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Undercurrents of Urban Modernism: Water, Architecture, and Landscape in California and the American West

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Undercurrents of Urban Modernism:
Water, Architecture, and Landscape in California and the American West

by

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Undercurrents of Urban Modernism:
Water, Architecture, and Landscape in California
and the American West

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Abstract: "Undercurrents of Urban Modernism: Water, Architecture, and Landscape in California and the American West" conducts an art-historical analysis of historic waterworks buildings in order to examine cultural values pertinent to aesthetics in relationships between water, architecture and landscape in the 19th and early 20th centuries. Visual study of architectural style, ornamental iconography, and landscape features reveals cultural values related to water, water systems, landscape/land use, and urban development. Part 1 introduces a historiography of ideas of "West" and "landscape" to provide a context for defining ways in which water and landscape were conceived in the United States during turn-of-the-century urban development in the American West. Part 2 provides a historical context for California waterworks with a discussion of major U.S. city waterworks from 1799 to 1893 in Philadelphia, Louisville, New York, and New Orleans. Primary architectural styles discussed are Greek Revival, Egyptian Revival, and Roman Revival. Part 3 presents the dissertation's central object of study: waterworks and hydropower architecture for the greater San Francisco Bay Area between 1860 and 1939. From substations to dams, architects who designed waterworks structures drew from historical revival, academic eclecticism, and structural design traditions. The specific waterworks structures anchoring inquiry in this chapter are two

round, peripteral, neoclassical water temples built for San Francisco's water supply to mark key underground aqueduct features. I analyze these two temples—the Sunol Water Temple from 1910 and the Pulgas Water Temple from 1939—in formal terms as well as from within broader urban and historical contexts. Part 4 culminates the dissertation with a case study of two dams whose aesthetic features were obscured by unneeded buttresssing when concerns for dam safety arose after a Southern California dam failure had killed several hundred people in 1928. I inquire into a cultural ambivalence stemming that seems to stem from historical conflicts determining the relative aesthetics of "use" and "beauty" in utilitarian waterworks structures. The overall questions in this dissertation inquire into ways in which aesthetic aspects of architectural design of waterworks structures expressed cultural values regarding water, architecture, and landscape in California between 1860 and 1939.

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PART 1

BETWEEN EDEN AND EMPIRE: LANDSCAPE IDEALS AND ARCHITECTURAL AESTHETICS FOR CALIFORNIA WATERWORKS

History cannot happen—that is, [people] cannot engage in purposive group behavior—without images which simultaneously express collective desires and impose coherence on the infinitely numerous and infinitely varied data of experience. These images are never, of course, exact reproductions of the physical and social environment. They cannot motivate and direct action unless they are drastic simplifications, yet if the impulse toward clarity of form is not controlled by some process of verification, symbols and myths can become dangerous by inciting behavior grossly inappropriate to the given historical situation. The special status accorded agriculture in federal legislation shows that Congress is still markedly influenced by the now archaic myth of the Garden.

--Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth*[1]

To depict America as a garden is to express aspirations still considered utopian—aspirations, that is, toward abundance, leisure, freedom, and a greater harmony of existence…[and] a truly successful "pursuit of happiness."

--Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America*[2]

Only in mountainous country…can we count on the landmarks being what they were, and not there unless the builders of dams and highways have withheld their hands. Elsewhere settlement may have obliterated landmarks and nature may have so altered the topography that the place where we fought Indians is now ten miles on the other side of the river and the lake we guided by has dried up. I have done my full share of field work, perhaps more than was called for, and I have spent a great deal of time following my characters across the land. But it must be candidly admitted that in most statements of routes some portions are by grace of historical convention.

--Bernard De Voto, *The Course of Empire*[3]

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[1] Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth* (1950, repr., Cambridge, MA: Harvard University Press, 1982), ix.

[2] Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), 43.

[3] Bernard De Voto, *The Course of Empire* (Boston: Houghton Mifflin, 1952), 635.

CHAPTER 1

Introduction

Thinking about aesthetics of California water systems must consider the wide landscape scope of California and the American West. The purpose of this art-historical dissertation is to articulate cultural values water carries in the design elements of its waterworks systems architecture. I regard California's waterworks architecture as an artistic product whose visual analysis reveals cultural values grounded in historical notions of landscape, water, and urban development. Large-scale movement of water from its watershed origins to urban centers combines natural processes with human engineering, and the terrain of a water system from source to destination traverses a variety of landscapes—agricultural, industrial, rural, urban. **[Figures 1-6, inclusive]** The urban context for the entire dissertation is water systems development in American cities, in the context of the idea of "West," from 1800 to about 1940. The specific target for this investigation is architectural design of waterworks structures in San Francisco and its surrounding metropolitan region. Without question, long-distance water movement is the American West's supreme cultural signature, and this is writ large in California. The engineering and the architecture of the state's water infrastructure systems has given symbolic expression to cultural values that underlie modern conceptions of water movement as a part of the modernization of her cities. Design of the structures on these large systems involves issues not only of architectural but also of landscape design. As designed structures in crafted landscapes, waterworks are aesthetic objects.

This history of California waterworks belongs in turn to a broader and preceding American waterworks history, which is also part and parcel of a larger history of architecture in the United States. Art historical analysis reveals that formal structures and iconographies function as signs one can interpret as expressing cultural values related to water and architecture within urban contexts proper to them. My job is to unravel the many ways in which material figurations signal core values for the cultures that have shaped them: not only what those ideas meant in their own time, but also what they come to mean historical time. Situations change: at certain times, visual elements of a representational object (a work of art) vividly activate ideas and values; at other times, underlying meanings go dormant in the object. This is a historical observation that bears upon cultural development. The brief history of ideas about water, land, landscape, and water I present in this Introduction grounds a visual analysis that revives the cultural values inherent in California's waterworks structures.[4] I present a selected historiography of ideas as these relate to my art-historical examination of waterworks architecture in California and the American West, to about the middle of the 20th century.

CULTURAL IMAGES OF "WEST": IF A TREE FALLS IN THE LANDSCAPE…

Even as I begin, I stop: the word "landscape" gives pause. My word choice is conscious, given my aim, to examine cultural values underlying waterworks architecture and their landscapes. The task of defining the study and its terms is complicated by historical ideas of landscape, but the territory narrows when one confines the picture to the art-historical conception of landscape as an imaginative cultural product. "A landscape is a cultural image, a pictorial way of representing, structuring or symbolizing surroundings," write historical geographers Denis Cosgrove and Stephen Daniels. To keep the idea in the physical realm, where it belongs, Cosgrove and Daniels insist on a proviso: "This is not to say that landscapes are immaterial."[5] Do they mean to correct or deny an implication embedded in their definition, that a landscape, as a cultural image, is immaterial, *only* an idea? Is landscape real? How does *land* relate to *landscape*? In what ways does a landscape representation relate to the physical ground it represents? One might broadly term *landscape* an expansive watershed terrain surrounding a waterworks

[4] My brief summary of this landscape idea encapsulates several centuries of landscape art, literature, and art historical theory, and follows from the work and ideas of many sources impossible to catalogue or discuss fully in this dissertation. This introductory discussion presents a selected historiography directly applicable to my specific topic.

[5] Denis E. Cosgrove and Stephen Daniels, eds., *The Iconography of Landscape: Essays on the Symbolic Representation, Design, and Use of Past Environments,* No. 9 in the Cambridge Studies in Geography Series (New York: Cambridge University Press, 1988), 1-10.

structure. What's the difference between a rural waterworks landscape and an urban one, or a "natural" one and a "designed" one? When water enters the picture, what changes?[6]

> A landscape park is more palpable but no more real, nor less imaginary, than a landscape painting or poem. Indeed the meanings of verbal, visual and built landscapes have a complex interwoven history. …And of course, every study of a landscape further transforms its meaning, depositing yet another layer of cultural representation.[7]

Cosgrove's repetition of certain words in the above excerpt suggests that a cultural image of a palpable reality poses problems of "meaning" and "understanding." In my own research, I find "palpable" images of landscape in the history of California and the West to be varied and plentiful, ranging from early maps to paintings, photographs, and literary, journalistic, or scientific descriptions. At any point in U.S. settlement history, representations of Western landscape attempt (and claim) to depict the "fact" and the "art" of land and landscape. As Cosgrove suggests, cultural images of landscape are intimately connected to the ideas, beliefs, and values *about* landscape that inform them.

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[6] No study of water in America can fail to consider landscape history, and, for an art historian, images and representations of landscape, in whatever form. Denis Cosgrove introduces the complicated ways in which landscape formation history works psychologically and sociologically in Western culture; many of his European and global precepts are applicable to the American situation. I cite his work, and the work of his sources and others working in the field, where these ideas apply. Historical ideas of landscape in the American West are rooted in European traditions of Romantic landscape that grounded cultural values with the first European explorers and settlers, from the Renaissance forward. See also landscape and garden historian John Dixon Hunt's *Garden and Grove: The Italian Renaissance Garden in the English Imagination, 1600-1750* (London: Dent, 1986), one among several of Hunt's works that develop cultural ideas of landscape and garden in Europe, whose circulation he traces to the European Renaissance. Reinhard Bentmann and Michael Müller's *The Villa as Hegemonic Architecture* (Atlantic Highlands, NJ: Humanities Press, 1992) discusses the Italian Renaissance *villagiatura* in a context of landscape and hydraulic engineering, land reclamation, architecture, and iconography; the authors' Marxist point of view focuses on ways the *villagiatura* illustrates elements of socioeconomic class structure. Also on the Italian *villagiatura*, water management, and cultural landscape, see Denis E. Cosgrove, *Social Formation and Symbolic Landscape* (1984, repr., Madison, WI: University of Wisconsin Press, 1998), 98-101, 135-41; and Denis Cosgrove, "Platonism and Practicality: Hydrology, Engineering, and Landscape in Sixteenth-Century Venice," in *Water, Engineering and Landscape: Water Control and Landscape Transformation in the Modern Period*, eds. Denis Cosgrove and Geoff Petts (London: Bellhaven Press, 1990), 35-53. This dissertation cannot take on that full history, but my brief discussion in this Introduction, and allusions and mentions elsewhere in the dissertation text and footnotes, mean to indicate its importance to my topic.

[7] Cosgrove and Daniels, eds., *Iconography of Landscape*, 1-10.

THE AMERICAN WEST AND THE LANDSCAPE IMAGE

Cosgrove argues that the idea of landscape grounds a way of seeing.[8] "A cultural image, a pictorial way of representing, structuring, or symbolizing surroundings," landscape is central to cultural identity in western European culture. Tracing the idea from pre-Renaissance Europe forward, he applies art history's tools of visual analysis to cultural geography's study of landscape and garden theory.[9] It comes as no surprise that he has also examined landscape ideas as ways to interpret waterworks design.[10] Water and landscape fused in a public works prospect throw traditional landscape ideas into a quandary, and require new acts of reflection.[11]

HISTORIOGRAPHY OF THE AMERICAN WEST

Modern historiography proper of the American West begins in 1893 with Frederick Jackson Turner's famous frontier thesis, "The Significance of the Frontier in American History," which he read at the American Historical Association meetings at the opening of the Chicago World's Columbian Exposition.[12] Turner articulated historical observations about ideas of *West* and its *frontier* that were new. He grounded the paper in two ideas. First, he emphasized that the American concept of *West*, shifted constantly

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8 Cosgrove, *Social Formation*, 1.
9 Cosgrove, *Social Formation*, 98-101, 135-41.
10 Cosgrove's work specifically related to hydraulic engineering and waterworks projects, from a global and specifically non-American point of view, includes Denis E. Cosgrove and Geoffrey E. Petts, eds., *Water, Engineering, and Landscape: Water Control and Landscape Transformation in the Modern Period* (New York: Belhaven Press, 1990), esp. 1-11, 188-208; and Denis E. Cosgrove et al., "Landscape and Identity at Ladybower Reservoir and Rutland Water," *Transactions of the Institute of British Geographers*, New Series 21, No. 3 (1996): 534-51.
11 For ideas on ways in which ingrained cultural ideas are overturned in history, and for a metaphysical analysis of processes by which cultural ideas and values change in American history, see, for example, historical philosopher Roland Van Zandt, *The Metaphysical Foundations of American History* (Gravenhage, The Netherlands: Mouton, 1959), 17-19, and his sources and critics.
12 A paper read at the meeting of the American Historical Association in Chicago, July 12, 1893. It first appeared in the *Proceedings of the State Historical Society of Wisconsin*, December 14, 1893, with the following note: "The foundation of this paper is my article entitled 'Problems in American History,' which appeared in *The Ægis*, a publication of the students of the University of Wisconsin, November 4, 1892." The text I have consulted is: Frederick Jackson Turner, *The Frontier in American History* (New York: Dover Publications, 1996), 199-227. It was printed with additions in the *Fifth Year Book of the National Herbart Society*, and in various other publications.

based on the prevailing "direction" of westward growth and settlement in relation to Europe.

> Up to our own day American history has been in a large degree the history of the colonization of the Great West. The existence of an area of free land, its continuous recession, and the advance of American settlement westward, explain American development. …At first, the frontier was the Atlantic Coast. It was the frontier of Europe in a very real sense. Moving westward, the frontier became more and more American. …Thus the advance of the frontier has meant a steady movement away from the influence of Europe, a steady growth of independence on American lines. …The true point of view in the history of this nation is not the Atlantic coast, it is the Great West.[13]

Turner's primary point after this was to proclaim the "closing" of the Western *frontier*, based on the term as it had been conceived by the U.S. Census Bureau. Just before its 1890 count, the Census Bureau had declared the term *frontier* to be of no further use as a statistical category. Previously, unsettled expanses of Western land masses identified the idea of *frontier*. But before 1890, settlement had reached a geographical extreme at the Pacific Coast, and no major unpopulated expanse remained. Turner's conclusion regarding the elision of the *frontier* category: the Census Bureau's "brief official statement marks the closing of a great historical movement."[14]

Turner's work laid groundwork for American historiography.[15] One aspect built on Turner's generalizations and abstractions, while another formed a critical historical response that insisted on revision of Turner's generalized notions. Beginning in the 1930s, new historical perspectives pointed out critical ideas Turner and others had not

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[13] Turner, *The Frontier in American History,* 1, 3. In the preface to the 1920 edition, Turner implies that the common theme among the essays treats "the age of colonization which came gradually to an end with the disappearance of the frontier and free land." He declares that the "new age" that replaces that of the frontiersman and the freelander has been characterized by "consolidated and complex industrial development" and by new kinds of connections between "the New World and the Old." At base, the history of the post-frontier American West is about "the economic, political and social characteristics of the American people and … their conceptions of their destiny."

[14] Turner, *The Frontier in American History*, 1, 3.

[15] Beyond Turner's 1893 publication, subsequent writings culminated in two volumes of essays, one in 1920, *The Frontier in American History* (New York: H. Holt and Co., 1920), and another, *The Significance of Sections in American History* (New York: H. Holt and Co., 1932), published in the year Turner died.

considered fully, first and foremost the geographical specifics of land, water and climate, and the real human pressures those exerted during settlement and cultural development of the West. Misalignments of fact and figure in landscape perceptions date as early as the first quarter of the 19th century, when visual and literary representations first circulated in print, following upon the first Lewis and Clark expeditions of 1804. By the 1870s, during "the second opening of the West," American landscape painters and photographers joined expeditions of the U. S. Geological Survey, producing landscape representations *in situ* to illustrate published reports.[16] Prominent expedition participant artists Sanford Gifford, Thomas Moran, and Albert Bierstadt went on to found a grand-scale American Romantic landscape painting style. Later, 20th-century historians of the American West pointed out that such widely-circulated artistic and literary visions suspended the idea of West behind a veil, serving to obscure the real nature of land and water in the region.[17]

In 1879, John Wesley Powell led his famed Colorado River expeditions, which initiated the founding of the U.S. Geological Survey, and his ensuing *Report on the Arid Region of the United States* presented a decidedly non-romantic approach. He privileged scientific and geographic realities of land and water, and of their uses, over the cultural preference of art's popular romantic vision. For decades, Powell's observations carried little cultural weight against the fictions perpetuated by images of the Far West's unknown lands. For Powell, water posed an extreme exception within the landscape problem. New problems for grappling with topography, weather and supply issues of Far West water rendered traditional conceptions of the landscape idea "contradictory and

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[16] Wallace Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (1953, repr., New York: Penguin Books, 1992), 174-91, and section of images with captions inserted between 92-93.

[17] G. Malcolm Lewis also points to emigrant guides and promotional publications for emigrants describing the American West, published from 1820 to the end of the century, as "forgotten" sources of 19th-century views of the America West. "…[I]nvaluable sources of descriptions of what environments and landscapes were supposed to be, would be found to be or ought eventually to be like…their content has not received as much retrospective attention as that of the region's literature of exploration and travel, official reports or accounts of scientific surveys." See G. Malcolm Lewis, "Rhetoric of the Western Interior: Modes of Environmental Description in American Promotional Literature of the 19th century," in *The Iconography of Landscape*, eds. Cosgrove and Daniels, 179-93.

meaningless."[18] Without renovating historical means of reflection, the water problem for the American West remained stubbornly particulate. Powell's *Report* from the 1870s is now considered the first comprehensive history of the American West and the challenges water posed to regional development, but at the time, it was not perceived to be so.

By the 1930s, critical historians of the American West had roundly exposed the myths 19th-century representations, and had reintegrated the fact of the land into the historical narrative. In 1950, literary historian Henry Nash Smith reflected critically on the impact of land in *Virgin Land: the American West as Symbol and Myth*. Smith's study examined historical events and cultural trends leading up to the long-reverberating shock wave of Turner's 1893 declarations. Smith proposed a new and earlier perspective on this history, and, with Walter Prescott Webb before him, expanded notions of "West" historically, tracing European ideas of westward imperial movement to European Renaissance exploration. They established the idea that a modern perspective on the American West identified long-held images and beliefs about the West and questioned their prominence as cornerstones of American cultural values.[19] In the centuries preceding Turner's thesis, "the physical fact of the continent dominates the scene. The American interior is presented as a new and enchanting region of inexpressible beauty and fertility."[20] Even so, argued Smith, perceptions of fecundity were based on traditional conceptions of land, beauty, and fertility developed *east* of the Mississippi. Smith

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18 Van Zandt, *Metaphysical Foundations*, 17-19. Van Zandt quoted in F.S.C. Northrop, *The Logic of the Sciences and the Humanities* (New York: Macmillan Co., 1947), 16. Historical Philosopher Van Zandt examines ways in which historical problems come to be framed in his time. He cites historian F.S.C. Northrop's tenets, that " 'the presence of a problem means that the traditional beliefs are in question,' " and that not until a problem is identified does inquiry into those beliefs begin. "A problem thus announces its presence," observes Van Zandt, "as a conflict between what exists and what is thought (traditionally) to exist."

19 Henry Nash Smith's 1940 Harvard University dissertation was "American Emotional and National Attitudes Toward the Great Plains and the Rocky Mountains, 1803-1850." Smith advised Leo Marx's 1950 Harvard dissertation, "Hawthorne and Emerson: Studies in the Impact of Machine Technology upon the American Writer."

20 Smith, *Virgin Land*, 11. Turner defines the frontier as "the meeting point between savagery and civilization," with the conditions of "savagery" being that "at the frontier the environment is at first too strong for the man. …The wilderness masters the colonist." He does not define his conditions for "civilization"; would it be something of a corollary, i.e., when the colonist masters the wilderness? See *Frontier in American History*, 4.

advanced a guiding figurative image, "The Garden of the World," which, in coordination with the "yeomen" who worked upon it, represented the enduring idea of an agrarian West.

> The image of this vast and constantly growing agricultural society in the interior of the continent became one of the dominant symbols of 19th century American society—a collective representation, a poetic idea…that defined the promise of American life.[21]

Many preconceived notions overlaid ideas of agricultural productivity in the western lands. Not least of these was agriculture's steady transformation into a large-scale industrial mechanistic operation. This occurred even as cultural ideals clung to the mythic primacy of the independent farmer. Many cornerstone ideas related to the 160-acre independent homestead (the Homestead Act had become law in 1862) conflicted with realities of agriculture as industry. Mercantile businessmen, absentee land owners, and enterprising capitalists became mainstays of Far West settlement in ways that undermined frontier myths of the independent farmer. Smith concisely sums it up: "The Homestead Act failed because it was incongruous with the Industrial Revolution." Nonetheless, the "Garden of the World" ideal guided cultural identity even long after agricultural industry, urbanization, and the "closing of the frontier" had outpaced it.

> …[T]his symbol, like that of the Wild West, became in its turn a less and less accurate description of a society transformed by commerce and industry. …But the image of an agricultural paradise in the West, embodying group memories of an earlier, a simpler and, it was believed, a happier state of society,…survived...to the very end of the 19th century…as a force in American thought and politics.[22]

The thinking that led to Turner's frontier hypothesis and its consequences derived from the myth of the garden.[23]

Post-Turnerian critique brought into close focus the fact of the land itself—*not representations of the land*—as the defining characteristic of the American West. Bernard De Voto, for example, declared that "too many treatises have erred through forgetting or

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[21] Smith, *Virgin Land*, 124-25.
[22] Smith, *Virgin Land*, 124-25.
[23] Smith, *Virgin Land*, 251.

ignoring our geography—and some from being ignorant of it."[24] Stepping back from cultural images of waves of heroes in perpetual motion like wind across prairie grass, new historical views insisted on real movement upon real land, and upon the specific cultural marks upon the land. Critics bemoaned not only the Turnerian denial of geography, but also its stubborn attribution of such "frontier" characteristics as "cult of action, rough individualism, physical freedom, and adventurous romance" to the American West.[25] De Voto called these anachronisms "four fixed and indestructible stereotypes about the West, all of them meaningless," dismayed to see them perpetuated as late as his own day, by prominent historians who "should know better."

