded to the same sets of open-ended questions. This

method was chosen to value the participants' accounts of their lived experiences (Smith et al., 2009). Data analysis was interpretative and aided by the use of NVivo 12 Qualitative Data Analysis software. Phenomenological methodology guided data interpretation and analysis.

The five general themes that emerged from the data analysis were 1) knowledge of the industry, 2) motivation to enter, 3) education and training, 4) challenges, and 5) job satisfaction. The themes emerged by verifying the transcribed data for accuracy and reviewing the notes made by the researcher during the interviews.

The theoretical framework guiding this study encompassed tenets from feminist political ecology and integrated water resources management. The findings from this research may challenge water organizations to reexamine policies in their workforce recruitment and diversity efforts. Existing literature included a focus on the importance of women's participation in all aspects of water management to ensure sustainable water supplies.

The research findings indicated that water organizations are attempting to recruit, train, and retain women in the technical aspects of water management, but more work is required to make these programs more effective for women. A dialogue is necessary between women and water organizations regarding women's motivations to pursue technical certifications and employment in the water industry and the challenges they face in remaining in the water treatment field.

Chapter 5 included interpretations of the themes that emerged in the study of women working in water treatment and made recommendations on how organizations might make use of the data and results to diversify the industry's workforce, as well as study the findings for implications and recommendations concerning further study. Additional investigations

concerning this topic could include exploring the connections between the ages of women who enter the water treatment industry, the ethnicity and race associated with women entering this profession, the particular personality types of women who enter water and wastewater treatment, the educational level of women entering the water treatment field, and the socioeconomic characteristics of women in the water and wastewater treatment industry.

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Appendix A: Citi Test Certificate

Completion Date 24-Sep-2018
Expiration Date 23-Sep-2021
Record ID 28801306

This is to certify that:

Pamela Murawski

Has completed the following CITI Program course:

Human Research	(Curriculum Group)
Social / Behavioral Investigators and Key Personnel	(Course Learner Group)
1 - Basic Course	(Stage)

Under requirements set by:

University of South Florida

Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w6d78a3e1-c39d-4eee-bdb9-0ffa1e4e8259-28801306

Appendix B: Email Invitation to Participate

Email Subject: Invitation to participate in the research project titled: Women in Water: An Interpretative Phenomenological Analysis of Women's Lived Experiences as Water or Wastewater Treatment Operators

Dear Woman in Water,

As a student researcher at the University of South Florida, Department of Leadership, Counseling, Adult, Career, and Higher Education, I am conducting interviews as part of a study entitled "Women in Water: An Interpretative Phenomenological Analysis of Women's Lived Experiences as Water or Wastewater Treatment Operators." The aim is to increase understanding of the experiences of women water and wastewater operators.

As a woman working in the water industry, you are in an ideal position to provide valuable firsthand information from your own perspective. The interview will take one hour, in which I will try to capture your thoughts and perspectives as a women water manager. Interviews will be conducted at the offices of California Rural Water Association, located at 1234 N. Market St. Sacramento, CA or a location convenient to you, and I can provide transportation at your request.

Your responses to the questions will be kept confidential. Each interview will be assigned a number code to help ensure that personal identifiers are not revealed during the analysis and write-up of findings. You may discontinue the interview at any time, or withdraw from the research altogether, without prejudice and will be afforded the opportunity to ask questions about any facet of the study.

There is no compensation for participating in this study. However, your participation will be a valuable addition to research, and the findings could lead to greater public understanding of the experiences of women in the water industry.

Attached to this email you will find an informed consent document and a copy of the interview questions. Please review the attached documents and, within one week of the date of this email, let me know by email response if you are willing to participate or if you need more time to review the documents. Also, please suggest a day and time that suits you and I'll do my best to be available. If you have any questions please do not hesitate to ask.

Thank you in advance for your participation in this research.

Sincerely,

Appendix C: Informed Consent

Informed Consent to Participate in Research Involving Minimal Risk

Information to Consider Before Taking Part in this Research Study

Title: Women in Water: An Interpretative Phenomenological Analysis of Women's Lived Experiences as Water or Wastewater Treatment Operators

Pro #00042439

Overview: You are being asked to take part in a research study. The information in this document should help you to decide if you would like to participate. The sections in this Overview provide the basic information about the study. More detailed information is provided in the remainder of the document.