> So our problem here exists in a medium of pure irony. For, to whatever degree the Turner hypothesis may be applicable to American experience east of the 100th meridian, it fails almost altogether when applied to the West. The study of a single water war, in fact of a single irrigation district, should reveal its irrelevance.

THE LANDSCAPE IDEAL AND COLD, HARD WATER

No garden without water. Not only the garden image posed problems for settlement in the Far West: physical access to real water was an upstream battle, mostly unacknowledged, against a current of landscape ideals. During the 1860s and 70s, Nash found that "voluminous discussions of rainfall" accompanied westward shifts in settlement toward the geographical barrier of the arid Great Plains: "The response of Westerners [to this shift] was to create the notion that in some fashion…the rainfall would be increased sufficiently to allow the agricultural frontier to continue advancing as far as the Rocky Mountains."[26] Several studies show this idea to be "quite unfounded"

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24 De Voto, *Course of Empire*, xxxiv.

25 All quotes in this paragraph are from Bernard De Voto, "Introduction," in Wallace Stegner, *Beyond the Hundredth Meridian*, xv-xxiii.

26 All quotes in this paragraph come from Henry Nash Smith, "Rain Follows the Plow: The Notion of Increased Rainfall for the Great Plains, 1844-1880," *Huntington Library Quarterly* 10, No. 2 (February 1947): 169-93. Nash explains: "During the two decades preceding the advance of the agricultural frontier into the dangerously arid portions of the Plains—which came with the burst of westward expansion after the Civil War—two conflicting estimates of the potentialities of the region were current. One, a vague folk-belief endemic in the West, maintained that the American frontier farmer would in the course of time be

and came in the face of "warnings that overconfidence concerning the rainfall was leading to dangerous over-settlement of the Plains." Yet, desperate optimism devised rain's probable increase, and settlement continued in defiance of the realities.

De Voto, too, argues that misconceptions and errors by settlers formed certain unrealistic responses to conditions of the land.[27] For a long time, these were difficult to assess historically. Yet, to a historian bent toward geography, this is critical for unraveling a history of American cultural values.

> …[H]istory is not geography, it is men and the events they produce. But the natural conditions in which men live help to shape their societies. They can and do live in the desert and on the Arctic ice, but on terms which desert and ice impose. A river or a mountain range will not stop a society that has a strong enough desire to cross it, or a sufficiently compelling dream. Yet there are places where the river can be bridged and places where it cannot be; a road can be built across the mountains by some routes only. …In such elementary ways geography admittedly conditions history.

De Voto laments—almost angrily—the degree to which the implied dialectic between Powell's geography and Turner's romance went unheeded by American historians. He criticized writers for perpetuating anachronisms that he, along with Webb, Smith, Stegner, and like-minded critical historians, had already soundly dispelled well before 1950.

The title of Wallace Stegner's 1953 book—*Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West*—explicitly stated overdue needs that hinged on joint imperatives. First, Stegner examined John Powell's early contributions, mainly that of renaming the historical importance of the 100th Meridian, the west of which lay "arid lands" of little rainfall. It was a cultural task to integrate

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able to occupy all the Plains as he had occupied the eastern half of the Mississippi Valley. The other view, endorsed by prevalent scientific opinion, affirmed that the Plains were a desert not open to cultivation and habitable only by nomadic herdsmen like the Bedouins of Arabia. Both estimates assumed that the Plains had been in the past too dry for successful agriculture, and that rainfall was the factor determining the extent to which the area could be brought under cultivation. The marked difference between the conclusions reached by the two schools of thought was due to contrasting estimates of the probable future precipitation."

[27] All citations in this paragraph come from De Voto, *Course of Empire*, xxxiv.

geography into the long view. Physical aspects of land and water, as well as potentials for large-scale technological management of regional water supplies, were "forgotten" issues from John Wesley Powell's 19th-century reports. Stegner's refocus on Powell's work underscored the importance of water study to geographical questions of identity. Key geographical differences between watersheds east and west of the Mississippi River directly affected large-scale potential uses for water, whose volume is regulated by climate, and whose physiological response to topography determine availability and access. With De Voto and others, Stegner reminded readers of historical and cultural blindness to relative East-West realities such as amount of natural precipitation, access to water sources, land irrigability, and applicability of hydraulic technologies.

The impact of industrial technology on the garden ideal was the topic of Leo Marx's 1964 *The Machine in the Garden: Technology and the Pastoral Ideal in America*. Marx built upon Henry Nash Smith's conclusion that 19th-century agrarian philosophy and myth grounding Turnerian thought was "powerless to confront issues arising from the advance of technology."[28] Smith had summarized "Turner's predicament" as the product of a blind match between a persistent pastoral ideal and a burgeoning industrial technology:

> From the time of Franklin down to the end of the frontier period almost a century and a half later, the West had been a constant reminder of the importance of agriculture in American society. It had nourished an agrarian philosophy and an agrarian myth that purported to set forth the character and destinies of the nation. The philosophy and the myth affirmed an admirable set of values, but they ceased very early to be useful in interpreting American society as a whole because they offered no intellectual apparatus for taking account of the industrial revolution.[29]

The cultural mindset that clung to this mismatch made crucial missteps in historical reasoning regarding American technological development. Marx emphasized: "The agrarian emphasis of the frontier hypothesis has tended to divert attention from the problems created by industrialization for half a century during which the United States

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[28] Smith, *Virgin Land*, 259.
[29] Smith, *Virgin Land*, 259.

has become the most powerful industrial nation in the world."[30] A yearning to be closer to nature "is the psychic root of all pastoralism" in the broad historical sense. The American brand complicated its form by coupling an older pastoral longing to strict Protestant Biblical precepts requiring material well-being to be "'the spontaneous fruit of an Edenic tree.'"[31] Leo Marx picked up this point, focusing on ways in which the runaway train of American industry and technology overtook the agrarian-pastoral ideal, the "image in the mind that represents aesthetic, moral, political, and even religious values."[32] The pastoral landscape ideal in its various forms in the United States, then, whether represented as agrarianism, as rural values, or as the image of the garden, became an "impediment to clarity of thought and …to social progress."[33] Images of the garden during this period finally served "to mask the real problems of an industrial society."[34] Marx discussed a "geographical basis of American politics" in an analysis of Thomas Jefferson's writings, concluding that "the machine's sudden entrance into the garden presents a problem that ultimately belongs not to art but to politics."[35]

To a degree I am only able to suggest in this dissertation, waterworks aesthetics addresses interplay among the cultural complexities of their time and place. Leo Marx's ideas imply that while art clarifies a cultural situation, politics is required to address civic problems within that situation. In terms of value, increasingly after the middle of the 18th century, "the vital element in pastoral [was] the design, the ordering of meaning and value around the contrast between two styles of life, one identified with a rural and the other with an urban setting." It is significant to note from within this paradigm that specific sets of building and ornamentation styles of waterworks and hydropower structures were labeled either "In Town" or "Out of Town" architecturally, that is, as

30 Smith, *Virgin Land*, 259.
31 Marx, *Machine in the Garden,* 6-8. On Eden, Marx quotes José Ortega y Gasset, *The Revolt of the Masses*: *Authorized Translation from the Spanish* (New York: W.W. Norton & Co., 1932), 1030.
32 Smith, *Virgin Land*, 128.
33 Marx, *Machine in the Garden*, 7.
34 Marx, *Machine in the Garden*, 7.
35 Marx, *Machine in the Garden*, 124, 365. Neither Marx's book, nor this dissertation, develops the larger political analysis, but means to acknowledge its underlying importance.

appropriate either for an urban setting or a rural landscape. Attempts to resolve American ambivalence between urbanism and agrarianism, between industrial technology and pastoral idealism, and between utility and beauty—that is, between work and art—surface in my interpretations of form, style, and iconography in waterworks architecture.

WATERWORKS ARCHITECTURE AND THE WHITE CITY

The World's Columbian Exposition at which Frederick Jackson Turner spoke in 1893 served as a celebratory historical gesture that looked toward the turn of a new, modern century even as it professed a backward glance at Columbus' 1492 discovery of the New World. Judging from photographs of exposition displays, grounding in past forms was one way of framing the modern.[36] The most prominent historical revival styles for waterworks were Greek Revival, Egyptian Revival, and Gothic Revival, styles also at the center of 19th-century American architecture. Influence by the French École des Beaux-Arts upon American architecture had reached a peak at the Chicago Exposition in New York firm McKim, Mead, and White. In collaboration with the firm, Daniel Burnham's White City/City Beautiful ideal dominated fair architecture.

To leave analysis open in the face of the endemic influence of the Beaux-Arts, I adopt the term *academic eclecticism*, as coined by California architectural historian Richard Longstreth. He quotes a Boston architect in 1904 to underscore problems with eclecticism in American architectural history: "To get a style by avoiding a style—that is the paradox of American architecture."[37] Longstreth likes this statement for the way it

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[36] Several exposition photographs I have viewed in the Ephemera Collection, The Huntington Library, San Marino, CA, amply illustrate this.

[37] See Richard W. Longstreth, "Academic Eclecticism in American Architecture," *Winterthur Portfolio* 17, No. 1 (Spring 1982): 55-82. Longstreth adapted the idea to California, and specifically to San Francisco, in the first chapter of his book *On the Edge of the World: Four Architects in San Francisco at the Turn of the Century* (1983; repr., New York: Architectural History Foundation, 1998), 9-39. One of the four architects he examines is San Francisco architect Willis Polk, who plays a central but under-examined role in waterworks design in California, as I discuss at length in this dissertation. Robert Andrews quoted in Longstreth, *On the Edge of the World*, 9. Roderick Nash summarizes, historically: "So much effort in the early 19th century went into calling for and worrying about a national style that there was little actual progress toward achieving one." See Roderick Nash, *Wilderness and the American Mind* (1967; repr., New Haven, CT: Yale University Press, 1976), 74. Specifically to the point of hydraulic architecture, historian of the Tennessee Valley Authority's waterworks architecture Walter Creese observes: "America was

encapsulates multiple issues leading to "a major shift in the way American architects—to include Beaux-Arts architects—approached design" between the 1880s and the 1930s.

> The paradox identified by Boston architect Robert Andrews was …generated by embracing historicity and innovation in more or less equal measure and by expressing these dual values in numerous ways. …The aim was academic in encouraging architectural development through a scholarly knowledge of the past. The method was academic in the importance given to formal education as a means of acquiring that knowledge. The movement's origins were academic in having emerged from a system of instruction and practice that had been cultivated in France since the 17th century.[38]

Indeed, the Parisian École des Beaux-Arts had been an explicit driving force for academic architectural training and design in the United States. Architects were "civilizing agent[s]" who made time-honored neoclassical architecture accessible to the public.[39] Around the turn of the 20th century, architects "sought to foster a gradual evolution in their art by drawing from a wide range of historical precedents, modifying and combining them according to contemporary needs" to honor both continuity and change.

> Proponents of academic eclecticism became more concerned with the enormous diversity found in historic precedent. …In contrast to the visual bombast of Victorian architecture, in which the parts often received emphasis at the expense of the whole, it was believed that all elements should act in concert to form a logical and coherent statement.

Longstreth emphasizes architects of the period who rejected "traditional stylistic parameters" set in the first half of the 19th century. They aimed instead to cultivate a

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always a 'never ready' country. Its architectural imagery was supplied on the spur of the moment, as if the nation had never possessed an authentic tradition or any disciplined interpretation of its visual heritage." See Walter L. Creese, *TVA's Public Planning: The Vision, The Reality* (Knoxville, TN: University of Tennessee Press, 1990), 147.

38 All quotations in the remainder of this paragraph are from Longstreth, *On the Edge of the World*, 9-16.

39 "The notions of maintaining continuity with the past; of balancing tradition and innovation; of studying the best historical examples from all periods in order to learn the principals of good design; of achieving unity, order, and simplicity through careful, rigorous compositional techniques; of striving for a rational synthesis of beauty and utility; and of the architect's role as an artist were all prevalent French attitudes during the later part of the 19th century. …The basic concepts of good design advanced by the École were accepted; however, by the 1890s, considerable debate arose over the degree to which this Franco-American bond was productive… [and] how the lessons of European precedent could best be adapted to American conditions." Longstreth, *On the Edge of World*, 15-16.

historical flexibility as they enlivened "the creative spirit of past eras" to create a "substantive departure from earlier phases of eclecticism."

One pertinent element of architectural debate at this time focused on a "marriage of opposites" between *use* and *beauty*.[40] Period critic A.D.F. Hamlin encouraged architectural practice that "serve[d] at once the ends of use and beauty" so that "each enhance[d] the other":

> …[T]he true purpose of architecture…is to harmonize the independent and oft-conflicting claims of use and beauty, so that the very forms devised to meet practical needs in the most perfect manner shall also satisfy the human craving for beauty, grace, refinement.[41]

Cultural historian of technology Cecelia Tichi points out an "old Victorian dualism separating art from technology" in which "the arts belonged by definition to a higher spiritual realm untainted by machines or structures… [and in which] the engineer…had no legitimate place…."[42] Leo Marx, too, had pointed out that the 19th-century pastoral "separates beauty from utility and work."[43] Also prominent among *fin de siècle* ideas for 20th-century structural art were Louis Sullivan's universal law of forms, which inspired his famous imperative that "form ever follow function," and John Wellborn Root's natural law of utility or fitness, which grounded his Utilitarian Theory of Beauty: "Based upon uses, art becomes useful."[44] I wonder if the relative absence of art historical work on the aesthetics of utilitarian waterworks structures is evidence that this separation still holds currency?

New engineering materials appearing in the late 19th and early 20th centuries—wrought iron, steel, and reinforced concrete—created new design possibilities for what

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40 Longstreth, *On the Edge of the World,* 15.

41 A.D.F Hamlin, "The Battle of the Styles," *Architectural Record* 1, No. 3 (January-March 1892): 268, quoted in Longstreth, *On the Edge of the World*, 15.

42 Cecelia Tichi, *Shifting Gears: Technology, Literature, Culture in Modernist America* (Chapel Hill, NC: University of North Carolina Press, 1987), 180.

43 Marx, *Machine in the Garden*, 93-94.

44 Louis Henry Sullivan, "The Tall Office Building Artistically Considered," *Lippincott's Magazine* 57 (March 1896): 403-09. John Wellborn Root, "The Utilitarian Theory of Beauty," as presented in ample excerpts in Harriet Monroe, *John Wellborn Root: A Study of His Life and Work* (Boston: Houghton, Mifflin, 1896), 206-11.

engineering historian David Billington calls "structural art." He specifically relates this term to civil engineering structures. Distinguishing between architecture and engineering practice—he calls Root "an architect who did engineering"—he confines the discussion of structural art to utilitarian works of civil engineering, specifically towers and bridges.[45] Exemplary structures not only conform to traditional engineering standards of maximum *efficiency* and *economy* of materials, but also meet the differentiating aesthetic criterion of *elegance*. Elegance is the element that qualifies them as premier aesthetic structures, works of engineering art, by differentiating them not for transparency of structural elements, but also for the denial of surface ornament. This contrasts against historical revivalism's focus on details of ornament and iconography for the identification of style, and against the intentional identification with past forms. In discussions of late-19th-century bridges featuring historical revival ornamentation, such as some of Roebling's first suspension bridges (which I discuss briefly in this dissertation), Billington addresses the aesthetics of structure, but not of surface. He does not discuss waterworks (even though many waterworks structures *are* towers and bridges), yet his discussion of utilitarian aesthetics applies directly to design for water-related structures.

Historian of dam engineering Donald C. Jackson develops an application of Billington's structural art idea in a discussion of early 20th-century dam technology in the American West.[46] Jackson's controlling example, a specific type of dam design called a multiple-arch dam, touches on issues of acceptance and rejection of aesthetics in waterworks structures. As a work of structural art, the multiple-arch dam relies for its overall success on the type's joining of structural *and* aesthetic strengths. In one of Jackson's cases upon which I build in my final case study, an arcade of thin-shell concrete barrel arches on a multiple arch dam—technically engineered for superior strength, especially under the load of a full reservoir—were derided for appearing female, lace-like, and weak. At least one dam in this style was physically buttressed to make it

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[45] David Billington, *The Tower and the Bridge: the New Art of Structural Engineering* (Princeton, NJ: Princeton University Press, 1985), 107. On this point, see also Cecelia Tichi, *Shifting Gears*, 180-83.
[46] Donald C. Jackson, *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* (1995; repr., Lawrence, KS: University Press of Kansas 2005), 232-35.

appear more stable, against evidence that it needed no such support. In another case of my own investigation, the face of a technically-sound curved-arch gravity dam was backfilled with millions of tons of earth to hide the dam from view. In both cases, alterations were purely visual, and had no structural effect on the dam. It goes without saying that a dam can look aesthetically pleasing, but if it fails to hold back water, its success as a work of art is moot. By the same token, if a dam that is structurally sound is criticized based on visual features alone, the work fails culturally. In the examples I discuss, even the suggestion of structural failure of a dam is conceptually catastrophic, and visual failure in fact doomed a structurally sound dam.

Perceived clashes in the relative ethics of art and utility remain unresolved in such cases. These open questions rear up in times of conflict or crisis, yielding ongoing ambivalence and resulting in indecision. To examine ambivalence as a cultural value in response to formal elements of utilitarian waterworks structures helps to reveal ways in which cultural values and beliefs can direct interpretation of waterworks forms.

MATERIAL VALUE: AMERICAN AESTHETICS, MACHINE TECHNOLOGY, AND GILDED AGE CRITICS

The opposite of economy is waste, and waste is theoretically a product of inefficiency. Billington's criterion of elegance for structural art signals a special case of extreme (and, theoretically, desirable) economy of materials and efficiency. Here utilitarian aesthetics enters consideration as an economics issue. This makes sense, because waterworks projects, being large-scale, are expensive; a single project typically spurs manufacturing and labor for years, sometimes decades. Such projects participate both in efficient and in wasteful use, at several levels. It is pertinent to this study to mention social behavior related to economics that may reveal cultural values relevant to waterworks.

This leads to 19th century social economics theorist Thorstein Veblen, whose 1899 work, *The Theory of the Leisure Class* directly applies, as does his less-known work on machine production.[47] Veblen's structural theory of social economics presented social behaviors and material trappings as signs that decode cultural practices regarding material wealth and social class identity. The cornerstone of Veblen's theory is *conspicuous waste* (intentional overproduction meant to draw attention to its antithetical economy), which results as a consequence of *conspicuous consumption* (overt purchase and excessive flaunting of material goods).[48] At all levels of the capitalist socioeconomic scale, success and upward mobility hinge upon visibly promiscuous display of goods and services at a level of excess slightly higher than one's actual economic standing would appear to permit. Excess, or waste, is interpreted as luxury, and display of luxury is a sign of wealth. When one establishes socioeconomic standing in the public eye as being stable, goods and services at the current level become basic needs. To rise to the next social level, conspicuous consumption must increase to achieve visibly higher levels of luxury. One appears even more wealthy.[49]

Veblen's sardonic tone throughout his work signaled the depth of his cultural criticism. He decoded everyday behavior in the form of cultural exposé. Historian Basil Willey has observed a commonplace that should need no reminding, that "it is almost insuperably difficult to become critically conscious of one's habitual assumptions."[50] Along the same lines, Alfred North Whitehead quipped: "Such assumptions appear so obvious that people do not know what they are assuming because no other way of putting

[47] Thorstein Veblen, *The Theory of the Leisure Class: An Economic Study of Institutions* (New York: Macmillan, 1899); *The Theory of Business Enterprise* (New York: Charles Scribner's Sons, 1904); *The Instinct of Workmanship and the State of the Industrial Arts* (New York: Macmillan, 1914); and *The Engineers and the Price System* (New York: B.W. Huebsch Inc., 1921).
[48] Thorstein Veblen, *The Theory of the Leisure Class: An Economic Study of Institutions* (New York: Random House, 1899), 68-101.
[49] For a historiography of the terms "waste," "efficiency," "instability," specifically as they relate to machine technology and engineering between about 1890 and 1920, and including analysis and cultural impact of values in engineering and technology not only from Veblen's ideas, but also from Henry Adams and Viollet Le Duc, see Tichi, *Shifting Gears*. As these ideas apply to Veblen, see 55-74, 133-37. As they apply to Henry Adams and Viollet Le Duc, who are relevant but whom I will not discuss, see 137-68.
[50] Basil Willey, *The Seventeenth Century Background: Studies in the Thought of the Age in Relation to Poetry and Religion* (London: Chatto & Windus, 1949), quoted in Van Zandt, *Metaphysical Foundations of American History*, 24.

things has ever occurred to them."[51] Veblen exposed assumptions that kept not only socialites, but also historians, from perceiving practices that impeded the potential for insight. The social economist's observations were precursors to the critical methods of the mid and late 20th century. Such sub-disciplines in American history as Veblen's social economics joined the new disciplines of American studies, environmental history, cultural geography, landscape theory, and the "new" art history. Foundationally subversive, revisionist critical approaches reveal underlying inequities that the "majority" socioeconomic class—to include historians—legitimized. Veblen applied his criticism to Turner's historical work, exposing unexamined assumptions. The two thinkers were contemporaries (they attended Johns Hopkins together as undergraduates), yet comparative analysis reveals divergent thinking regarding Far West frontier migration, settlement, and history: "Veblen…focused on the often dreary and ugly realities of rural existence that Turner, in his celebration of the frontier experience, was prone to ignore."[52] The economist's specificity denies Turner's romantic typifying tendencies.[53]

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51 Alfred North Whitehead, *Science and the Modern World* (New York: Macmillan, 1925), 71, quoted in Van Zandt, *Metaphysical Foundations of American History*, 25.

52 Vernon Mattson and Rick Tilman, "Thorstein Veblen, Frederick Jackson Turner, and the American Experience," *Journal of Economic Issues* 21, No. 1 (March 1987): 219-35, esp. 224-25. "A consequence of the farmer's desire to own a disproportionate amount of land, more than he could reasonably expect to till, was that the farming population was greatly dispersed. The problems of transportation and communication were greatly exacerbated because of distance and providing education for schoolchildren and adequate medical care was exceedingly difficult in many regions. Veblen also traced a high rate of insanity among housewives to the rural isolation…. For purposes of comparison with Turner, Veblen's indictment of the frontier experience may be broken into six parts, including: (1) economic waste and destruction of the natural environment, (2) the traits and function of self-help and cupidity, (3) the role of absentee ownership in exploiting rural America, (4) the oppression of racial minorities, especially Native Americans and blacks, and (5) the very real material progress weighed against the human costs."

53 For instance, Veblen substantiates the complex realities of frontier homesteaders' dilemmas, and their long-term consequences, with the following examples: "…[I]n much of the country where the ground was covered with hard-wood timber it was in its time not unusual for the impecunious settlers to raise some slight funds for urgent use by hastily felling the stand of timber, burning it, and selling the ash, which was used for making potash. So also, in the same sections, as well as in many places where the land was timbered with pine and hemlock, it has not been unusual to construct fences by felling the timber along the fence-line in such a way as to make a barrier of it to serve the purpose of a fence by cumbering the ground. The Independent Farmers were commonly very nearly penniless, and so were driven to many ingenious devices to find ready money, at the same time that their competitive enterprise in land-grabbing scattered them and their work out over wide spaces of half-wild country with long distances and atrocious roads, leaving them far out of reach of reasonable transportation. They were (commonly) unable to buy or to bring in anything like the equipment and materials required in their work. So they took this way out of present

Citing a dearth of concrete evidence, Veblen insisted that American historians needed a changed perspective. He expressed frustration with historical analyses blind to unexamined cultural assumptions and slavish toward historically-ingrained beliefs. He warned of future costs incurred by decisions and practices based on them. Lack of critical self-consciousness at critical junctures in historical development, he implied, laid a foundation for an ambivalence that clouds the ability to sense historical or cultural consequenc, for example, ways in which past influences present or present can influence future, or ways in which one aspect of culture relates to another.[54]

This ambivalence troubled Leo Marx, too. He traced back to Thomas Jeffereson a deep American ambivalence toward the relationship of industrial technology to ideals of landscape. Marx analyzed Jeffersonian indecision regarding roles of manufacturing and agriculture in Americans' desire to become economically independent from Europe. Jefferson struggled to align irreconcilable desires. Placing "the manufacturer by the side of the agriculturalist," Jefferson saw an either-or dilemma: "He…who is now against domestic manufacture, must be for reducing us either to dependence on that foreign nation, or to be clothed in skins, and to live like wild beasts in dens and caverns.'".[55] About Jefferson's quandary Marx observed:

> …the "inconsistencies" just mentioned are not the sort that can be swept aside by a tidying-up of…reasoning.… They stem from a profound ambivalence—a complex response to the conflicting demands of the self and society…. [Jefferson] expresses decisive contradictions in our culture and in ourselves.[56]

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difficulties at the cost of the future; and the future, which has now become the present, is paying the cost in a scarcity of timber." Quoted in Mattson and Tilman, "Thorstein Veblen," 234 n. 19.

54 Quoted in Mattson and Tilman, "Thorstein Veblen," 234 n. 19. Veblen concisely summarizes long-term effects, for example, of timber clear-cutting on the plains for short-term gain: "[Settlers] took this way out of present difficulties at the cost of the future; and the future, which has now become the present, is paying the cost in a scarcity of timber."

55 Thomas Jefferson to Benjamin Austin, Jan. 9, 1816, in *The Writings of Thomas Jefferson*, ed. Andrew A. Lipscomb (Washington, D.C.: Thomas Jefferson Memorial Association of the United States, 1903), XIV, 387-93, quoted in Marx, *Machine in the Garden*, 139, 375 n. 47.

56 Marx, *Machine in the Garden*, 136-37, 141. Marx cites his indebtedness to the ideas of Richard Hofstadter, *The American Political Tradition and the Men Who Made It* (New York: A.A. Knopf, 1948), 24-5; and Merrill D. Peterson, *The Jefferson Image in the American Mind* (New York: Oxford University Press, 1960), 443-46.

From within this cultural self-conflict, Marx proposed a middle ground, a dialectical relationship between *garden* and *machine*, a "mediation between the extremes of primitivism and what may be called 'over-civilization.'"[57] Dialogue between these extremes (the terms, perhaps, of a paradox) might resolve deeply-held cultural ambivalence and permit the old problem to assume "'a new form.'"[58]

With the development of critical methods, terms for historical analysis began to change. According to Walter Benjamin, for example, the stubborn apotheotic "aura" surrounding cultural products created by elite makers needed to become less exclusive.[59] Benjamin's critical theory, associated with the Institute for Social Research, or Frankfurt School, appropriated the social economics of Karl Marx and the psychoanalysis of Sigmund Freud. Scholars at the Institute for Social Research related histories of knowledge and discourse to cultural production, and aimed, in the words of Frankfurt School historian Martin Jay, to bridge "the missing link between ideological superstructure and socio-economic base."[60]

Within its broad scope, this school of thought developed a sociological approach to aesthetic theory. Its aim was to examine production and consumption of cultural products, interpreting works of art and architecture as signifiers of unconscious 'ways of seeing' informed by unacknowledged beliefs and values. For the critical theorist, aesthetic theory ultimately identified the very act of valuing art as a sociological sign. Works of art are the focus of social behavior aiming to legitimize social status through the ownership and appreciation of art. Take, for example, an iconographical detail such as

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57 Marx, *Machine in the Garden*, 139-40.

58 Jefferson quoted in Marx, *Machine in the Garden*, 139, 375 n. 47.

59 It is beyond the scope of this dissertation to expound completely on the broad issues of Critical theory implied within the topic of water systems architecture. I quote various thinkers associated with the Institute for Social Research (Frankfurt School) in this introduction as relevant to issues I discuss here. As to my mention of Walter Benjamin, see "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations: Essays and Reflections*, ed. Hannah Arendt, trans. Harry Zohn (New York: Schocken Books, 1968), 217-51. I quote other contributors of the Frankfurt School where appropriate in this Introduction.

60 Martin Jay, *The Dialectical Imagination: A History of the Frankfurt School and the Institute of Social Research, 1923-1950* (Boston: Little, Brown, 1973), 92. Jay's book is the accepted introductory overview of the topic; its primary advantage is that when Jay was doing doctoral research on the Institute, he was able to meet, interview, and correspond with most of its key members.

an unfurling tendril, a detail on a column capital on a structure from 1910 called the Sunol Water Temple, located at a special confluence point on San Francisco's water supply system. Under traditional art historical analysis, this tendril signifies only within a specific code of aesthetic interpretation practiced by the elite group who promulgates it—including myself as the author of an analysis of this column capital in an art history dissertation. Recognition of such formal elements within a certain closed circle of connoisseurs defines an exclusive group in whom cultural power resides. Deconstruction of the connoisseur's cultural authority involves showing that characteristics of eliteness are signs in themselves. These signs reveal the values of valuing. A cultural theorist concludes that aesthetic values *per se* have historically excluded non-connoisseurs in art-related cultural practices and processes of aesthetic valuing.[61] The role of art and architecture in society serves—some would say intends—to neutralize the access of a large part of the population to artistic products and activities. In limiting access, connoisseur groups legitimize not only their right to valuable objects, but their exclusive right to value itself, a circular process that judges as socially valuable those within the closed circle. In late-20th-century sociologist Pierre Bourdieu's terms: critique opens a traditionally closed cultural value system—the system of taste—so that choices involved in exhibiting artistic taste are exposed as signs with the underlying purpose of codifying socioeconomic differentiation in pecuniary terms.[62]

In the architectural design of waterworks, a style, an ornamental detail, or an iconographical program stakes a visual claim on a cultural value system that confers elite status on symbolism related to water, its movement, and its role in urban economic and social development. Patrons of waterworks architecture designed and placed each structure as if a temple to mark and glorify the system. Utilitarian waterworks structures

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[61] Here, *connoisseur* defines the theoretical *majority*, the exclusive group or dominant class small in number but large in social privilege and social, economic, and political power. The *minority*, by contrast, is any *non-connoisseur* or *Other* group, by contrast large in number but low in socioeconomic and political power.

[62] See Pierre Bourdieu, *Distinction: A Social Critique of the Judgment of Taste*, trans. Richard Nice (Cambridge, MA: Harvard University Press, 1984), e.g., 1-7, 466-67. I also borrow here from semiologist Umberto Eco's idea of the more or less open text in *The Open Work* (Cambridge, MA: Harvard University Press, 1989), 1-4, 84-104.

thus functioned symbolically, not only as valued aesthetic commodities, but also as signs of progress and prosperity in the larger picture of American urban development.

CALIFORNIA ARCHITECTURE HISTORY: WATERWORKS IN CONTEXT

One part of tracing the historical development of California waterworks design is to discover its place within a broader history of waterworks in the United States. In Part 2 I build a history of American urban waterworks design from 1800 to 1983. Between 1801 and 1860, all major cities in the United States, as far west as Chicago, St. Louis, and New Orleans, built urban waterworks systems installed with new technologies. The first opened in Philadelphia in 1801.

One cannot ignore that date as concurrent with Jefferson's Louisiana Purchase, whose vast lands beyond the Mississippi River opened new ways of envisioning "West" in terms of land and water. Terms of urban development changed significantly beyond the hundredth meridian. Cosgrove points out that for New England and New York, "as America's place in the industrial capitalist order began to be formulated in the early 19th century…social stratification of a form more closely akin to that of Europe emerged."[63] But at mid-century, with the Gold Rush and the secession of the California Republic from Mexico in the Far West, new and discrete conditions had to be acknowledged for California. A special geographical situation that bore directly upon access to and delivery of water resources for urban development in the West forced a different trajectory than that of water development to the east. Uniqueness in California's situation is a valid assessment for its waterworks history, in part because solutions to urban water delivery problems had to take into account dramatic geographical watershed terrain and distances water supplies had to travel. In extent, these were new challenges to urban water infrastructure development. Historian of energy and technology James Williams confirms the perception of California as an exception:

> In general, national studies of America's energy experience ignore developments in the West. Perhaps this is not surprising, considering that California and other

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[63]Cosgrove, *Social Formation*, 163.

> western states have been perceived as having grown up as economic and social colonies of the rest of the nation, but it is unfortunate. Regional differences that are in themselves interesting and instructive and that, in some cases, are quite important beyond the region, are obscured.[64]

This dearth of scholarly attention posits an inverse relation to the broad (almost ravenous) public attention paid to political and environmental controversies that hydraulic systems in California and the American West have attracted.

Part 3 focuses on waterworks for the San Francisco Bay region, and is the central focus of the dissertation. The Far West's primary urban metropolis after the mid-19th century, San Francisco required early access to imported water, a situation that differed from water access for eastern cities, most of which drew directly from nearby rivers or surface water supplies. Comparison with Manhattan draws similarities, primarily for the criterion of distance: New York, too, drew from springs and from the big, reliable Hudson River. By 1860 in San Francisco, the private Spring Valley Water Company had encumbered a coastal watershed 30 miles south of the city, and, by the 1880s, the distance city water traveled had increased to 70 miles, tapping an even more distant rural water supply across the bay. Around 1870, city leaders had begun hiring hydraulic engineers to study and map of potential large-scale sources for the city's future water supply. These exhaustive studies made clear that water would have to be imported long-distance from the Sierra Nevada Mountains, 150 miles distant. Before the turn of the century, municipal planners honed in on the high-elevation Tuolumne River, where it passed through the Hetch Hetchy Valley, to locate its major city reservoir site. Despite decades of controversy about the damming of a portion of protected Yosemite National Park (which persists to this day), approval for the Hetch Hetchy Aqueduct came in 1913, but only after a Congressional bill put legal dissent to rest and granted the City of San Francisco water and construction easements within the parkland. After decades of

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64 James C. Williams, *Energy and the Making of Modern California* (Akron, OH: University of Akron Press 1997), 5. California's remoteness affected the hydraulics community in the state: "In 1884, California's civil, mechanical, and hydraulic engineers already had responded to their geographic isolation from the discourse of America's professional engineering organizations by forming the Technical Society of the Pacific Coast." Williams, *Energy*, 187-89.

protracted development phases, the multi-purpose storage, hydropower, and aqueduct system delivered water to San Francisco, in 1934.

Geography and climate spelled a water situation for Los Angeles and Southern California even more challenging. Southern California is truly arid, well under the 20-inch annual criterion for aridity. San Francisco's annual precipitation hovers just above 20 inches annually, while nearly every other California city to the east and to the south of the San Francisco Bay Area, to her desert borders with Arizona and Mexico, averages 10 to 17 inches a year. Outside the San Francisco area, the largest-growth urban centers fall on the low end of that rainfall scale, yielding an inconsistent surface supply. For Los Angeles to grow, this meant diverting California's east-facing Sierra Nevada watershed, that of the Owens River, which drains through an inland desert. **[Figures 1-6]** In 1913, the Los Angeles Aqueduct opened, "exporting" the entire drainage of the vast watershed through 200 miles of canals, pipelines, and reservoirs into the Southern California metropolis.

The Los Angeles Aqueduct *opened* in 1913, the same year in which San Francisco had just received federal permission to *begin* its Hetch Hetchy Aqueduct. Hetch Hetchy completion delays persisted until the aqueduct's 1934 opening, but it would be a mistake to conclude that San Francisco was "behind" Los Angeles in urban water systems development. San Francisco's long-distance aqueduct amplified a sophisticated system already in place, one initiated at mid-19th century, designed to respond to statistical forecasts for expected population and industry growth. By dramatic contrast, the 1913 Los Angeles Aqueduct did not expand infrastructure in response to existing growth patterns, but *created* massive new growth *specifically through water delivery*. The Los Angeles Aqueduct made California's signature sprawl manifest as her destiny. To meet the modern standard the Los Angeles Aqueduct set, to outgrow itself, the region distinguished itself as a water culture characterized by increasing and irreversible dependence on a gargantuan water supply. Not only Southern California, but California and the American West at large, established a now-ingrained cultural trait: to take water, in inexhaustible supply, for granted.

WATER IN THE HISTORY OF IDEAS FOR CALIFORNIA AND THE AMERICAN WEST

Articulating water's critical role in California and the West owes its initial advancement to several historians. Donald Worster, whose 1985 book *Rivers of Empire: Water, Aridity, and the Growth of the American West* was an environmental and sociological history, defined large-scale regional water planning as a centralized tool of power designed to control regional social behavior and cultural values.[65] Journalist Marc Reisner's 1986 *Cadillac Desert: The American West and Its Disappearing Water* brought water history into the public sphere, as Polanski's 1974 film *Chinatown* had done. In 1992, Norris Hundley, Jr. published *The Great Thirst: Californians and Water, 1770s – 1990s*, a comprehensive water history focused on "human values and what humans beings do to the waterscape" in California.[66] Hundley examined ways in which values related to water have shaped technology and industry, private business, and government policy. Hundley's basic interest, building in part upon Pisani's formidable work in water law history, is in specific ways Californians conceive, regulate, and monopolize water rights—from the earliest pre-Contact indigenous communities to the most recent large-scale corporate or government political machinations related to water appropriation and management.

Worster argued that water systems development in the American West was motivated primarily by large-scale hegemonic ends. He crafted his water history upon the theory of "hydraulic society" presented in 1957 by Karl Wittfogel (a founding member of the Institute for Social Research) in *Oriental Despotism: A Comparative Study of Total Power*. This post-war study of Communism in China defined centralized control of water as being directly in the service of social control—Wittfogel called it bureaucratic

[65] Worster's water history followed from his 1977 *Nature's Economy: A History of Ecological Ideas,* based on his 1971 Yale University doctoral thesis in the Philosophy and History of Science. Worster holds credit for being one of the founders of environmental history, an interdisciplinary field calling on histories of landscape, geography, hydrology, ecology, conservation, economics, and philosophy.

[66] See Donald Worster, *Rivers of Empire: Water, Aridity and the Growth of the American West* (New York: Pantheon Books, 1985); Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1977); Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (New York: Viking, 1986); Norris Hundley, Jr., *The Great Thirst: Californians and Water, 1770s-1990s* (Berkeley, CA: University of California Press, 1992), xvi.

totalitarianism for a non-Western hydraulic society.[67] Worster's work adapted Wittfogel's thesis to the American West and California.[68] Several scholars, Hundley, for one, object to Worster's sweeping application of Wittfogel's thesis about Communist China to a dissimilar situation in the American West, challenging Worster's attribution of a single motivating factor—hegemonic imperialism—to the California situation. Hundley looks instead to interplays over time of local elements—political, social, *and* economic—to be "understood within the larger context of…ways in which…national culture resonates in California."[69]

The contribution of German intellectual history—Wittfogel and the Institute for Social Research being crucial examples—to the development of American values is widely recognized. A recent study relating watershed development to cultural values in German history is relevant to this dissertation: David Blackbourn's *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany* (2006). Blackbourn focuses on effects of land reclamation and water conveyance systems on wetlands and river sheds, from the 18th century forward. He constructs a German history of related ideas in science and naturalist philosophy akin to American Transcendentalism, analyzing culturally resonant ideas like "conquest," "nature," and "paradise" as these relate to water and landscape. Blackbourn notes complicated ways in which elements in works of art signify cultural values in German artists such as Breughel. He questions notions of "pristine" nature and "wilderness" in the context of "reclamation" projects in the 19th and 20th centuries.

> When we consider these apparently pristine wetland habitats, the question arises: how pristine were they? …Almost all of the reclaimed wetlands were in fact hunting preserves before they became pastures or fields of corn, which is why so

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67 Karl August Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (1957; repr.,New Haven, CT: Yale University Press, 1967).

68 Worster argues that this has resulted in environmental disaster. Thorstein Veblen and others had criticized this and many other aspects of frontier settlement in the West much earlier. See Roderick Nash whose 1967 book *Wilderness and the American Mind* examines ways in which ideas of *wilderness* and related cultural values developed in the United States, specifically in the American West; and Robert W. Righter, *The Battle Over Hetch Hetchy: America's Most Controversial Dam and the Birth of Modern Environmentalism* (New York: Oxford University Press, 2005), and their sources.

69 Hundley, Jr., *The Great Thirst*, xx.

> many Prussian nobles protested against the process of reclamation. Examine these apparently natural habitats closely, and it becomes apparent just how much they owed, directly or indirectly, to human interventions.[70]

Compare Blackbourn's idea to a quote by my epigraph by Bernard De Voto:

> Only in mountainous country…can we count on the landmarks being what they were, and not there unless the builders of dams and highways have withheld their hands. Elsewhere settlement may have obliterated landmarks and nature may have so altered the topography that the place where we fought Indians is now ten miles on the other side of the river and the lake we guided by has dried up. I have done my full share of field work, perhaps more than was called for, and I have spent a great deal of time following my characters across the land. But it must be candidly admitted that in most statements of routes some portions are by grace of historical convention.[71]

Societies tend to "forget" major landscape alteration, often in less than a single generation, so that over time, there is a social perception that even a dramatically altered landscape is believed to be a pristine natural wilderness.[72]

In type of analysis Bourn carries out, aesthetics appear in discussions of watersheds themselves, but aesthetics is largely missing from historiography about architectural design of waterworks structures. Indeed, the one single book-length

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70 David Blackbourn, *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany* (New York: W.W. Norton and Co., 2006), 74-75; and 20, image of the painting. The long view of history is certainly longer in Germany than in the United States, but the German ideas apply to the American situation. One must also consider Blackbourn's indebtedness to decades of study of water systems and landscape alteration in the United States.