Study Staff: This study is being led by Pamela Murawski, who is a student and doctoral candidate at University of South Florida. This person is called the Principal Investigator. She is being guided in this research by Dr. Johanna Lasonen. Other approved research staff may act on behalf of the Principal Investigator.

Study Details: This study is being conducted by telephone interview and is supported/sponsored by University of South Florida College of Education, Department of Leadership, Counseling, Adult, Career, and Higher Education. The purpose of the study is to understand the meaning that women water and wastewater treatment operators make of their experiences in entering and remaining in these occupations, and to provide insight on the successes and challenges they have faced. I will collect data from you during a one-hour semi-structured interview in which you will answer open-ended questions.

Participants: You are being asked to take part because you are a woman who is currently certified and employed in California as a water or wastewater treatment operator. I am asking you to take part in this study because you have insight into the lived experiences of women water and wastewater treatment operators.

Voluntary Participation: Your participation is voluntary. You do not have to participate and may stop your participation at any time. There will be no penalties or loss of benefits or opportunities if you do not participate or decide to stop once you start. Your decision to participate or not to participate will not affect your job status, employment record, employee evaluations, or advancement opportunities.

Benefits, Compensation, and Risk: We do not know if you will receive any benefit from your participation. You will not be compensated for your participation. This research is considered minimal risk. Minimal risk means that study risks are the same as the risks you face in daily life.

Confidentiality: Even if we publish the findings from this study, we will keep your study information private and confidential. Anyone with the authority to look at your records must keep them confidential.

Why are you being asked to take part?

The underrepresentation of women in water resources management threatens water resource quality, quantity, and sustainability (Adams et al., 2018; International Water Association, 2014). The American water industry is facing serious risks to water resource sustainability as well as looming workforce challenges. Poorly managed water treatment systems result in a lack of water quality and quantity, and a diminished workforce reduces water resource sustainability. Human capital shortages hinder the nation's ability to provide clean, safe water (Moore et al., 2013).

The water industry is highly segregated (Dickerson & Butler, 2018; Kane & Tomer, 2010). Technical occupations are male-dominated, and despite years of research stressing the importance of their participation, women's involvement continues to be minimal (International Water Association, 2016). This occupational segregation has not only advantaged men in terms of income but also compounded issues of workforce development and contributed to poor and unstainable environmental management practices (Maphosa, 2010).

You are being asked to take part because continued research is necessary to determine the factors that compel women to enter and persist in the water resources management fields (Global Water Alliance, 2006). Because research is the conduit for government, industry, and educational institutions to address human resources gaps, the International Water Association (2014) recommends additional investigation into the motivation and incentives that attract and retain women to the water industry. Additional research indicates that if local water employers can design new ways to develop their workforce pipelines, the solutions could be replicated across the United States and the broader water infrastructure sector (Kane & Tomer, 2018).

An understanding of the lived experiences of women who work as water or wastewater treatment operators will add to a body of knowledge concerned with insights into their motivations and reasons for entering and the challenges and rewards of remaining in a male-dominated water occupation.

Study Procedures:

I will collect data in the form of semi-structured interviews using open-ended questions. Before the interview commences, I will review the informed consent document with you and answer any questions you may have.

Prior to commencing the interview, I will ask permission to utilize a digital recorder and take written notes. After activating the recorder, I will check that it is working. I will ask the semi-structured interview questions in the order they appear on the list. I will ask probing questions or for clarification when needed and will annotate these in my written notes. I will conclude the interview after one hour. I will remind you that I will transcribe the interview and notes and email them to you for approval before beginning coding and analysis. You will have access to the recording and digital transcriptions for a period of five years after the final report is submitted to the IRB. After this time, the recordings and transcriptions will be destroyed by shredding.

Total Number of Participants

I will interview a total of five participants.

Alternatives / Voluntary Participation / Withdrawal

You do not have to participate in this research study. You should only take part in this study if you want to volunteer. You should not feel that there is any pressure to take part in the study. You are free to participate in this research or withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study.