71 De Voto, *Course of Empire*, 635.

72 On the topic of engineered landscape change, I am in the process of researching and writing an art historical study of major landscape alterations made in American urban centers in the first half of the 19th century. My central case study for this work is the city of Boston, whose large-scale excavation and landfill projects are noteworthy examples of engineered landscape changes made during city expansion and modernization in the 19th century. My argument dwells on Hermann Melville's 1851 ruminations on landscape and urban land use in *Moby Dick* as primary period commentary; in the novel, the author refers to Boston landfill projects as one of many musings on American cultural values as they pertain to land, landscape, and land use. For landscape change and land use issues in 18th- and 19th-century Boston city development, see, for example, Walter Muir Whitehill, *Boston: A Topographical History* (1968, repr., Cambridge, MA: Belknap Press of Harvard University Press, 1996), 47-84, 104, 180-81. For a sampling of comments on landscape from Melville's 1851 novel, see Hermann Melville, *Moby Dick* (1851, repr., San Francisco: Arion Press, 1979), 198, 440-41, 557**.** Also, see my thoughts on the idea, applicable here, of cultural 'forgetting' regarding landscape and terrain change, and of historical readjustment to topography changed by engineered waterworks in ancient Rome. In "Aqueduct as Hegemonic Architecture: A Case from the Roman Republic," in *Ideas of Water from Ancient Societies to the Modern World,* series 2, vol. 1 of *A History of Water,* eds. Terje Tvedt and Terje Oestigaard (London: IB Tauris, 2010): 147-91.

exception of note, in which aesthetic factors are the principal line of inquiry for the analysis of waterworks design, is architectural historian Walter Creese's art and architectural study of the Tennessee Valley Authority's waterworks architecture, *TVA's Public Planning: The Vision, The Reality*. Donald C. Jackson also mentions design aesthetics in dam history, calling on historians to pay closer attention to ideas of artful design such as David Billington's "structural art" thesis regarding elegance in works of civil engineering. My art historical inquiry looks to aesthetics to identifiy visual precedents as foundational signifiers of cultural values related to water.

CALIFORNIA CONTEXTS FOR A HISTORY OF WATER, ARCHITECTURE, AND LANDSCAPE

To summarize the scope of this dissertation, Part 2 examines waterworks for the cities of Philadelphia, New York, and Louisville, analyzing ways in which architectural styles, iconographies, and images of waterworks codify cultural values that address the importance of water in American urban development as a whole.

Part 3 presents a visual analysis of selected California waterworks. My analysis centers on the idea of a *water temple* in American urban waterworks history, framing my in relation of two specific round peripteral water temple structures, both created for the city of San Francisco. In an extended analysis, I compare the 1910 Sunol Water Temple, built for the private Spring Valley Water Company by San Francisco architect Willis Polk, with the 1938 Pulgas Water Temple, designed by local architects Day and Michelson for the San Francisco Public Utilities Commission with sponsorship from the federal Public Works Administration. I discuss the history of the round temple form, its significance in the realm of historical revivalism, and its formal and conceptual transformations in California waterworks and hydropower history, for San Francisco and the greater San Francisco Bay Area region. Always keeping the controlling idea and image of the water temple in mind, I conduct a visual analysis of major waterworks buildings and engineering structures in the remote watershed well as in local urban landscape settings of the San Francisco Bay-Delta region of north-central California. In both Parts 2 and 3, I discuss a trend of reliance on architects to design aesthetically-sound waterworks.

Part 4 is a dam case study as a way to examine my precept of deep cultural ambivalence in American culture toward aesthetics. My vehicle for this discussion is an examination of ways in which aesthetic features of two dams were altered by heavy buttressing in the wake of a 1928 catastrophic dam failure on the Los Angeles Aqueduct. First, the Mulholland Dam in the Hollywood Hills was backfilled from base to crown with earth, then terraced and planted with a forest of trees to hide it from view. Second, the face of the multiple-arch Lake Hodges Dam on the San Diego watershed was retrofitted with a series dam-height concrete panels between the dam's arches. In both cases, changes were ostensibly made to buttress dams whose stability was questioned. My analysis of primary evidence suggests that, in both cases, the motivation for this retroactive buttressing was not made on technically-sound criteria, but on subjective judgements in response to beliefs about aesthetic features unrelated to structural performance. I questions changes made to the dams' appearance in the name of structural safety. This analysis raises historical questions of relationships between aesthetic form and cultural values.

My art historical methods are iconological, literary, and semiotic. I rely on close, formal analysis. I interpret visual themes in ornamentation and iconography as symbols or signs whose "meanings" allude to images in past images in language, literature, art, and architecture. While formal analysis *per se* seeks similarity in order to ascribe images to cultural traditions and artistic or architectural styles, my theoretical approach is poststructuralist in its desire to tease out difference. For this reason I like the epigraphic quotation from Richard Helgerson, that "at the root of all representation is differentiation."[73] When analyzing iconography or symbolism, it is far too easy to group signs by likeness, when it is precisely the uniqueness of a sign that singles it out for analysis. Perhaps that is why a poststructuralist would ask if there is any point in

[73] Richard Helgerson, *Forms of Nationhood: The Elizabethan Writing of England* (Chicago, IL: University of Chicago Press, 1992), quoted in Richard L. Kagan, *Urban Images of the Hispanic World, 1493- 1793* (New Haven, CT: Yale University Press, 2000), 107.

ascribing underlying meaning at all. This is valuable in so far as a poststructuralist art historical analysis commits to doubt as a way not to perpetuate false or redundant readings. For, contrary to popular belief, reinventing the wheel is impossible, and history never repeats itself.

PART 2

AMERICAN WATERWORKS ARCHITECTURE, 1800 - 1880

In the history of American public architecture structures of a utilitarian nature have generally been overlooked. Buildings of a commercial or residential type usually are chosen to illustrate technical advances and representations of style. Occasionally, an industrial building is cited as an exception to the rule…. Not that they are unimportant; they simply do not fit as well as other building types into what is traditionally classified as architecture. They represent feats of engineering, not examples of design. That such structures did receive the attention of some outstanding American architects should not be forgotten.

--John S. Garner, "Tanks and Towers: Waterworks in America," in *American Public Architecture: European Roots and Native Expressions* (1989)[74]

[74] John S. Garner, "Tanks and Towers: Waterworks in America," in *American Public Architecture: European Roots and Native Expressions,* eds. Craig Robert Zabel and Susan Scott Munshower (University Park, PA: Pennsylvania State University Press, 1989), 206-27.

A Brief Prologue: Aesthetic Ambivalence

Whether John Garner's late-20th-century assessment of American waterworks architecture history in the epigraphic quote above is right or wrong, the architectural historian reveals he is at odds with himself. In his first sentence, he makes a statement of historical neglect, and as such, he implies the question "Why?" This statement is one of the premises of this dissertation: in the main, historians have ignored utilitarian waterworks structures. He follows by situating the problem, as he sees it: domestic and commercial (including corporate) architecture has historically garnered more interest than industrial architecture, and the stylistic terms that apply to the more popular building types have determined the language of architectural analysis in general. It follows, he observes, that industrial or utilitarian architecture has only occasionally entered the discourse, and then "as an exception" to the "rule" of accepted architectural analysis. Utilitarian structures in the main continue to hover within a void charged with ambivalence regarding the relationship of engineering design to architectural design. Modernism's insistence on the tectonic (structure as form) has resolved the difficulty of categorizing works of civil engineering to a certain extent, primarily for those types of works whose structural body is not *underlying*, but patently *visible*—what in today's parlance one might call "transparent." Such structures (bridges are easiest to visualize and classify in this way) *are* structure, pure and simple: they have no outer skin that needs an architect to design or to ornament in a certain style. Perhaps this is the crux for Garner when he differentiates "feats of engineering" from "examples of design." Parsed, the sentence reveals self-contradiction, for any work of civil engineering worth analyzing from an art historical point of view is not just an example, but indeed a feat, of design. Engineering structures are feats of design.

In stating at the outset that historians have overlooked waterworks structures, Garner leaves himself open to provide a corrective, but instead, by the end of this excerpt, he muddies the problem in ways he seems not to realize. In his last sentence, he expands the focus of historical need not just to the buildings, but also to the architects whose attention they received, as he puts it. I take his point: this dissertation acknowledges the condition that architects' contributions to waterworks design *should not be forgotten*, and in this dissertation I begin the process of reactivating that historical memory. "Should not" hides a more direct and true statement: America's history of architect-designed waterworks buildings has been forgotten. Garner's way of stating the problem—conditional, contrary-to-fact, in the passive voice—quietly indicts. But whom does it finger? To judge from my discovery of a near-total lack of historical study of architects' contributions to major works of urban waterworks architectural design, one looks to historians, but then historians look to the buildings, shrug their shoulders, repeat Garner's wish-statement, and the argument becomes circular. Why is this so? As I will discuss, domestic and corporate (and I must add civic) architectural traditions in the United States, parallel with developments in democracy and capitalism, depend upon overstated visual statements of distinction. With this in mind, I will unravel selective pieces of the forgotten history of waterworks design aesthetics for the United States in Part 2, and will make my revelations for California in Part 3. I will show that such structures did not simply "receive the attention" of outstanding architects. Garner's light-handed and passive claim masks a truer situation. Architects assertively led, innovated, and guided architectural development for American urban waterworks architecture, and the achievements of those earlier architects related to the shape of waterworks design as it developed in California and the American West. Garner's enigmatic and highly qualified closing wish-statement, that architect-designed industrial and utilitarian works of engineering "should not be forgotten," also reveals a hidden shame in historical neglect.

My response to Garner's problem statement does not offer a panacea to the real discomfort underlying discoveries of (and attempts to redress) historical omissions. The utterance Garner's language avoids is couched in unclear language because it is an evasive concept. What he means to say is this: endemic cultural ambivalence insists on an enduring aesthetic standoff between design in engineering and design in architecture. This is a large cultural and historiographic problem of modernism and of art history. It will benefit from ongoing historical work and emerging approaches. I can only begin to suggest a start at remediation with my specific art historical analysis in this dissertation.

CHAPTER 2

Architect-Engineers and the American Greek-Revival Water Temple: Philadelphia as Template, Louisville as Companion

GREEK REVIVAL ORIGINS FOR AMERICAN WATERWORKS IN PHILADELPHIA

An art-historical study of American waterworks and the architects who designed them must begin with the nation's first modern urban waterworks system in Philadelphia. From 1801 to 1875, Philadelphia's waterworks were renowned, as technological spectacle, urban park centerpiece, and sophisticated waterworks architecture. The city's first waterworks, the 1801 Center Square Water Works, by architect Benjamin Latrobe (1764-1820), was a round Greek Revival temple: a white marble drum with a clerestory beneath a saucer dome rising from the center of a square base, with a colonnaded porch on each face. It stood in the very geographical center of Philadelphia's 17th-century William Penn Plan. After 1805, Latrobe's prominence led to his selection as Architect of the Capitol and secured his signature Greek Revival as a national style, and he left Philadelphia, but his initial mark was secure. **[Figures 7, 8, 15]** In 1811, when the Center Square works became technologically obsolete, the elegant building continued in use as a storage reservoir, while the city's waterworks moved to a new facility, the Fairmount Waterworks, on the banks of the Schuylkill River about a mile from town. The new works assumed the workhorse functions even as the retired temple remained the cultural centerpiece of Center Square Park. In the ensuing six decades, the new waterworks at Fairmount were expanded, renovated, and updated. Finally complete in 1872, the whole presented a sophisticated villa-style Greek Revival complex featuring a central peripteral temple with pavilions flanking the structure's endcaps. **[Figures 9, 10, 27, 29, 31, 32]**

Through its seven decades, the riverside Fairmount Waterworks retained premium cultural value in engineering and aesthetics (in both architecture and landscape), setting a national standard for modern urbanism: "Philadelphia pioneered in building America's first municipal waterworks and thus operated…an experimental water supply project for all other large cities in the nation."[75] Decades passed before other major American cities followed Philadelphia's remarkable 1801, 1811, and 1812 debuts. The first city to do so, New Orleans, opened its first modern waterworks in 1821. This waterworks temple was also designed by Benjamin Latrobe (now the National Architect) and featured an octagonal, Greek Revival central pump house, essentially a copy of the Philadelphia's Center Square Water Works temple; New Orleans expanded with a second updated system in 1840.[76] Not until 1842 did New York City open its long-distance Croton Aqueduct, with Roman Revival and Egyptian Revival architectural styles for its most prominent architectural features. In 1844**,** modern Cincinnati waterworks began operating; Boston completed its Cochituate Waterworks in 1850[77]; and Cleveland built modern works at mid-century—all three of these in Gothic Revival style. A Romanesque

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[75] I do not discuss in this dissertation reasons for Philadelphia's—or any other city's—timing or rationale for, or the decision-making processes involved in, initial development of an urban water supply. Interested readers might consider investigating the following topics outside the purview of this study. Yellow fever epidemics in 1793 and 1798, and again in 1802, 1803, and 1805, heightened urgency to maintain an uncontaminated water supply and to clean the streets. And, as in all U.S. cities, fire prevention became a major motivation for waterworks. From a sociopolitical point of view, "the success of Philadelphia's water program stands as a tribute to its old merchant-led committee system of government. Indeed, in the beginning, its success was as much a product of an aggressive committee as it was the result of sponsorship by the municipal corporation….Municipal water supplies were established in Philadelphia in 1801, in New York in 1842, Boston in 1848, Baltimore, a small private system in 1808, expanded in 1838, and a full public system in 1857." See Sam Bass Warner, *The Private City: Philadelphia in Three Periods of Its Growth* (Philadelphia: University of Pennsylvania Press, 1968), 102. From the perspective of the economic feasibility of domestic water use, Warner reports that "The original Latrobe scheme for financing the works was based on the assumption that many families would want direct water connections to their houses and that these private subscriptions would carry the cost of building and operating the system…. By 1811 only 2,127 Philadelphians subscribed for water. Most of the city's 54,000 residents (city proper in 1810) depended for water on street hydrants or private wells. There were only two bath houses in the entire city. As for home bathrooms, American inventors did not turn their attention to sanitary appliances until the 1830s. Thus over the first three decades of operation the watering committee struggled against heavy deficits while continuing to supply its product at a loss in advance of popular usage, for public health reasons…. [But by 1837] the number of paying customers had jumped to 20,000. The system as a whole—street hydrants, house and commercial connections—served a total population of 196,000 [and] 1,500 Philadelphians had installed bathrooms with running water. That critical moment in the history of any social innovation, the time when a fashion of the rich becomes an imperative for the middle class, seemed to have arrived." See Warner, *Private* City, 105.

[76] Gary A. Donaldson, "Bringing Water to the Crescent City: Benjamin Latrobe and the New Orleans Waterworks System," in *Water-Supply and Public Health Engineering*, vol. 5 in *Studies in the History of Civil Engineering,* ed. Denis Fischbacher-Smith, (Aldershoot, Great Britain: Ashgate, 1999), 208-10.

[77] Nathaniel J. Bradlee, *History of the Introduction of Pure Water into the City of Boston, with a Description of Its Cochituate Waterworks Illustrated by Maps and Plans* (Boston: Alfred Mudge & Sons, 1868), pref.

pump house for the city of Chicago went up at mid-century, added a stone tower in 1869, and was the sole survivor of Chicago's Great Fire of 1871. Louisville, Kentucky, opened its sophisticated Greek Revival waterworks complex in 1860; in 1889, tornado and flood destroyed it, but it was rebuilt in replica in 1893 alongside a new brick structure on an adjacent site.[78] Of these major city waterworks, Philadelphia's easily stands out as "the most renowned American public works construction of the 19th century," a central, modern, technological and cultural landmark.[79]

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[78] George Yater, *The Water Works: A History of the Louisville Water Company* (Louisville: Louisville Water Company, 1996), 6-15.

[79] For the quoted segment, see Donald C. Jackson, "'The Fairmount Water Works, 1812-1911,' at the Philadelphia Museum of Art," *Technology and Culture* 30, No. 3 (July 1989): 635. The nation's first waterworks and supply system is generally considered to be the Bethlehem Waterworks in Pennsylvania (National Register No. 72001142), a single two-story stone structure housing a pumping system, built between 1754 and 1762. **[Figure 11]** "The first pumped water supply in America was completed in 1755 for the tiny Moravian community established at Bethlehem, Pennsylvania. Built by Danish millwright Hans Christopher Christiansen, the ingenious system featured an undershot wooden waterwheel, iron crankshaft, and three water-powered forcing pumps. The system sucked spring water through a lead and wood pipe to a water tower 320 feet away and ninety feet high, then distributed it by gravity to four cisterns. …The work survived into the 1830s…. Providence, Rhode Island, was the only other colonial town with a piped water supply. In 1772, two private companies brought water by gravity through wooden pipes from springs a mile distant, but these efforts in a town of barely four thousand people were short-lived." See Gerard T. Koeppel, *Water for Gotham: A History* (Princeton, NJ: Princeton University Press, 2000), 40. Koeppel specifically cites Nelson Manfred Blake, *Water for the Cities: A History of the Urban Water Supply Problem in the United States* (Syracuse, NY: Syracuse University Press, 1956), 15-16. As the previous quote attests, earlier forms of water conveyance existed, but the Bethlehem plant receives billing as the nation's first, owing to its municipal sponsorship and its innovative hydraulic pumping works. See an abbreviated history of the Bethlehem works at "Old Waterworks," U.S. Department of the Interior, National Park Service, accessed February 19, 2015, www.nps.gov/history/nr/travel/delaware/wat.htm. Architecturally, the building is "a 2 1/2-story native limestone rubble structure that measures 24 feet square and features a red-tile-covered bellcast-hipped-gable roof" with a red brick chimney. It housed a waterwheel mechanism and three cast-iron pumps that lifted water 94 vertical feet along a 320-foot-long pipeline. This hydraulic capacity is noteworthy, as 19th-century hydraulic systems had a general pumping capacity of about 50 vertical feet, and the Bethlehem plant is the first to include a water-lifting mechanism. Quotes come from the building's 1977 "National Register of Historic Places--Inventory Nomination Form," U.S. Department of the Interior, National Park Service, accessed February 19, 2015, pdfhost.focus.nps.gov/docs/NHLS/Text/72001142.pdf. To place the city of Philadelphia in context regarding its urban importance, note that at this time it was the second-largest city behind New York. Since the first U.S. Census of 1790, New York has always been the nation's largest city. In 1790, New York's population was 33,131 and Philadelphia's 28,522; in 1800, New York had 60,515, inhabitants, compared with Philadelphia's 41,220. Philadelphia was the second-largest city for almost a hundred years, from 1790 to 1880, except for a period of three decades between 1820 and 1840, when its relative population changes made it oscillate between the third and fourth ranks. As I discuss in this dissertation, New York did not have a comprehensive city water supply system until the Croton aqueduct opened in 1842.

Period images of Philadelphia's respective waterworks in their park settings ground an American waterworks iconography. **[Figures 7, 8, 10, 29, 33, 55]** In 1988, the Philadelphia Museum of Art mounted an exhibition on the Fairmount Waterworks to illustrate the extent of Philadelphia waterworks history and its broad cultural impact. The exhibition displayed dozens of 19th-century works of decorative, fine, and popular art—engravings, drawings, paintings, sculpture, print ephemera, painted porcelain and pottery, panoramic Daguerreotypes and stereographs—which glorified the waterworks buildings and their garden settings, focusing on a century of cultural importance. The exhibition catalogue describes the Fairmount waterworks and its surrounding park as a major cultural symbol, one that "occupies a unique position in the iconography of nineteenth-century Philadelphia."[80] This collection of images successfully cohered to identify this specific waterworks building as a sign. It signaled a type of valued cultural space, a space specifically designed in form and function to signal the control of water's movement, and to glorify that control. The Philadelphia exhibit—as represented by its printed catalogue—succeeded in substantiating the idea that a waterworks structure signifies certain special values regarding water, its movement, and its use, especially as these accompanied the initial development of water infrastructure as part and parcel of 19th-century modern American urbanization.

The Philadelphia system and the park that developed around these Fairmount Waterworks provided a successful model exhibiting a sophisticated set of iconographical elements. The architecture and the garden setting functioned as a precursor for every major American city's waterworks design, technologically and architecturally. By 1927, architectural historian Harold Eberlein had placed the whole of Philadelphia's waterworks buildings within a historical perspective that underscores these works as leading components of a national architecture.

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80 See the 1988 catalogue text, illustrations, and exhibition checklist of nearly 140 objects from the Philadelphia Museum of Art's exhibition on the history of the Fairmount Waterworks: Jane Mork Gibson and Robert Wolterstorff, "The Fairmount Waterworks," *Philadelphia Museum of Art Bulletin* 84, no. 360/361 (Summer 1988): 7. See also Jackson, "*The Fairmount Water Works*, 635-39, and Eleanor A. Maass, "A Public Watchdog: Thomas Pym Cope and the Philadelphia Waterworks," *Proceedings of the American Philosophical Society* 125, no. 2 (Apr. 30, 1981): 134-54.

> Whatever may be one's preferences or sympathies in the matter of style, the Graeco-Roman or Regency is of considerable historic import because it was this manner of building of which Latrobe and his pupils, Robert Mills, Strickland, Graff and others, were such capable exponents. It was a style that still retained the human warmth as well as the suave Classical polish of the eighteenth century, in contrast to the archaeological frigidity and desiccated exactitudes of the Neo-Grec manner that was soon to overwhelm it and fill the land with temple-fronted houses. The arch and the lighter amenities had not yet been banished before the advancing hosts of the orders. The Graeco-Roman spirit, gracefully interpreted as it was by Latrobe and his contemporaries, profoundly affected the trend of public architecture for the first three decades of the nineteenth century, for Latrobe may justly be counted the father of monumental architecture in America.[81]

An idea emerges: the waterworks temple is among a small group of primary early-19th-century American buildings that give substantial expression to a new national style of monumental, civic-minded, waterworks architecture.

BENJAMIN LATROBE'S ROUND TEMPLE: CENTER SQUARE WATER WORKS (1801)

Philadelphia's waterworks system is most remarkable to this study from the standpoint of design and style, though it was justly lauded for its engineering and technological advancement as well. In Eberlein's terms, the city's three respective structures "afford a distinguished example of early American civil architecture and admirably represent that type of expression that marked the beginning of the nineteenth century…."[82] The originating centerpiece in the system, Latrobe's 1801 Greek Revival Center Square Water Works temple, pumped, stored, and distributed water from the Schuylkill River through a mile of wooden pipes to residences and pumps to Philadelphia's center. **[Figures 7, 8, 12, 15]** As with others of his revolutionary architectural designs, the engineer-architect "abandoned the simple, typically American

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[81] Harold Donaldson Eberlein, "The Fairmount Waterworks, Philadelphia," *The Architectural Record* 62 (July 1927): 57, 64.

[82] Eberlein, "Fairmount Waterworks," 57.

… model in favor of a much more architecturally sophisticated scheme with an entirely different lineage."[83]

The Center Square Water Works was the first example of a Greek Revival temple design for a water structure, and the first for which the aesthetics of design and setting were considered to have importance in conjunction with new technologies defining the building's utilitarian functions: Construction began in 1799, and the works opened in 1801, "the first truly modern system," with the nation's first successful steam pumps, elevated water storage tanks, and extensive pipeline distribution system.[84]

> The waterworks were not only to be the latest in steam technology, they were to be aesthetically pleasing as well. Latrobe's plan called for a new-classic structure at Center Square to house the engines; a park with fountains, and a promenade were to add to its elegance.[85]

The structure's prominent site was a centerpiece of Philadelphia's town square—it was literally the center point in the William Penn Plan—and, to judge by period prints, it was landscaped and served as a public park. Historian Koeppel remarks that "the triumph of the building's design was its external harmony with the parkland setting, which gave no indication of its internal, throbbing, industrial function: boiler, steam engine, pump and

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[83] Michael W. Fazio, "Benjamin Latrobe's Design for a Lighthouse at the Mouth of the Mississippi River," *The Journal of the Society of Architectural Historians* 48, no. 3 (September 1989): 232-47, esp. 236. Fazio's comment quoted here refers specifically to the development of Latrobe's designs for a New Orleans lighthouse, but it applies to Latrobe's work generally, and certainly to his waterworks design for Philadelphia.

[84] John S. Garner, "Tanks and Towers: Waterworks in America," in *American Public Architecture: European Roots and Native Expressions,* eds. Craig Robert Zabel and Susan Scott Munshower (University Park, PA: Pennsylvania State University, 1989), 208. According to Garner, the 1801 Philadelphia pipeline system consisted of six miles of wooden pipes, which were replaced with cast iron pipes in 1818. Warner qualifies this assessment: "The changeover to cast iron pipe went slowly." See Warner, *Private City,* 105 n. 9. Scharf and Westcott claim replacement did not begin until 1818 and that in 1822 there were still thirty-two miles of wooden pipe in the city. See *History of Philadelphia, 1609-1881* (Philadelphia: L.H. Everts & Co., 1884), 605. In "The Fairmount Waterworks," Gibson and Wolterstorff report that "by 1832 there were over thirty-two miles of spruce and yellow pine pipes supplying about 3,500 houses and businesses, along with 'upwards of 300 cistern pumps placed in the streets for public use'" (15, quoting Frederick Graff to Joseph Lewis, December 22, 1817, Watering Committee Archives, City Hall Annex, Philadelphia, PA).

[85] Maass, "Public Watchdog," 136.

water tanks were jammed inside its walls, along with the offices of the engineer and city water officials."[86] **[Figure 12]**

Koeppel lauds the exterior form for its *disguise* of the interior works function. His observation points to a historical dichotomy between form and function in public works design, an idea central to this study. The historian's comment does triple-duty as it reveals ingrained cultural values regarding relationships not only between form and function, but also between architecture and landscape, in public architecture. First, the "external harmony" Koeppel perceives in the arrangement of neoclassical temple within a "parkland setting" conjoins with 18th and 19th century values that define Romanticism's pastoral mode. Here, the modern viewer's satisfaction within a 'familiar landscape' of an ancient 'ruin' in a 'natural' or 'wilderness' setting is grounded in an acculturated nostalgia for an imagined golden age in antiquity for which one imagines a longed-for return. The "triumph" of this pastoral romanticism signals a 19th-century belief in artistic and cultural superiority indicated by identification with a perceived cultural dominance of western civilization, initiated in classical antiquity. Romanticism's historical revival of a Roman—more accurately, a Greco-Roman—aesthetic requires preeminence of neoclassical ornamental aspects (to include the basic outer shape of the building), the sole indicator of prestige. Building form, in plan and elevation, and in surface ornamentation, must "give no indication" of the contents or purpose of the building, particularly if the building is utilitarian in its primary function. By way of the supremacy of an accepted program of neoclassical ornamentation, the building becomes a sign. As a sign, it signifies values of romanticism, that is, a modern historical revival of Greco-Roman architectural ideals and of idealized material and cultural accomplishments of classical antiquity. These are in a generalized form fashioned from architectural and

[86] Koeppel, *Water for Gotham,* 105. For many historical revival waterworks examples, one faces this problem of a mismatch between form and function, since the architecture generally disguises the utilitarian function of the structure, fashioning it into a temple, even when the public knew full well the industrial function of the building. One apparent aim of a historical revival design for waterworks is to function visually as a building that houses or advances a humanistic—that is, a cultural—function as much as a technological one. It houses, displays, and celebrates water and the machinery that processes it. The effect of this architecture is transformative: it creates a water temple, a sacred cultural type of architecture that sanctifies water and the technology of its movement and use.

iconographical borrowings from an idealized ancient classical world—signified by the simple brevity of temple proportions, where relationships of circle, column, and lintel signal structural perfection and beauty. Since what the water temple signifies is also a sign—of a civilization Americans glorified and wished to emulate—the modern water temple is a sign of a sign. It no longer makes a direct reference to an originating idea, but glorifies and cross-references itself in an American-born form that marries aesthetics and technology. In the romantic vernacular of the time, this defined a revival of Roman cultural ingenuity—in art, architecture, engineering technology, building, government, religion, philosophy, civic order. The problem inherent in Koeppel's assertion of the building's contemporary value is the robust emphasis he places on the industrial core he insists the classical and pastoral aesthetic seemed intent upon hiding. In spite of the idea that the building's stylistic form worked visually to "give no indication" of its industrial purpose, it in fact in real time and space gave *every* indication of its industrial contents, in the experience of the building, its actual, working presence. Judging from the way in which working machinery was crammed into the above-ground central drum, the noise of the machinery must have been deafening, and period prints illustrating plumes of black belching from the oculus in the dome, make evident the acrid smell of the industrial processes within.

It was a turn-of-the-century building, designed and built between 1799 and 1804. Leo Marx points out that in the last quarter of the 18th century, "the very notion of 'technology' as an agent of change scarcely existed….Although many features of what we now call industrialism already were visible, neither the word nor the concept of a totally new way of life was available. Today our view of history is so deeply colored by an appreciation, if not awe, of technology as an agent of change that it is not easy to imagine" a time when the large-scale implications for the future of machine technology was hardly a notion.[87] The 1801 Philadelphia water temple is in fact an example of a work that "constitutes mediation between ideal and reality" from within Marx's thesis of

[87] Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), 149-50, 155.

"the machine in the garden." That is, architect Latrobe and engineer Frederick Graff may indeed have created a relief from machinery's puncture of the pastoral ideal, in *not being able to* obscure the industrial nature of the building. The seeming forced entry of industrial machine processes into established *mores* accompanying an agrarian pastoral landscape ideal created a set of contradictory terms. Marx contends that only *artists* initially were able to address this contradiction, in representations depicting "machine technology [as] a proper part of the landscape."[88] Marx's examples come primarily from literature and landscape painting; I propose Latrobe's Center Square Water Works offers an instance from architecture. Indeed, the Center Square itself—the central garden park in the geographical center of Philadelphia's historic downtown grid—constitutes an integrated landscape. This integrated landscape takes the form of a structure that houses the advanced machine technology of the waterworks within an idealized temple, *centered* on the center of the historic town grid in the economic urban center of the nation. This must have been proposed, seen, and accepted as a proper aspect of a modern urban pastoral landscape, in deeper ways than we may today be able to imagine. It precedes by some time the concept embedded in Philadelphia's own Fairmount Park, and in later urban parks like Olmsted's Central Park or Boston Fens, of the large-scale pastoral garden. The Center Square privileged a landscape ideal, part "beautiful," with its symmetrical temple centered on a town grid, and part "pastoral," surrounded as it was by a garden made to look rural rather than urban. To revise Koeppel's exultant praise that the building gives "no indication of its internal, throbbing, industrial function," I rather propose that the building *simultaneously contains and exhibits* its industrial works, integrating industrial and pastoral ideals for urban America in perhaps the only form possible for the period. Indeed, no visitor would miss the belching smokestack or block out the noise of the interior works. Leo Marx reminds readers, "a garden is a miniature middle landscape. It is a place as attractive for what it excludes as for what it contains."[89] For the complex task in this period, then, the city called in the lauded engineer-architect

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[88] Marx, *Machine in the Garden*, 226.
[89] Marx, *Machine in the Garden*, 138.

Latrobe from England, known expert not only in contemporary forms of classical revival design, for which he would gain status as the virtual inventor of an American architectural style, but also in waterworks engineering, as I will discuss.

Leo Marx's analysis reminds current-day readers of two important contexts for the evaluation of the "machine in the garden" situation. First, Marx points out the chasm of difference between ideas of machine technology in our current age and in post-Revolutionary 18th century, when Latrobe designed the Center Square Water Works. Second, he emphasizes the American drive to develop a "native" economy, divorced from Europe's influence and freed from subservience to it. Both of these combined into a common internal conflict, as Marx makes clear: "although machine production was becoming an accepted fact of life in England" (where Latrobe received training and experience in architecture and waterworks engineering), "it was little more than an idea in America."[90] On both points of this conflict, Marx points to earlier, late-18th-century writings of Tench Coxe, Secretary of the Treasury for President Andrew Hamilton, who was part of "a small but influential group of 'friends of American manufactures' who made up the new Philadelphia society," and one of the first thinkers to write insightfully about the promising implications of machine technology for the American economy. On the promise of machine manufacturing, Coxe presents a new and controversial topic fraught with popular doubt.

> …[C]ombinations of machines with fire and water have already accomplished much more than was formerly expected from them by the most visionary enthusiast on the subject. Perhaps I may be too sanguine, but they appear to me fraught with immense advantages to us, and not a little dangerous to the manufacturing nations of Europe; for should they continue to use and improve them, as they have heretofore done, their people may be driven to us for want of employment, and if, on the other hand, they should return to manual labour, we may underwork them by these invaluable machines.[91]

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90 Marx, *Machine in the Garden*, 155.

91 Marx, *Machine in the Garden,* 150-69, esp. 154-55, and 376 n. 4-8. Marx cites Tench Coxe, *A View of the United States, in a Series of Papers Written at Various Times Between the Years 1787 and 1794* (Philadelphia, William Hall, 1794), 1-56. Alexander Hamilton and Coxe had done a survey of the state of American manufactures in 1790, in preparation for their "Report on the Subject of Manufactures." This followed upon many important publications that helped to form 18th and 19th century cultural ideas about the role of "manufactures" to the future of American economy, labor, and trade. Leo Marx argues that from

The arrangement of "invaluable machines" carefully packed into the cylindrical space Latrobe designed for Philadelphia's first modern waterworks temple matched the novelty, and even the artistic promise, of its architectural style.

The Center Square Water Works temple was square in plan, with the central, domed, cylindrical body rising up through the base structure. **[Figure 12]** It featured two porches on opposite sides of the building, one centered on each of the east and west elevations. These shallow porticos opened between two Greek Doric columns on a raised platform.[92] The symmetrical plan centered upon the cylindrical engine room, and was anchored by four corner offices; five evenly spaced windows lined the north and south sides of the building.[93] Above the square office block, the drum divided visually into three stacked, horizontal bands: the base smooth-faced and unadorned; the middle third crowned by a clerestory of a dozen small rectangles; and the top third, like an attic storey, punctuated by a series of small rectangular niches centered above the clerestory ring. Topping all was an oculus with a masonry rim, the outlet for a smokestack hidden below the dome within the drum.

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the time of the Revolutionary War to about the time of the President's 1890 survey, "all reliable opinion supported [the view that] industry, as compared with agriculture, would be of trivial significance. …In *The Wealth of Nations* (1776), the work of political economy to which the age deferred beyond all others, Adam Smith had warned Americans that it would be folly to direct capital into manufactures. Everyone repeated his sensible argument. During the war, especially, the British delighted in reminding their difficult cousins that, even if they won political independence, they could count upon protracted economic subservience" (146-50). Marx also cites the widely-read *Observations on the Commerce of the American States* (London, 1783) by John Baker Holroyd, Earl of Sheffield, as a period source underscoring the prevailing notion on both sides of the Atlantic that "there was no danger of provoking serious competition from America."

92 See Leland M. Roth, *American Architecture: A History* (Boulder, CO: University of Colorado Press, 2001), 125-26. Roth discusses Philadelphia buildings as the first to use Doric columns in the U.S., and a print image of the Center Square Water Works appears in Roth on 125.

93 Several of Latrobe's drawings of the Center Square Water Works building label use of spaces. On the ground floor, for example, the columned porches are labeled "porticos;" one side, comprising three offices, were "water offices of the city;" the two remaining corner rooms were the "engine keeper's apartments;" the remaining portico-shaped room contained the stairway down into the foundation level. Lower level rooms around the cylindrical engine room were used for utilitarian purposes, as a coal cellar, for example. See Darwin H. Stapleton, ed., *The Engineering Drawings of Benjamin Henry Latrobe* (New Haven: Yale University Press for the Maryland Historical Society, 1980), 174-78, esp. 178, fig. 41.

The central cylinder was jammed with machinery.[94] Steam engine, pump, boilers, and flywheel worked within the compact space to lift water from its subterranean supply pipeline up into storage tanks, placed just beneath the saucer dome, elevated to provide the drop needed to create pressure for distribution through town. These were the first elevated water storage tanks in the U.S., preceding by more than fifty years a general trend of elevated water for storage and distribution.[95]

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[94] Several historians' accounts differ considerably regarding interior elements of the Center Square Water Works building. Garner and Roth offer what appear to be conflicting descriptions of the mechanisms and their arrangements inside the cylindrical engine room in the structure's drum. Section, elevation, and plan drawings by Frederick Graff (c. 1828), made just before the building was demolished in 1829, show the center cylinder containing the pumping mechanisms and boiler in the area of the interior that rises to the level of the moulding bands around the drum, visible above the clerestory. That slender moulding also serves as an exterior marker of the position of the floor of the interior space directly beneath the saucer dome, in which Graff depicts two cylindrical wooden reservoir tanks of different sizes, but of equal heights, sitting side-by-side. By contrast, Roth describes an "annular-shaped" or "doughnut-shaped" water tank within the upper part of the drum through the center of which rose "a flue for engine smoke." Engravings of the Center Square structure from 1901, published in Garner, "Tanks and Towers," 201, fig. 8-2, and in Roth, *American Architecture,* 125, fig. 4.29, as well as other period images of the waterworks structure, depict smoke issuing from the dome's oculus. Yet the number, shape and arrangement of the water tanks in the Graff drawing (two cylindrical tanks side-by-side and off-center in the space) are at odds with Roth's description (one annular-shaped tank filling the center of the space). Roth refers readers to Latrobe's Center Square drawings in Stapleton, ed., *Engineering Drawings,* as a general reference. He does not, however, indicate where one might find the specific sources that substantiate his claims regarding the arrangement and nature of the waterworks mechanisms in the rotunda space.

[95] "Water tanks, or elevated tanks, did not appear in number until after 1870, despite Latrobe's early design." See Roth, *American Architecture*, 125-26, fig. 4.29, caption. Garner cites a Philadelphia water department report published in 1860 that says the elevated tanks inside the Center Square Water Works were the first in America. See Garner, "Tanks and Towers," 208-09, 212 n. 9, 215-16. Different historians' accounts differ considerably regarding the elevated tanks. In "Public Watchdog," author Eleanor Maass reproduces a drawing by Frederic Graff, Jr., the son of the elder Frederic Graff who had worked as Latrobe's assistant and succeeded him in 1804; Graff, Sr.'s son took his father's job upon the elder's death in 1848. The younger Graff's drawing reveals an arrangement of two coopered tanks of different sizes set together off-center in the top third of the dome, and not an annular-shaped reservoir tank. The younger Graff's drawing also reveals clearly that a cast-iron flue allows smoke to exit through the opening in the oculus; the flue does not issue straight up through center, as Roth has claimed, but runs along the inside wall from the first-floor boilers and then curves up inside the dome alongside the two water tanks, where the flue again takes an angular turn in order to orient vertically to allow smoke to exit from the center of the dome. See Maass, 145, fig. 5. In Costen Fitz-Gibbon, "Latrobe and the Center Square Pump House," *Architectural Record* (July 1927): 18-22, two Latrobe drawings of the Center Square waterworks appear, "taken from a portfolio which Latrobe prepared for his son as a record of some of the work he had done….They are not the drawings used at the time the pump house was built, but as they are from Latrobe's own hand and made by him expressly for record purposes there can be no question of their correctness" (19). Latrobe's section drawing reveals what appear to be two rectangular-shaped tanks of equal sizes set against opposing walls under the lip of the saucer dome. In hand-written notes, Latrobe identifies these two tanks, both marked with the letter "a" on the section diagram, as "Elevated Reservoir." One could interpret this section drawing as depicting the cross-section of a "doughnut-shaped tank,"

Latrobe's supply pipeline pulled water from the Schuylkill River, a mile from Center Square at the foot of Chestnut Street. Pumped by steam directly from the river into a vaulted brick tunnel, water moved up a vertical shaft into a small Schuylkill Engine House, the first of two pump houses. **[Figures 13, 14]** The supply flowed by gravity from there through a mile-long wooden conduit beneath Chestnut Street to the town square at Market and Broad Streets, entered the Center Square Water Works building underground. Steam power ran the pumps that raised water into the reservoirs tucked under the dome. From there, gravity distribution conveyed water through six miles of bored-log pipeline to public pumps and hydrants.[96]

Philadelphia's Watering Committee adopted Latrobe's proposal for the waterworks temple on March 2, 1799.[97] His engineering and design drawings make clear

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particularly since Latrobe refers to the two halves or two parts of the "reservoir" with one letter and in the singular. But neither Latrobe's section nor the plan reproduced in Fitz-Gibbon appears to indicate a central vertical flue, even though there is room for one in the section drawing. In *The Engineering Drawings of Benjamin Henry Latrobe,* Stapleton publishes several of Latrobe's plans for the Center Square Water Works building, including a color rendering from March, 1799 ("Latrobe probably displayed this drawing at the 2 March 1799 meeting of the Philadelphia city councils when his plan for the waterworks was adopted," 173), which indicate that the architect planned for two rectilinear marble reservoirs, but that when the Center Square structure was built, "the reservoirs in the dome were wood rather than marble" (173). Stapleton reports that "Latrobe wanted to have a ring-shaped marble reservoir encircling the inside of the dome, but the Watering Committee decided to erect wooden reservoirs instead. They first put up a small tank originally meant to be a supply cistern for the Schuylkill engine boilers, and they did not replace it until 1807 or 1808 when two reservoirs of cedar plank were installed. Frederick Graff, superintendent of the waterworks, designed the reservoirs." In 1807 the Watering Committee reported on the decision to erect two reservoirs rather than the three that Graff's plan called for, because a third would block needed light from the clerestory windows to the intricate machinery below (193-195).

96 When first completed the wood pipeline system fed 42 public hydrants; 32 private residents subscribed to household water in 1801. For a descriptive history and drawings of Philadelphia's original distribution elements, including wooden pipes, stopcock valves, fireplugs, and two styles of hydrants, one opened by a cock and an improved design operated by a pump handle, see Stapleton, ed., *Engineering Drawings,* 196-98. See also 199-200, for Latrobe's images of public pumps in Philadelphia, sketched upon drawings for an 1811 New Orleans waterworks design.

97 For more background on Benjamin Latrobe, whose work I survey briefly here primarily in relation to the Philadelphia waterworks structures, and in relation to his importance to Greek Revival architecture in the U.S., consult Talbot Hamlin, *Benjamin Henry Latrobe* (New York: Oxford University Press, 1955). For Latrobe's architecture, see Jeffrey A. Cohen and Charles E. Brownell, *The Architectural Drawings of Benjamin Henry Latrobe*, 2 vols. (New Haven, CT: Yale University Press for the Maryland Historical Society and the American Philosophical Society, 1994). Latrobe's correspondence and papers are also in publication. Even as inventor of a new national building style and of the new professional field of architecture at the turn of the 19th century in Philadelphia, Latrobe's authority as a waterworks designer was suspect to some, especially to council members who had gained exposure to engineering projects as part of civic decision-making duties. Some believed their expertise to equal—or possibly to surpass—the engineer-

that in shape, form, and style, and in plan, elevation, and perspective, he conceives his design as a deliberate and careful study in Greco-Roman temple architecture. Latrobe is the first architect-engineer to draw on a neoclassical tradition for waterworks structures in the United States, and the building is unique.[98] On the exterior, he eliminated excessive ornamentation, "with the primary ornament consisting of Greek Doric columns at the entrance carrying a geometricized entablature that circled the lower block."[99]

> It is highly significant that Latrobe's pump house…used Greek Doric, the heaviest and more severe of all the orders. Appearing here for the first time in the

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architect's. As a result, the Philadelphia Watering Committee **"**refused to turn over full control of the technical aspects of the Waterworks to Latrobe, the professional engineer": "The committee's distrust of the engineer was exacerbated by Latrobe's impatience with what he regarded as lack of vision and petty haggling over financial matters on the part of the committee. His inability to relate his architectural and engineering genius to fiscal reality was a problem that haunted him all his life." See Eleanor A. Maass, "Public Watchdog, 134-54, esp. 135-36. One committee member, Thomas Pym Cope, prominent in public works development in Philadelphia and a close civic supervisor of the waterworks projects, "believed that the committee, and hence the citizens of Philadelphia, were being deliberately hoodwinked by a pair of scoundrels" in Latrobe and his assistant Graff. See Maass, 136. See also Fazio, "Benjamin Latrobe's Design," 232-47: "…Latrobe exhibited an extraordinary technical expertise and adexterity for manipulating architectural form which was unique in America at the time; he demonstrated as well a resistance to American contracting procedures."