Benefits

I am unsure if you will receive any benefits by taking part in this research study.

Risks or Discomfort

This research is considered to be minimal risk. That means that the risks associated with this study are the same as what you face every day. Although minimal, the following risks may occur:

Some of the questions may make you feel uncomfortable. You are free to decline to answer any question during the interview. You may also edit or delete your responses during review of the transcripts.

Although it is unexpected, a breach of confidentiality may occur. A breach of confidentiality will most likely cause no risks to employability, insurability, and/or criminal and civil liabilities.

Compensation

You will receive no payment or other compensation for taking part in this study.

Costs

Taking part in this study will incur the costs of your time.

Conflict of Interest Statement

No conflicts reported.

Privacy and Confidentiality

We will do our best to keep your records private and confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Certain people may need to see your study records. These individuals include:

The research team, including the Principal Investigator, study coordinator, and other research staff.

Certain government and university people who need to know more about the study. For example, individuals who provide oversight on this study may need to look at your records. This is done to make sure that we are doing the study in the right way. They also need to make sure that we are protecting your rights and your safety.

The USF Institutional Review Board (IRB) and its related staff who have oversight responsibilities for this study, and staff in USF Research Integrity and Compliance.

We will publish what we learn from this study, but your name will not be included. We will not publish anything that would let people know who you are.

A federal law called Title IX protects your right to be free from sexual discrimination, including sexual harassment and sexual violence. USF's Title IX policy requires certain USF employees to report sexual harassment or sexual violence against any USF employee, student or group, but does not require researchers to report sexual harassment or sexual violence when they learn about it as part of conducting an IRB-approved study. If, as part of this study, you tell us about any sexual harassment or sexual violence that has happened to you, including rape or sexual assault, we are not required to report it to the University. If you have questions about Title IX or USF's Title IX policy, please call USF's Office of Diversity, Inclusion & Equal Opportunity at (813) 974-4373.

What if new information becomes available about the study?

During the course of this study, we may find more information that could be important to you. This includes information that, once learned, might cause you to change your mind about being in this study. We will notify you as soon as possible if such information becomes available.

You can get the answers to your questions, concerns, or complaints.

If you have any questions, concerns or complaints about this study, call *Pamela Murawski at 386-965-8454*. If you have questions about your rights, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu.

Consent to Take Part in Research

I freely give my consent to take part in this study. I understand that my verbal consent is necessary to take part in research. The researcher has read this information to me, and I have received a copy of this form by email.

Statement of Person Obtaining Informed Consent and Research Authorization

I have carefully explained to the person taking part in the study what he or she can expect from their participation. I confirm that this research participant speaks the language that was used to explain this research and is receiving an informed consent form in their primary language. This research participant has provided legally effective informed consent.

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Signature of Person Obtaining Informed Consent Date

Appendix D: Semi-Structured Interview Questions

Background information

- age
- certifications held
- occupational title
- years of experience in the water industry

Research Aim 1: To understand the meaning that women who work as water or wastewater treatment operators make of their experiences in entering and remaining in water treatment occupations.

- Is WTPO the occupation you aspired to have? What types of jobs interested you before you considered this industry?
- How did you learn about w/ww treatment occupations and become an operator?
- What factors motivated you to enter this profession?
- What do you like and dislike about your job?
- Have you experienced any setbacks in becoming a water or wastewater treatment operator?
- What do you do in this job?
- Describe the education and certification process and how you experienced it.

Research Aim 2: To provide insight on the successes and challenges women have faced in entering and persisting as water or wastewater treatment operators.

- Describe some good and bad experiences of your work as a woman in water.
- Describe your work environment and any modifications you have required. Did you receive them?
- What kinds of pushback or support have you received from male colleagues? How do you handle it?
- What advantages or disadvantages have you experienced by being a woman in this industry?
- Do you feel respected? How?
- What words would you use to describe yourself as a woman who works in this industry?
- What are some traits that make you successful?
- Describe what makes you feel accomplished in this profession.
- What advice would you give to help other women enter the water industry?
- Is there anything you would like to add?