98 A word on the term "architect-engineer": In a letter to Mills, Latrobe mused on the architect-engineer for his age: "The profession of architecture has been hitherto in the hands of two sorts of men. The first, of those, who from travelling or from books have acquired some knowledge of the theory of the art, but know nothing of its practice; the second, of those who know nothing but the practice, and whose early life being spent in labor, and in the habits of a laborious life, have had no opportunity of acquiring the theory. The complaisance of these two sets of men to each other renders it difficult for the Architect to get in between them, for the building mechanic finds his account in the ignorance of the *Gentleman-architect,* as the latter does in the submissive deportment which interest dictates to the former." See Hamlin, *Benjamin Henry Latrobe,* quoted in *American Architecture, 1607-1860,* vol. 1 (Cambridge, MA: MIT Press, 1981) by Marcus Whiffen and Frederick Koeper, 586. The "building mechanic"—perhaps analogous to today's building contractor—headed engineering and construction but not necessarily design. Unlike the gentleman-architect, the building mechanic's experience came not from travel or architectural education, from time provided by independent wealth, or from academic history or architecture study, but from practical experience. "Master builders tended to rise through the ranks from apprentice to journeyman to master and almost never had the opportunity to travel abroad. These men gained their knowledge of design from visits to the larger American cities and from European- and, later, American-architectural books. In New England, a new generation of builder-architects religiously followed the federal style of Charles Bulfinch." See Kenneth Hafertepe, "Banking Houses in the United States: The First Generation, 1781-1811," *Winterthur Portfolio* 35, no. 1 (Spring, 2000): 1-52, esp. 14.

99 Roth, *American Architecture,* 125-26. Latrobe's approved project differs from the built product. The proposed drawing he submitted illustrates four rather than two columns on the porticoes, delineates pilasters running the height of the drum between the clerestory windows, and includes other exterior detailing that appears in period engravings to have been omitted. In fact, I observe on Latrobe's March 1799 color drawing, which includes plan, section, and elevation for the building proposal, that he has handwritten: "NB no pilasters." See Stapleton, ed., *Engineering Drawings,* pl. 8, 174, fig. 39.

> United States, it became the hallmark of the Greek Revival, elaborated and spread later by Latrobe's pupils William Strickland and Robert Mills.[100]

The architect's 1799 drawing of the riverside site where water entered the system includes a small, imprecise sketch of the lower pump building, called the Engine House. Canal and conduit lead from the river to a vertical tunnel shaft that draws water up into the Engine House. The architecture of this Engine House is noteworthy in this discussion for the way in which under-emphasis on its design calls clear attention to the greater cultural importance of the Center Square structure. The tiny, imprecise rendering indicates the Engine House's location in the system and gives an impression of neoclassical styling. One makes out a row of three tall arched windows on the main level and an abbreviated clerestory above, but the building is topped by an angular, hipped roof, not a drum with a dome as at Center Square. Another image of the Schuylkill River Engine House—equally suggestive—appears in another unscaled and undetailed Latrobe drawing, from 1799, of the east façade. It confirms the building's shape and orientation, and shows two smokestacks, one for each boiler. Taken together, these two sketches, along with precise renderings by engineer Frederick Graff of the structure's internal machinery, clarify an exterior that suggests neoclassical design. In plan, the Engine House exhibits nothing as thought-provoking as the Center Square temple: the rectilinear structure on the river functioned as a warehouse for engines and pumps and was placed in an unremarkable location. Its ambition for cultural importance is limited to its utilitarian role as a supplement to the downtown centerpiece. Falling back on just enough design attention to suggest its companionship with the more prominent Center Square temple emphasizes the architect's conscious, specific, and assertive aesthetic statement. It, too, is "a sign of a sign"—that is, a neoclassical revival building whose style signifies an ancient classical aesthetic, with a dual purpose to also signal the status of the new technology of

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[100] Roth, *American Architecture,* 125-26. The Center Square waterworks was Latrobe's second building in the U.S. His first, and the one he came to the United States to build, was the Bank of Pennsylvania, with its domed rotunda. On influences on Latrobe by his first European employer, John Smeaton, known for waterworks projects, see Garner, "Tanks and Towers," 208, and Fazio, "Benjamin Latrobe's Design," 232-47, esp. 233 n. 14, on sources regarding Latrobe's work with Smeaton.

water-supply delivery. Taken together, the style's dual purposes serve as a symbolic cultural package laden with civic and economic values for their own time and place. This new American style and type sought to create a hefty sign of social, economic, and political sophistication that would be identified as American but also recognized on an international scale.[101]

The Center Square building's cylindrical engine room further underscores this point. **[Figure 12]** Enclosed in the central drum, the engine room indicates the supreme priority Latrobe gave the building's aesthetic form, in the remarkable way the machinery was arranged to conform to the round temple design. The drum's cylindrical foundation footings extended below the underground supply pipeline; the drum interior, then, was open cylinder from the foundations up to the lip of the dome, with the high clerestory the sole source of light (the oculus was the mouth of the smokestack, so did not admit light as an oculus historically does). The fact that "all the parts of the steam engine, the boiler, and the pump did not easily fit into the space provided in the interior of the building did not appear to disturb Latrobe or the Watering Committee." In other words, it appears to have been a given that industrial function would integrate with classical form.

This waterworks was valued for aesthetic aspects as much as for its utilitarian function. Given the engineer-architect's status, the building's central placement in the city, and the site's prominence as historical center in William Penn's city grid, we must surmise that the "contents" of the building—water and the mechanism of its movement—were a cultural achievement worthy of conscious high-status placement. By architectural historian Talbot Hamlin's assessment, the final product was "an early example of Latrobe's influential neoclassical architectural style. The building was admired for its proportions and use of Greek prototypes."[102]

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[101] For descriptive analyses and Latrobe's and Graff's renderings of the Schuylkill Engine House discussed in this paragraph, see Stapleton, ed., *Engineering Drawings,* 144-72. See the small sketch of the south elevation, and the section that corresponds to it, in Stapleton, figs. 21 and 33. For the tiny east elevation sketch and its corresponding section drawing, see Stapleton, figs. 26 and 30. Drawings of the building plan appear in Stapleton, figs. 27, 28 and 29.

[102] Gibson and Wolterstorff, "Fairmount Waterworks," 9.

> It is highly significant that Latrobe's pump house…used Greek Doric, the heaviest and more severe of all the orders. Appearing here for the first time in the United States, it became the hallmark of the Greek Revival, elaborated and spread later by Latrobe's pupils William Strickland and Robert Mills.[103]

Hamlin assesses the importance of design sophistication for this specific moment in U.S. architectural history, when Latrobe and his like-minded associates were making "revolutionary innovations" in waterworks and other industrial and utilitarian building designs.

> [T]here was the closest possible connection between engineering and architecture—that in beauty of workmanship and sound integrity of design, in grace of detail and care in appearance, one's aesthetic sense could be satisfied and need not be expected suddenly to 'black out' when confronted with a work of 'mere utility.' If there is one lesson to be learned alike from the work of Latrobe and of Strickland it is that; and if America had remained true to this vision the terrific sprawling ugliness of late nineteenth- and twentieth-century industrial development would never have occurred.[104]

Latrobe's Center Square building originated an ideal form for waterworks design in the United States—based on romantic reverence for the classical models that represented ideals in proportion, balance, symmetry, and civic values—and created the first self-conscious neoclassical temple design for a large-scale urban water system in the country. As Hamlin suggests, it functioned stylistically in conjunction with the most advanced technological function of its day. New but built upon historically-resonant forms, Latrobe's first water temple became an important modern, cultural, historical, economic, and even moral referent. Philadelphia's Center Square Water Works set a solid precedent for American waterworks building design.

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103 Roth, 125-26.

104 Hamlin, *Benjamin Henry Latrobe*, 68, 80-81. Hamlin cites William Strickland, Henry R. Campbell and Edward H. Gill, eds., *Reports, Specifications and Estimates of Public Works in the United States of America* (London: John Weale, 1841), accessed February 23, 2015, http://catalog.hathitrust.org/api/volumes/oclc/1867959.html. For more on Latrobe and public works developments, consult L.W. Formwalt, "Benjamin Henry Latrobe and the Development of Internal Improvements in the New Republic, 1796 – 1820" (PhD. diss., Catholic University, 1977); and Edward Carlos Carter, Darwin H. Stapleton and Lee W. Formwalt, *Benjamin Henry Latrobe and Public Works: Professionalism, Private Interest, and Public Policy in the Age of Jefferson* (Washington, D.C.: Public Works Historical Society, 1976).

PHILADELPHIA'S WATERWORKS ON THE SCHUYLKILL: NEW URBAN PARK (1811-1820)

By 1811, a decade after the Center Square Water Works had opened, it was technologically obsolete, no longer able to supply enough water to the city. To build its replacement, the Philadelphia Watering Committee turned to Frederick Graff, Latrobe's former assistant engineer. In 1803, Latrobe left Philadelphia for Washington, D.C. upon his Presidential appointment as Architect of the Capitol.[105] Philadelphia's new Federal-style waterworks building was sited on the Schuylkill River shoreline at the base of the Fair Mount, a rocky hillock whose summit was Philadelphia's highest elevation. Between 1812 and 1815, as the new Engine House was under construction, the Fair Mount summit was leveled for the city's elevated reservoirs, with room to expand through the decades.[106] **[Figure 16, 59]** When the riverside waterworks site was new, the first Fair

105 "In 1804, Latrobe described Graff as his first pupil." See Gibson and Wolterstorff, "Fairmount Waterworks," 10. After Latrobe's Philadelphia commissions, he designed the Baltimore Cathedral**,** considered with the Bank of Pennsylvania in Philadelphia and with his extended work on the U.S. Capitol to be his most prominent work. In 1811, he began working on the New Orleans waterworks system; his work in that city had begun in 1805 when, as the nation's supervising architect for government projects, he was asked to look over drawings for a lighthouse to be erected at the mouth of the Mississippi River. A lighthouse had been ordered by an act of Congressional legislation in 1804, which President Thomas Jefferson signed as one of the first actions that symbolically and materially established the United States as the new governor of the vast Louisiana Territories, acquired by Jefferson's Louisiana Purchase in 1803. For a case study of Latrobe's design process in relation to the New Orleans lighthouse—between 1805 and 1817 he worked on four different designs—see Fazio, "Benjamin Latrobe's Design," 232-47. According to Fazio, "The belief that New Orleans would become the greatest American port was common in the 19th century" (232 n. 4). In Washington, Latrobe served as the Architect of the Capitol from 1803 until 1811 and again from 1815 to 1818, when he had to rebuild the Capitol and the White House they were burned in the war with England. Thomas Bulfinch succeeded Latrobe in 1818, serving until the Capitol building was complete in 1829. Robert Mills and other Washington architects maintained the building between 1829 and 1851, when there was no Architect of the Capitol. Between 1851 and 1865, Thomas Ustick Walter, like Robert Mills a student of William Strickland, served as the Architect of the Capitol Extension, expanding the wings and adding the new dome. From 1865 to 1902, one of Walter's assistants, Edward Clark, took the office, which was renamed to the post's original title, Architect of the Capitol. On the Capitol building, Clark completed Walter's extension design, worked on new dome projects, reconstructed the west central interior, and constructed the western terraces designed by Frederick Law Olmsted. He also moved the Library of Congress into its own building. Details in this section come from sources cited herein, and from "Architects of the Capitol," Architect of the Capitol, accessed February 24, 2015, http://www.aoc.gov/architect-of-the-capitol.

106 "Work was begun in 1812 and completed by 1815. Between those years—probably by the latter part of 1913—the engine house was finished. By 1815 the reservoir site on the hilltop had been planned and the Fairmount plant was in working order." See Eberlein, "Fairmount Waterworks," 64-65. The Federal-style Engine House delivered river water 98 feet up the Fair Mount into a reservoir from which a bored-log pipe system distributed it throughout the city center.

Mount Engine House had two-engine capacity, but only one steam engine operated. Even this single engine soon became a financial burden and a safety hazard: the amount of wood required to keep the boilers running was prohibitive, and the risk of steam engine explosions was high.[107] Once elevated into the reservoir, water moved by gravity pipeline to the Center Square temple, where it was pumped up into the elevated reservoirs and carried by gravity distribution through an initial six miles of bored-log pipeline.[108] The round temple in Center Square remained in use as a reservoir for a decade after its 1811 closure, and it continued to be an architectural centerpiece for the city's turn-of-the-century urban image; objects on display in the Fairmount Waterworks exhibition are ample evidence of both waterworks' cultural prominence.[109] Later modernization of the city's distribution system rendered the Center Square Water Works temple useless, and it was torn down in 1829.[110]

The building that replaced it, the new Fair Mount Engine House on the river, was a Federal-style, steam-powered pumping station. **[Figures 21, 22, 23, 24]**

> From the outside, the engine house resembled a typical stuccoed house with Federal-period detail, with doors and windows belying the actual space of the interior, where the floor levels and supporting structure were determined by the great size and the location of the engine cylinders, the lever beams, the flywheels, and the pumps.[111]

Frederick Graff's original plan showed building facing of cut blue stone, but the Watering Committee substituted stucco, a less costly option.[112] The residential style was interrupted by industrial necessity: two smoke stacks rose conspicuously behind the

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107 Gibson and Wolterstorff, "Fairmount Waterworks," 9, 12. Regarding safety, in fact, the boilers had exploded in 1818 and 1821, killing three men (15). Boilers consumed 7 cords of oak wood per day, or 3,650 cords a year. As a response to the need to lessen the dangers and costs of running steam engines, Graff did set to work designing a new facility that would convert the system to water power.

108 An image of a New York log pipe appears in Koeppel, *Water for Gotham,* 290, fig. 50, from the Chase Manhattan archives.

109 See images throughout Gibson and Wollterstorff, "Fairmount Waterworks."

110 Gibson and Wolterstorff, "Fairmount Waterworks," 15. Questions of value remain: To what degree was the structure of cultural value once it had become technologically obsolete and the Fairmount site began to be developed?

111 Gibson and Wolterstorff, "Fairmount Waterworks," 12.

112 Gibson and Wolterstorff, "Fairmount Waterworks," 13.

building, announcing its utilitarian purpose. This three-story building housed two steam engines, which pumped water directly from the river up to reservoirs built on the leveled summit of the Fair Mount. The Federal style drew on an American residential standard, whose visual and symbolic expression yielded very different terms from Latrobe's Greek Revival designs. To address this incongruence, which glared once the Greek Revival Fairmount works rose next door to the Federal Engine House, Graff later (in 1835) attached a columned porch to the building; this tied the Federal style more cohesively to the Greek Revival. **[Figure 21, 31, 55]**

Federal-style residences were generally rectangular, brick or frame, three stories high, with low hipped roofs. Portico columns were narrow, with ornamentation confined to door, window, and porch detailing.[113] Innovative versions of Federal residences began to appear in Philadelphia townhouse blocks at this time. Hamlin drew clear associations between one specific block of new row houses and the Fair Mount Federal-style Engine House. He highlighted the contemporary prominence of the look-alike Ninth Street Row Houses he singled out, designed by Latrobe's assistant, Robert Mills. **[Figures 23, 24]** Based on a nuanced comparison of these row houses with the new waterworks, Hamlin attributed the Engine House design to Mills, despite the fact that Frederick Graff had signed and submitted all drawings for the waterworks. In making the attribution to Mills, Hamlin noted the architect's close involvement in Philadelphia's waterworks planning.

> [T]he influence of Mills may perhaps be traced [to] the waterworks on the Schuylkill River, built between 1811 and 1819. The design is usually attributed to Frederick Graff, who was undoubtedly the engineer in charge, but an examination of the Graff drawings in the Franklin Institute reveals a perhaps significant fact. All of them are extremely detailed so far as the machinery is concerned, but surprisingly sketchy with regard to the buildings themselves. It would seem impossible that the buildings should have been built from them; it is perhaps rather to be surmised that Graff made these drawings for the machinery from another set, now lost, which controlled the architecture. It is also perhaps significant that Mills had been in close touch with the entire project and had in 1810 refused the presidency of the company. It is therefore not beyond the bounds

113 For concise illustrated descriptions of the Federal style (and other architectural styles), see John C. Poppeliers et al., *What Style Is It? A Guide to American Architecture* (Washington, D.C.: Preservation Press, 1983), 30-33.

> of possibility that Mills designed the buildings, or at least had great influence in their creation. Certainly many of the details of the powerhouse have the closest resemblance to other works of the time, such as the Ninth Street houses; stylistically the combination of restraint and delicacy would indicate a strong influence from Mills or someone exactly like him.[114]

Hamlin's phrase, "*or someone exactly like him*," sears the text. To examine Philadelphia's architectural terrain at this moment in history, when only a handful of prominent architects was practicing (and these within a limited and closely defined urban extents), is to recognize that, at a stretch, there were two or three architects "exactly like" Mills. All were protégées of Latrobe.

I share Hamlin's doubt regarding Graff's ability to have designed the clean, sure, sophisticated, cohesive architectural style he drew. With Hamlin, I find that both reason and doubt seek a more likely scenario to account for aesthetic elements of the design. Hamlin's comparisons of Mills' Federal-style residences with the 1912 Federal Engine House, and the architectural historian's further evidence, such as the architect's involvement with the waterworks and the Watering Committee, and the refused company presidency, provide persuasive evidence for a plausible option to the otherwise doubtful assumption that engineer Frederick Graff devised the architectural design. Similar discussions throughout this dissertation bear out continuous historical problems, not only discontinuities between an engineer's technical and artistic capabilities, but also the nagging supposition that an invisible hand, that of a gifted architect, influenced these sophisticated designs. This study continues to ask: To what degree did architects have direct influence on waterworks building designs?

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114 Talbot Hamlin, *Greek Revival Architecture in America: Being an Account of Important Trends in American Architecture and American Life Prior to the War Between the States* (New York: Oxford University Press, 1944), 67-68, and fig. XIII. Robert Mills designed the Upper Ferry Bridge over the Schuylkill River, a prominent historical bridge site near the Fairmount area, in conjunction with Lewis Wernwag (discussed elsewhere in this dissertation). The various bridges that stood here were well illustrated in period prints and photographs and often were depicted in landscapes that included both the bridge and the Fairmount waterworks as a conjunctive landscape along the river. Mills also composed the design ultimately adopted for the Washington Monument in Washington, D.C. See Hamlin, fig. X.

GREEK REVIVAL FOR THE NEW FAIRMOUNT WATER WORKS OF 1820

Based on issues that had arisen regarding cost, safety, and capacity for the Federal-style Engine House structure, the Watering Committee needed to approve a facility capable of long-range expansion, considering that each of its first two ground-breaking facilities had become obsolete within a decade. Upon approved designs submitted by Graff in 1820, a new Greek Revival, villa-style building complex, originally called the Mill House, rose adjacent to the Federal-style Engine House. **[Figures 25, 26, 27, 28]** Graff's drawings propose a revolutionary Greek Revival waterworks complex that consciously accommodated future expansion over several decades and through several major phases of renovation and expansion. Indeed, during the waterworks' actual building stages over the course of the 19th century, designs referred reliably back to Graff's original 1820 architectural proposal. The Watering Committee elected to install waterwheels—innovative, safe, and inexpensive—in answer to the high costs, dangers, inefficiencies, and maintenance requirements of the steam engines that had powered waterworks pumps until this time. In 1820, "there was no prototype for the scale and configuration of the kind of structure that would be needed to contain multiple waterwheels."[115] Graff designed a building that could accommodate eight waterwheels, each about a story in height. When the first stage of this Greek Revival Mill House opened in 1822, waterwheels occupied four bays, with the remaining four "apartments"

115 *History of the Works and Annual Report of the Chief Engineer of the Water Department of the City of Philadelphia* (Philadelphia: C.E. Chichester, 1860), quoted in Garner, "Tanks and Towers," 212 n. 9-13. The quoted portion is cited in Gibson and Wolterstorff, "Fairmount Waterworks," 18. Changes and expansions were also taking place in Philadelphia's distribution system at this time. "Inefficient, small-diameter wooden mains linking the reservoirs to the old distribution chest at Center Square were replaced by twenty- and twenty-two-inch cast iron pipe, the first metal pipe used in an American public water supply; by 1829, the distribution chest had been bypassed and Latrobe's Center Square landmark was torn down." See Koeppel, *Water for Gotham,* 109. Koeppel cites "The Fairmount Waterworks" correctly but misstates the page number. The correct citation is Gibson and Wolterstorff, "The Fairmount Waterworks," 15. Koeppel also notes that "neighboring Burlington, New Jersey, bought much of the pipe, which remained in use until the 1880s." See "History of Plumbing in America," *Plumbing and Mechanical Magazine* (July 1987), accessed February 23, 2015, http://www.theplumber.com/usa.html, quoted in Koeppel, *Water for Gotham,* 109 n. 10.

reserved for future expansions.[116] Steam engines in the existing Federal-style building were retired as soon as the new waterwheel system was functioning.[117] Water collection came directly from the Schuylkill River, pumped uphill to the open-air storage reservoirs on the Fair Mount hilltop. In design, technology, and capacity superior to the Federal-style Engine House next door, the Mill House complex became a continuous national attraction from the time it opened in 1822, and it is this, the Greek Revival Fairmount Waterworks, which has retained historical, cultural, and aesthetic prestige through two centuries.[118]

The Greek Revival, villa-style temple complex design was an unadorned Tuscan order.[119] Its long symmetrical riverfront façade was punctured with eight arched "apartment" openings at water level.[120] A low mound dam crossed the river at the waterworks, slowing the river to divert water into a mill race canal on the upstream side of the works and on into the waterwheel bays. There, the water-powered wheels operated

116 By 1850, all eight bays in the Fairmount waterworks Mill House were operating (in 1851 the first hydraulic turbine was installed), but demand had reached a point the Fairmount Waterworks facility could no longer meet. Gradually, various suburban areas near Philadelphia formed waterworks systems apart from the city's. All were incorporated in 1854 when Philadelphia County was consolidated fiscally. From 1815 to 1854 Fairmount was the sole fully functioning waterworks for Philadelphia. See Warner, *Private City,* 108, and Gibson and Wolterstorff, "Fairmount Waterworks," 7, 33.

117 "Although initially held in reserve for emergencies, [the two steam engines] soon deteriorated and were sold for scrap in 1832. A few years later the utilitarian engine house was coverted to a public saloon, where refreshments were provided . . . , and its surroundings were developed into a public garden." Gibson and Wolterstorff, "Fairmount Waterworks," 16.

118 For drawings, narrative descriptions, and period representations of the structure at various stages, see Gibson and Wolterstorff, "Fairmount Waterworks," 17-27. Many thanks to Albrecht Koschnik, for sharing his expertise and his sources on Philadelphia history and architecture with me while we were both in residence at the Huntington Library in 2008.

119 One is at a loss to ascribe an ancient precedent for Graff.'s 1872 central temple. It is most like the Temple at Segesta in Sicily, with its smooth columns, simple pediment, and absence of a naos, or cella. Hexastyle pediment support is common in Greek examples, but a 9-column side is not; the ideal proportion for peripteral hexagonal temples were more commonly 6 x 13, and columns were much more often fluted than not in such temples. It makes more sense to look at American Greek Revival architecture for influence. From stages of building on the U.S. Capitol and the U.S. Patent Building, for example, into the 1840s, to the 1874 San Francisco Mint, any of a number of major buildings might have influenced the modest but clean Greek Revival architectural developments on the Fairmount Waterworks. The Tuscan variety of the Doric order was considered commonly to have been used for utilitarian buildings. Unfluted columns are the exception rather than the rule in monumental architecture.

120 The new central building of the Fairmount waterworks, then called the Mill House, was 238 feet wide and 57 feet deep, with its longest side facing the river.

pumps that raised water into the reservoirs atop the Fair Mount. The water used to turn the wheels returned to the river through the downstream bays of the works complex.[121]

The "apartments" designed as waterwheel bays were installed two feet below the river's high watermark. A full story above these waterwheel bays, the level roof exterior was paved as a public promenade. Upon this promenade, capping the two ends of the structure, rose two Greek Revival temple pavilions, each with a four-columned portico; Graff's plan indicates the temple pavilions housed water offices. By the standards of the time, in design, scale, extent, and capacity, the building was monumental, an unprecedented works structure designed for future renovation and expansion.[122] Major phases of construction and renovation took place about every decade. Interior alterations accommodated technological advancements in machinery and power processes, while exterior additions included patios, promenades, pavilions, and belvederes, all coherent with the original Greek Revival design. All architectural changes were made with a clear eye to enhancing the visitor experience of the site as it grew into a major cultural site. **[Figures 10, 30, 33, 34]** The Fairmount Waterworks and Fairmount Park were favorite subjects for artists' representations.

CULTURAL PROMINENCE OF THE FAIRMOUNT WATERWORKS SITE

The cultural transformation of the Fairmount area into Fairmount Park developed, with the waterworks, over time. From the beginning, the principal draw to the site was the riverside waterworks structures, the fascinating machinery and its operation, and the spectacle of the elevated hilltop reservoirs. From the 1820s, Fairmount Park developed into a picturesque public garden surrounding the ever-popular waterworks. After the steam engines were removed from the Federal-style Engine House in 1832, that building

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[121] The dam backed up a six-mile-long upriver "pool" that was protected from industrial development and dedicated to recreation through its history, with boat houses eventually lining the banks.

[122] In 1800, when the waterworks were begun, the city population was 41,220. By 1820, the census counted 63,802 inhabitants in the city proper. Warner reports the population of greater Philadelphia was 114,000 in that year. The 1830 census reports 80,462 inhabitants and yields an average of 25% growth per decade on census counts. See census data at www.census.gov. See also Warner, *Private City*, 105.

was converted into a popular "saloon" for refreshments and a tourist gathering place.[123] By 1835, a major renovation and expansion had been completed, and an extensive Fairmount Park had officially been laid out. In planning, size, scale, and cultural importance, Fairmount was famed as a city park from its inception, but it was the waterworks architecture that formed the park's centerpiece and informed the cultural interest of its setting. Of additional importance in establishing the cultural importance of the site was the bridge over the Schuylkill River adjacent to the Fairmount site. The first bridge there was acclaimed as "The Colossus," a technologically accomplished 340-foot, long-span, laminated-wood bridge. It was acclaimed as well for its resemblance to the Rialto Bridge in Venice, Italy. This was replaced by the first roadway suspension bridge in the U.S., by French bridge-builder Ellet, as I will discuss later in this dissertation. In 1875, an iron trussed bridge replaced the Ellet suspension bridge. **[Figures 10, 54, 55, 120]**

By the time of the 1835 waterworks renovation, the gardens had expanded. The park featured a variety of both formal and wooded sections, and at its height in development and popularity, drew international attention.[124] Charles Dickens, visiting in 1840, reported:

> Philadelphia is most bountifully provided with fresh water, which is showered and jerked about, and turned on, and poured off everywhere. The Water-works, which are on a height near the city, are no less ornamental than useful, being tastefully laid out as a public garden, and kept in the best and neatest order.[125]

Dickens, of course, was not the first writer to praise the gardens and the waterworks on a Philadelphia visit to celebrate water. Calling attention to the waterworks as ornament opens a window onto the cultural status the site and its architecture had gained by mid-

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[123] Gibson and Wolterstorff, "Fairmount Waterworks," 24. The steam engines were removed in 1832.
[124] Gibson and Wolterstoff, "Fairmount Waterworks," 22-25.
[125] Charles Dickens, *American Notes for General Circulation,* (1842, repr., New York: St. Martin's Press, 1985), 89, quoted in.Gibson and Wolterstorff, "Fairmount Waterworks," 28-29.

century.[126] By the time significant improvements were made in 1844, Fairmount Park had become "the largest urban park in America, and, as such, was an essential link in the chain of outstanding landscapes that included Boston's Mt. Auburn Cemetery, New York's Central Park, and Chicago's lake front."[127]

From early on the site was of high interest to engineers, as well; continuous updates and renovations kept it at the forefront of hydraulic engineering. In the 1830s, New York City's Croton Aqueduct assistant engineer Fayette Tower, newly appointed by chief engineer John Jervis, honeymooned at Fairmount Park. Tower called it "'the most delightful spot I have seen for a long time.'" He described fountains, water jets, marble basins, and statuary which "'exhausted all the words we could find to express our admiration and then felt it long in silence.'"[128] Heightened attention on the site's technological and cultural aspects continued to the end of the century. In 1867, the Fairmount Park Commission was established with a mission to protect and develop the gardens. In the next decade, the 1876 centennial exposition was sited around the Fairmount area, with venues developed on both sides of the river; exhibit halls included the typical expo focus on industrial technology and machine engineering. In 1891, Emile Geyelin, French engineer and innovator of the hydraulic turbine, declared Philadelphia the "mecca of the hydraulic engineer," recognizing the cultural importance of the Fairmount Waterworks as the first comprehensive waterworks in American urban planning.[129]

By 1909, when the works were retired, the city had passed two ordinances transforming the Fairmount Waterworks from a utilitarian to a purely cultural site. The

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126 The Fairmount Waterworks' "golden age," between 1830 and 1850, corresponded with the largest rates of population growth in Philadelphia's history. In 1820-1830 the population of the city proper grew by 38 percent, in 1830-1840 by 37 percent, and from 1840-1850 by 58 percent. See Warner, *Private City,* 107.

127 George B. Tatum, "The Origins of Fairmount Park," *Antiques* 82 (November 1962): 502-507; and Thomas Gilpin, "Fairmount Dam and Waterworks, Philadelphia," *Pennsylvania Magazine* 37 (October 1913): 471-79, quoted in Warner, *Private City,* 106. In fact, funerary architecture and suburban cemetery planning did bear on the development of waterworks architecture. I will discuss this later in this chapter.

128 Koeppel, *Water for Gotham,* 241 n. 73.

129 Emile E. Geyelin, "Growth of the Philadelphia Water Works," *Proceedings of the American Water Works Association* (1891): 21, quoted in Gibson and Wolterstorff, "Fairmount Waterworks," 29, 33.

Greek Revival waterworks buildings became the city's aquarium, operating there until 1962. The decommissioned reservoirs on the leveled hilltop above the works became the site for the Philadelphia Museum of Art, approved in 1919 and finished in the late 1920s.[130] In 1927, when the art museum was nearing completion, Eberlein noted the Fairmount area's cultural importance, by that time marked by its joint cultural landmarks in their reuse from waterworks to museums.

> The Fairmount Waterworks…are within the field of current interest…. . [T]he group of buildings on the east bank of the Schuylkill River comes conspicuously into the extensive scheme of revised town-planning and park improvement now being carried out by the City, and the old engine and wheel-houses are in close proximity to the new museum and art gallery nearing completion on the site of the former reservoir. In fact, one might well say that both by historic association and position the old buildings on the river bank are so closely related to the new structure crowning the reservoir hill immediately above them that all of them, new and old together, may be regarded as more or less one composition.[131]

Even within this assessment, Eberlein criticizes changes made to the building's front façade, the eastern, upstream entrance side of the building, facing away from the river, whose alterations clearly did not take aesthetics into account.

> The only considerable change made since [the buildings were converted into an aquarium] in the immediate environment is the filling-in of the forebay, a regrettable performance that can only be characterized as a 'fool trick' since it serves no purpose further than to afford space for a needless roadway and the disappearance of the forebay robs the eastern side of the building of more than half their former charm.[132]

The joint neoclassical site, with 125 years in public service, reinforced the permanence of the cultural centerpiece with a hilltop temple to art on the hilltop interposed with its companion and legacy, the riverside temple to water. **[Figure 35]**

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130 Gibson and Wolterstorff, "Fairmount Waterworks," 38-39. By 1830, three waterworks reservoirs stood on Fair Mount hill.
131 Eberlein, "Fairmount Waterworks," 57-67. The architects of the "new museum and art gallery" were C.L. Borie, Jr., Horace Trumbauer, and C.C. Zantzinger. See Eberlein, 66.
132 Eberlein, "Fairmount Waterworks," 65-66.

FAIRMOUNT'S ENGINEERING LEGACY

The 1835 renovations and expansions of the Fairmount Waterworks secured the site as a national cultural center, and its design showed a dedication to continuity with the original vision, both in aesthetics and engineering. The two aspects developed in tandem. In 1848, Superintendent Frederick Graff, Sr. died, and his son, Frederick Graff, Jr., assumed his position. In 1851, Graff, Jr. installed a new water-powered Joval turbine, an experimental horizontal waterwheel designed by the French engineer Emile Geyelin. This renovation created major changes in the capacity of engine room spaces. Between 1856 and 1867, Graff, Jr. took a hiatus from the waterworks superintendency, and engineer Henry Birkenbine stepped in. Birkenbine's brief but productive tenure yielded a significant new pump house, constructed between 1859 and 1862, next to the main waterworks upon the mound dam. He also reconfigured the main Mill House, from its original eight waterwheel bays to six bays for Jonval turbines and updated pumps.[133] The flat roof above the new Mill House annex addition's three large hydraulic turbines was paved and made into a large terrace on a level with the pavements around the main Mill House, expanding the public promenade space considerably. This new garden promenade extended along the dam crest, where one strolled out above the water to an octagonal temple pavilion to view the river, the famous bridges, and the city beyond. **[Figures 29, 30, 32, 33, 34]**

After Frederick Graff, Jr. returned to his position, he radically renovated the interiors of the old and new Fairmount buildings to accommodate technological updates. In the process, between 1868 and 1872, he completed the vision his father's original architectural plan exemplified, adding the large central peripteral temple his father's 1820 plan had called for.[134] The initial drawing Graff proposed in 1820 showed a four-column

133 Gibson and Wolterstorff, "Fairmount Waterworks," 33-35.

134 "The wheel houses or mill-buildings, as they were called at the time, are 238 feet long, including the two terminal pavilions, and as originally constructed 56 feet wide. Along the forebay was a balustrade and brick-paved terrace 253 feet long and 26 feet wide. As finished in 1822 the parapet of the mill building was about on a level with the base of the two end pavilions and the two central entrances were surmounted by allegorical figures carved by William Rush. In 1865 the level of the terrace was raised several feet, the middle entrances were lifted to the same grade as the end pavilions, and between the middle entrances, on

porch supporting an unadorned pediment, that is, a prostyle tetrastyle temple much like Graff, Jr.'s final end-cap temples. **[Figure 25, 27]** The later central temple was different, and much larger: the final central structure was an open, rectilinear peripteral hexastyle temple with six columns on the front and back, supporting the pediment, and nine columns on each side.[135] **[Figure 31, 32]** Graff, Sr., had originally presented a modest, closed structure with a four-column porch, itself certainly in line with expectations for Greek Revival in his time. By the time Graff, Jr. built the central temple, the 1820 endcap pavilions, with their four-column open porticoes, had been in place for several decades. In place of Graff, Sr.'s drawing for a small central temple, in line with a comparatively modest-scale early Philadelphia Greek Revival order of the time, Graff, Jr.'s postbellum peripteral hexagonal temple in the Doric order columns fit into a stately American architectural iconography influenced by Beaux-Arts developments, and by the developing architecture of state buildings, especially capital buildings, in the United States. These later alterations amplified the approach that Graff, Sr.'s more severe early-century plan had called for in the central temple structure, but whose scale was unprecedented in waterworks in the first quarter of the 19th century. One notes as well that the Fairmount Waterworks building's final 1872 renovation also followed by more than a decade the 1860 Louisville Waterworks, a building cleanly but flamboyantly styled in a Beaux-Arts Greek Revival that clearly post-dates initial Philadelphia works design. I will compare these two structures later in this chapter, proposing a relationship between the two waterworks' design elements. At the Fairmount works in 1872, Graff, Jr. completed the

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the new level, was constructed the temple-like pavilion which does not appear in the early engravings. At the same time were built the ugly wooden huts which extend between the central pavilion and the end pavilions, and can be called hardly more than skylights for the structure beneath." See Eberlein, "Fairmount Waterworks," 65-66. Eberlein also cites a report from 1812 or later that "gives us reason to believe that the wings were used by the families of employees, while the great room seems to have been used as a sort of 'pump room' and a place of assembly and light refreshment for those who visited the works and made it the objective of their drives or walks from the city" (67).

135 For a photograph of the Fairmount Waterworks, c.1875, showing the complex after Graff had completed his renovations, see Kenneth Finkel and Susan Oyama, *Philadelphia Then and Now: 60 Sites Photographed in the Past and Present* (New York: Dover Publications in cooperation with the Library Co. of Philadelphia, 1988), 62.

vision his father had proposed, while also closing a period of more than 75 years of nearly continuous Latrobe-Graff waterworks design superintendency.[136]

SILENCES IN WATERWORKS DESIGN ATTRIBUTION: ARCHITECT AS CONSULTANT, OR ENGINEER AS DESIGNER?

The unprecedented 1820 Graff design proposal for Philadelphia is, for the most part, uncritically accepted in historical accounts as showing "indebtedness to Latrobe in the neoclassical exterior design for the buildings."[137] In general, historical narratives strongly imply either that Latrobe offered assistance from his new perch in Washington, D.C., or that Latrobe's precedent in the 1801 Center Square round temple inspired Graff's ambitious Greek Revival complex of 1820. Typical examples: "Graff was influenced by Latrobe's concept of designing an aesthetically pleasing building to house a potentially dangerous function, which the operation of stationary steam engines was considered to be at that time;" or "Graff's skilled rendering of the engine house reflects Latrobe's tutelage."[138] While the Greek Revival *style* of Latrobe's 1801 Center Square Water Works temple certainly "influenced" the 1820 Fairmount Waterworks design, it does not go without saying that Latrobe himself lent a hand on the Fairmount works. Of course, one would be hard-pressed to argue against Latrobe's "influence" on *any* Greek Revival structure in Philadelphia, given that he had invented the form in that city and had "trained" the architects developing that continued vision once Latrobe ascended to the nation's top architecture post in Washington. In my view, however, it is difficult to argue for Latrobe's *direct* influence on the 1820 Fairmount building, even though historians routinely suggest the collaboration. I find this doubtful. As architect of the Capitol, Latrobe was now the National Architect, directly responsible for any architecture with

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136 The completed Fairmount waterworks were done in time to be an architectural centerpiece for the U.S. Centennial in 1876 in Philadelphia. The fair's expansive grounds were built across the river from the Fairmount Waterworks and incorporated the grounds of Fairmount Park, making it "the first properly landscaped and planned international exhibition" in the United States. See John Allwood, *The Great Exhibitions* (London: Studio Vista, 1977), 52.

137 Gibson and Wolterstorff, "Fairmount Waterworks," 18.

138 Gibson and Wolterstorff, "Fairmount Waterworks," 9, 12, 13.

federal oversight. As far as waterworks buildings were concerned, Latrobe had no time to attend even to the New Orleans waterworks he himself designed, and in design, it was essentially a copy of the Center Square Water Works. To oversee and complete the project, Latrobe hired his son, a less capable architect, if an able project administrator and public relations liaison, as I will discuss later in this section. Upon close analysis, blanket implications of Latrobe's direct influence upon buildings designed in Philadelphia in his absence raise by inference a question Talbot Hamlin poses directly for the 1812 Graff, Sr. Federal-style Engine House, whose design he attributes to Mills. That is, did Graff also receive assistance from an architect in designing the 1920 Greek Revival Mill House? It comes as no surprise that Hamlin should openly doubt that Graff could have designed the sophisticated Greek Revival waterworks building, and proposes, as he did for the Federal-style building, that a well-known architect must have consulted on the 1820 Greek Revival design.[139] Again, Graff's own work shows no evidence of design experience, and his work with Latrobe did not reveal a talent for it (as Latrobe's work unquestionably did). I share Hamlin's doubt.

Hamlin explains in his history of American Greek Revival architecture that "Latrobe's influence on Philadelphia was not limited to his own work and did not cease upon his removal to Washington." This is not to say the architect was directly involved in projects, but rather that his indirect influence lived in the design work of his protégées. The architect's "most distinguished" students and assistants in Philadelphia, Robert Mills and William Strickland, continued to practice and to gain fame as leaders in developing a national style of American architecture.

> In their work one can trace with remarkable clarity the gradual shift toward a greater and greater dependence on Greek detail, until the final disappearance of the Soane type of English influences allowed the emergence of a completely new kind of Greek Revival architecture essentially native….[140]

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[139] Hamlin also attributes engineer Theodore Scowden's Louisville waterworks of 1860 to architect Gideon Shryock.

[140] Hamlin, *Greek Revival Architecture,* 66.

These Latrobe students went on to exert broad influence upon the development of 19th-century American architectural style, but it is essential here to emphasize their contributions specifically in the field of waterworks and other public works structures. Robert Mills, for example, had worked closely with water planning leadership in Philadelphia and had been offered the presidency of the Watering Committee. William Strickland, who began practicing architecture in Philadelphia in 1818, co-edited the 1841 publication *Reports, Specifications, and Estimates of Public Works in the United States of America*.[141] Hamlin attributes the 1812 Federal-style Engine House to Mills, whose Federal and Greek Revival structures in Philadelphia had defining influence on 19th-century American architecture. In his analysis of this attribution, Hamlin emphasizes the point that "the urban extent of the U.S. at this time, and therefore spheres of influence within it, were small in our modern terms." Hamlin's pert "or someone exactly like him" continues to stick, as one considers the question of design assistance on the Greek Revival Fairmount Mill House.

I wish to dramatize the point by suggesting an imaginary analogue. It seems to me that the dilemma posed to historians by Hamlin's phrase, "or someone exactly like him," might be akin to that faced by an imaginary future historian who, in the unfortunate erasure of primary evidence, must make a claim that a Frank Gehry building, for example, was designed by Frank Gehry, "or someone exactly like him." Today, in 2015, floating ribbon walls of thin-shell concrete are a contemporary avant-garde staple, if not by now an influential post-modern anachronism. In the 1980s, however, when Gehry's forms first appeared, Gehry and his immediate protégées were the initial and sole innovators of a landmark style. The buildings are unmistakably attributable to Gehry, even in instances when one of many talented architects in his practice actually developed and directed a specific design. The very point is that, in his time and place, there was *no one* "exactly like" Gehry or his direct protégées, just as in early 19th-century Philadelphia there was *no one* "exactly like" Latrobe, or even close to Mills or Strickland. These few

[141] Strickland et al., eds., *Reports, Specifications and Estimates* contained an accompanying Atlas of images which I have been unable to locate.

architects presented specific and identifiable stylistic marks that iconographical analysis can identify. Their stamp was definitive, insists Hamlin.

So, Hamlin's considered viewpoint applies to the nagging question of architectural attribution for the 1820 Fairmount Greek Revival design. In fact, however, the common discussion of the 1820 works is a distraction in this question of "influence." One recalls that the famous 1820 Greek Revival design *did not follow* Latrobe's 1801 Center Square works. The work that followed, the 1812 Engine House, was a Federal-style domestic revival building, *not* a Greek Revival civic temple design. The discrete styling of the 1812 domestic-style Federal Engine House, coming chronologically *between* two structures of high Greek Revival classicism–-the Central Square and the riverside Mill House temple-style buildings that bookend it—is the influence question's albatross. This becomes obvious if we oblige analysis to heel to Latrobe as the direct and sole "father" of Philadelphia waterworks design, and if, at the same time, we instantly throw up our hands in the absence of evidence and assign to engineer Graff mastery of sophisticated innovation in a new and definitive American architectural style. Recall that engineering historian David Billington calls John Wellborn Root "an architect who did engineering"—the same would apply to Latrobe—and Billington's entire study of civil engineering "structural art" is predicated upon engineers who "do" architecture. No evidence points to Graff as being this type of engineer. It makes more sense to admit Hamlin's doubt and his historical supposition, and to grant probable design consultation on waterworks structures not only to Latrobe but also to Mills and Strickland, and perhaps other major architects in this small and highly influential circle. Hamlin points out that the architectural ambitions of the Federal-style waterworks of 1812 are precisely what make Graff's unquestioned credit for the design problematic. These questions lead the historian to propose Mills' involvement. A similar problem, that of design quality, applies to the 1920 complex. Officially, Graff did propose both buildings, ten years apart, just as he had submitted signed drawings that were known to have been made by Latrobe. It was the standard practice then (and in fact, it still is today) for sponsors or builders to receive official credit for works designed by others. Hoover Dam, for example, is generally known as a product of federal reclamation, and not the specific work of Los Angeles architect Gordon Kaufmann, who was called in to salvage the dam's design when engineering teams making design attempts realized they were in over their heads.

Historian Harold Donald Eberlein probes such doubts in his analysis of the 1820 Fairmount waterworks design authorship.[142] In an article from *The Architectural Record* in 1927, when the Philadelphia Museum of Art was nearing completion on the former waterworks reservoir site, Eberlein exhorts skepticism regarding Graff's design capabilities, doubtful that the engineer could have created the designs without the help of an architect. He presents his conjecture that Latrobe and/or Mills consulted on the design.

> In all the city records, and in all the reports of the Water Bureau, the entire credit for the construction of the waterworks is given to Frederick Graff. For all the engineering in connection with them we know that he was unquestionably responsible. By implication, he was responsible also for their architectural design. As a matter of fact, in none of the official reports nor in any of the contemporary newspaper notices can we find any very illuminating allusions to the architecture. A great deal is said about the engines and about the engineering achievements, but the architecture is taken as a matter of course and is virtually ignored, so far as any specific mention occurs. …Frederick Graff was trained by Latrobe, but so far as we can learn his training seems to have been especially in the direction of engineering and it is a question of how much architectural aptitude he ever displayed. He was the superintendent of the old first waterworks, designed by Latrobe, and it was only natural that he should be entrusted with the responsibility of the later developments. If he was solely responsible for the design of the 1812 engine house and the 1822 mill buildings, he had made admirable use of the training he had received at Latrobe's hands. One cannot help feeling, however, that Latrobe or Robert Mills, or perhaps both, had some connection with the design of the waterworks buildings, although there is no documentary evidence to favor such a conclusion.[143]

Eberlein also implies that even Philadelphia sculptor William Rush may have influenced the waterworks design. Rush had been commissioned to create water-related figural sculptures for the waterworks. **[Figures 36, 37, 38]** First, in 1809, he carved *Allegory of the Schuylkill River*, or *Water Nymph and Bittern*, in wood, painted white. It was installed in the town's Center Square at the portico entrance of the Center Square Water Works

[142] Eberlein, "Fairmount Waterworks," 57-67.
[143] Eberlein, "Fairmount Waterworks," 66-67.

temple. When the waterworks was demolished in 1829, the sculpture relocated to the new Fairmount waterworks, where it joined a pair of white-painted cedar figures commissioned for the building in 1825. *Allegory of the Schuylkill River in its Improved State (The Schuylkill Chained)* and *Allegory of the Waterworks (The Schuylkill Freed)* were mounted over public entrance doorways. The former, a chained river god lying prone with an eagle at its feet, struggles against currents running below, to symbolize the hydraulic technology that slows and diverts the river's flow, restricting its reach, harnessing its natural power. By contrast, *Allegory of the Waterworks (The Schuylkill Freed)* personifies the works in the form of a robed goddess in flowing robes who turns the waterwheel to direct the water supply into the containing urn behind her. Together, the works represent a technological system that collects, stores, and redirects water in forward-moving, civilized gesture. Rush was president of the Watering Committee's Building Committee in 1822 when the new Mill House opened.[144] Eberlein posits that Rush, in his dual role as sculptor and Watering Committee leader, must have worked his social, political, and artistic connections to help facilitate a design consultation with an architect. Eberlein repeats his doubts of Latrobe's direct involvement.

> [W]e know [William Rush, the wood-carver] was deeply interested and contributed some of his work. The two figures of Wisdom and Justice, now in the niches of the Great Room, were carved for the triumphal arch erected [by Strickland] at the time of Lafayette's visit, in 1824. Afterwards, in 1835, they were placed in the Great Room. During Graff's activities Rush was a member of the City Councils and manifested his interest in a substantial way, but of Latrobe's hand we can find no visible evidence.[145]

At this juncture, I think it is quite possible to posit a similar attribution narrative for William Strickland—"or someone exactly like him," to borrow Hamlin's enigmatic qualifier. Strickland's name is omnipresent in discussions of his role in shaping Philadelphia's urban image in architecture. He was one of several of Latrobe's protégées and/or former employees, and was present in Philadelphia until 1837 when he moved to

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[144] Gibson and Wolterstorff, "Fairmount Waterworks," 27.

[145] Eberlein, "Fairmount Waterworks," 67. An image of the statue in its Great Room niche also appears on this page.

Nashville. Moreover, he was directly involved in public works planning for the city of Philadelphia. Hamlin assesses that Strickland's "fame during his life came almost as much from his engineering skill as from his work as an architect."

> He was sent to England in 1825 by the Pennsylvania Society for the Promotion of Internal Improvements, to study canals and other public works; his report, published by the society in Philadelphia in 1826, shows the keenness of his observation, his vivid sense of structure, and his enthusiasm for the newest and most modern engineering ways.[146]

The Philadelphia Architects and Buildings Project of the Athenaeum of Philadelphia lists the Fairmount Dam as one of Strickland's waterworks engineering achievements: "In 1828 he was a consultant for the Fair Mount Dam…. In Philadelphia his engineering impact is still felt in the Delaware Breakwater for which he served as supervising engineer from 1828 to 1840." [147] Hamlin describes Strickland's significant influence on the broader contemporary discourse on public works:

> It is significant, too, that the most important of the published works that bear Strickland's name is *The Public Works of the United States of America*, of which he was one of the editors—a sumptuous volume of engravings showing the advanced accomplishments that the young country had made in canal, bridge, and factory building and in harbor improvement. No one can run over these plates in the most cursory fashion without feeling that … there was the closest possible connection between engineering and architecture—that in beauty of workmanship and sound integrity of design, in grace of detail and care in appearance, one's aesthetic sense could be satisfied and need not be expected suddenly to 'black out' when confronted with a work of 'mere utility.' If there is one lesson to be learned alike from the work of Latrobe and of Strickland it is that; and if America had remained true to this vision the terrific sprawling ugliness of late nineteenth- and twentieth-century industrial development would never have occurred.[148]

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[146] Strickland et al., eds., *Reports, Specifications and Estimates,* quoted in Hamlin, *Greek Revival Architecture,* 80-81.

[147] The Philadelphia Architects and Buildings Project (PAB) is a consortium of archival institutions directed and administered by the Athenaeum of Philadelphia. See "William Strickland (1788-1854)," Philadelphia Architects and Buildings Project, accessed March 4, 2015, http://www.philadelphiabuildings.org/r.cfm?r=772404.

[148] Strickland et al., eds., *Reports, Specifications and Estimates,* quoted in Hamlin, *Greek Revival Architecture,* 80-81. I have been unsuccessful in locating a copy of Strickland's report, in any form, that includes the "sumptuous volume of engravings" named in bibliographical references as "Vol. II, an atlas folio of a portfolio of engravings, titled: *Public works of the United States of America*; plates engraved by John and J.H. Le Keux." Volume I is text only, explanatory of the atlas folio of detailed engravings

Hamlin's concept of an aesthetic "black out" in the face of utilitarian building design recalls David Billington's identification of only a few architects who also excelled at engineering. Latrobe and Strickland were clearly two of these. The corollary, engineers with a native aesthetic sense of "structural art," is of course the subject of Billington's study. He does not examine waterworks, but Hamlin tends toward the type of conclusion Billington might have reached, had the latter considered hydraulic works in his study.[149] William Strickland's local and national prestige is common knowledge. Considering the high-visibility nature of the Fairmount works, the surrounding area's status, and the integrity of the evolution and realization of the design over three-quarters of a century, one might reason Strickland to have been directly involved in Philadelphia's waterworks design. Hamlin observes:

> As with Latrobe, Strickland's influence was not limited to the work which he himself designed, for two of his pupils and employees went on to achieve fame as architects—one, Gideon Shryock, carrying into the West all the skill and technique he had learned from his work with Strickland; the other, Thomas Ustick Walter, practicing largely in Philadelphia but more famous for having been the final designing architect on the United States Capitol and for adding the present House and Senate wings and the great dome which so magnificently crowns it.[150]

In this context, one cannot help but conclude that Strickland must have been asked to provide design assistance on the Fairmount Water Works.

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elucidating the engineering works described. Volume II is evidently quite rare, as the two volumes have presumably been separated over time and bibliographical listings name both volumes for the holding, whether in rare books collections or on microfilm. In 2005 and 2009, paperback reprints of the text were issued, but these do not include the engravings. Hamlin notes: "It is noteworthy that among the subscribers to the Strickland report for the Pennsylvania Society were the architects Robert Mills and Alexander Parris." See Hamlin, 81 n. 22.

149 Since Billington wrote *The Tower and the Bridge: The New Art of Structural Engineering* (New York: Basic Books, 1983), he has co-authored another book on waterworks. See David P. Billington and Donald C. Jackson, *Big Dams of the New Deal Era: A Confluence of Engineering and Politics (*Norman, OK: University of Oklahoma Press, 2006).

150 Hamlin, *Greek Revival Architecture,* 66, 81. Consider also the competitions Strickland entered, and the architects who won them. The design contract for Girard College went to Thomas U. Walter, a former Strickland student. Laurel Hill Cemetery and the Philadelphia Athenaeum jobs went to John Notman, and the Franklin Institute to John Haviland.

It must have been standard practice for waterworks engineers to produce designs in consultation with an architect. The initial example of Latrobe's design for Center Square provides a significant example of both proof and model for this practice. As evinced by original drawings in the archival record, Graff routinely presented waterworks drawings designed by Latrobe without crediting the designing architect on those documents. Hamlin also makes an essential point: historical drawings and documents get lost. He urges historians to keep in mind that at no time is one in the presence of complete primary evidence. Two examples prompt us to consider similar situations in the difficult and sensitive guesswork of waterworks attribution. The clearest example is one for the 1860 Louisville Water Works. During the course of Hamlin's research, one of his interviewees showed him an unknown, privately-held, signed drawing that confirmed architect Gideon Shryock as the designer of the Louisville Water Works. Principal supervising engineer Theodore Scowden, of course, is famous for having drafted and submitted the design proposals, and it is he who holds design credit in the historical record, with no mention at all—except by Hamlin—of Shryock as designing architect.

Another example, not as cut and dried as Hamlin's privileged sneak peek at a previously unknown drawing, is indicative of the way in which historical questioning must more often proceed in the absence of complete evidence. In 1804, three years after Latrobe completed the Center Square Water Works, and the year following the nation's Louisiana Purchase, Latrobe (as the new National Architect) began designs for a national lighthouse at the mouth of the Mississippi River at New Orleans. Congress had ordered its erection, as the Louisiana Purchase highlighted potential for increased river commerce there: "The belief that New Orleans would become the greatest American port was common in the 19th century."[151] Between 1812 and 1817, Latrobe enlisted help from his son, Henry, in New Orleans to complete the lighthouse. In architectural historian Michael Fazio's discussion of Henry Latrobe's contributions to the New Orleans work, the historian cannot bring himself to assess very highly the younger Latrobe's gifts and talents as a designer.

[151] Fazio, "Benjamin Latrobe's Design," 232-47, esp. 232 n.4.

> Although both Latrobes were…involved in the lighthouse project, the exact contributions of each cannot be absolutely determined. No interim drawings remain, and no related correspondence exists for the period between late 1812 and mid-1816, although during this time there must have been considerable give and take between father and son. In June of 1817, Henry Latrobe's drawings of a new and final scheme reached his father who responded, "Your drawings came and were submitted to me. They do you infinite credit…Smeaton himself could have designed nothing of better construction and could not have designed a thing of such good taste."[152]

Fazio asks the question directly: "Could Henry have produced this design working on his own?" Henry's training had come in his father's office, after which he served as superintendent on the National Road. In 1810, his father sent him to New Orleans to work on the elder Latrobe's proposal for a city waterworks, as I have mentioned. Part of the success of that project came from the availability of his 18-year-old son, who spoke French, to supervise the project; his command of the language permitted the young Latrobe to negotiate the French-speaking New Orleans city council's acceptance of his father's water supply franchise scheme. Fazio comments on Henry's skills: "He was apparently a capable organizer, contractor, and inspector of the works, but the extent of his talent as a designer remains uncertain…. [T]he remnants of Henry's work…, while tantalizing, simply do not provide conclusive evidence."

The one drawing of the New Orleans waterworks temple I have found, for example, is inexpert. Judging from earlier drawings of Philadelphia's Center Square structure by Latrobe and Graff, it is implausible that Latrobe created this drawing, even though the building design is obviously a copy derived from his own Center Square Water Works. **[Figures 39, 40]** In the drawing, perspective and proportion are off; it appears to be an amateur effort clearly not penned by anyone of Latrobe's skill in architectural design.[153] The critical reasoning of Fazio, Eberlein, and Hamlin lends

152 Henry Latrobe to Benjamin Henry Latrobe, June 4, 1817, in *The Papers of Benjamin Henry Latrobe,* eds. Edward Carlos Carter and Thomas E. Jeffrey (Clifton, NJ: James T. White & Co. for the Maryland Historical Society, 1976), quoted in Fazio, "Benjamin Latrobe's Design," 241 n.42.

153 Images of the New Orleans waterworks temple are online at the "Collins C. Diboll Vieux Carré Digital Survey, A Project of the Historic New Orleans Collection," The Historic New Orleans Collection, accessed February 23, 2015, http://www.hnoc.org/vcs/. Relevant property record listings for the waterworks are

confidence to the supposition that prominent architects contributed to waterworks designs, even if those architects' contributions are not substantiated in the public or archival record. These waterworks engineers were highly influential in their own right—Graff, for example, consulted on 37 other waterworks in his career.[154] As leading innovators in their fields, and at the forefront of urban development, they would certainly have had a secure sense of their strengths and limitations.[155] As regular consultants on a wide range of city works projects, they themselves would have known on whom to call for help, particularly in areas outside their direct expertise, like aesthetic design.

BANKING ON GREEK REVIVAL: LATROBE'S FIRST TWO BUILDINGS, SIDE-BY-SIDE

In 1927, the same year Eberlein wrote about the transformation of the Philadelphia waterworks complex into a set of cultural institutions, he placed the waterworks' Greek Revival style in an architectural perspective. His commentary underscores the importance of the first three waterworks structures for the United States.

> Whatever may be one's preferences or sympathies in the matter of style, the Graeco-Roman or Regency is of considerable historic import because it was this manner of building of which Latrobe and his pupils, Robert Mills, Strickland, Graff and others, were such capable exponents. It was a style that still retained the human warmth as well as the suave Classical polish of the eighteenth century, in contrast to the archaeological frigidity and desiccated exactitudes of the Neo-Grec manner that was soon to overwhelm it and fill the land with temple-fronted houses. The arch and the lighter amenities had not yet been banished before the advancing hosts of the orders. The Graeco-Roman spirit, gracefully interpreted as it was by Latrobe and his contemporaries, profoundly affected the trend of public architecture for the first three decades of the nineteenth century, for Latrobe may justly be counted the father of monumental architecture in America.[156]

1000 Decatur Street, Square: 11, Lot Number 23331; and 800 Decatur Street, Square: 3_oldnumber, Lot Number: 18332-03.

[154] Gibson and Wolterstorff, "Fairmount Waterworks," 29.

[155] At Philadelphia, Graff, Jr. succeeded his father in the water superintendent's job from 1848 to 1856, when he resigned after governmental changes following city consolidation. He returned to the office from 1867 to 1872, making final alterations to and finishing the Greek Revival temple complex design for the Fairmount waterworks facilities. See Gibson and Wolterstorff, "Fairmount Waterworks," 29.

[156] Eberlein, "Fairmount Waterworks" 57, 64.

When Benjamin Latrobe arrived in the United States in 1796 from England and moved from Virginia to Philadelphia in 1798, he immediately set himself apart as one of the nation's first full-time builder-designers. While working in Philadelphia he alternatively labeled himself "architect" and "engineer," before American schools of architecture and the profession of architecture, *per se*, were established in the U.S.[157] He is celebrated as the first such professional in the United States to make a living purely as an architect. Before the development of architecture as a profession, building designers like Thomas Jefferson designed buildings as one among several avocations. Design foundations for Latrobe's Center Square Water Works are grounded in histories and antecedents Latrobe brought with him from England and the Continent, and which he amplified and innovated in Philadelphia for his first commission, Philadelphia's Bank of Pennsylvania, in 1798.

Bank architecture is an immediate context here, specifically due to Latrobe's relation to it and its relation to the Center Square Water Works as Latrobe's first American commissions. A bank was Latrobe's first building, and a waterworks was his second. To judge by his preeminence as the principal mover in a new American architectural style, it is imperative to examine that style, and Latrobe's relation to it, in the context of initial developments in Philadelphia's urban image. In 1871, about a decade before Latrobe's arrival on in Philadelphia, the first bank in the United States, The Bank of North America, had opened, headed by merchants interested in financing American Revolution war debt. Three years later, two more U.S. banks were founded on a Philadelphia banking model, one in New York and one in Boston. These new banks operated in existing buildings before they made plans to build new headquarters. Latrobe had been in London during the Bank of England's renovation in the 1790s, and brought

157 For example, in Latrobe's first report to the Watering Committee of Philadelphia, he is identified as "Engineer." The report was published as a letter to John Miller, Chairman of the Committee of the Select Council of the City of Philadelphia. See Benjamin Henry Latrobe, *View of the Practicability and Means of Supplying the City of Philadelphia with Wholesome Water: In a Letter to John Miller, Esquire, from B. Henry Latrobe, Engineer. December 29th, 1798* (Philadelphia: Zachariah Poulson, 1799). At another stage in the same project proposal, Latrobe signs "Archt" after his signature on his carefully rendered color "Sketch for a design of an Engine house and Water office in the city of Philadelphia March 1799." Stapleton believes that "Latrobe probably displayed this drawing at the 2 March 1799 meeting of the Philadelphia city councils when his plan for the waterworks was adopted." See Stapleton, ed., *Engineering Drawings,* 173-74, and pl. 8.

neoclassical elements of English bank design with him when he immigrated to the United States. In 1795, when Latrobe was arriving in Philadelphia, the new building for the Bank of the United States was under construction. Latrobe watched with interest as the work went up.[158] He admired "beautiful" material details, like the marble on the bank's Corinthian entrance portico, but he was not convinced by the workmanship on the ornamental details of the porch.[159] By 1798, then, when Latrobe began his Bank of Pennsylvania, he not only incorporated direct experience with English and other European architectural referents, but also assimilated very recent applications of similar referents. These influences certainly found their way into his first two Philadelphia buildings.[160] **[Figure 41]** The Bank of the United States had not included a dome; by contrast, Latrobe's Bank of Pennsylvania incorporated a square central block fashioned around a circular interior topped above the roofline by a shallow stepped dome on a low drum.

> Built in 1789-1800, the building appears at first glance to be a Roman temple on a podium, but the building combines many elements, each of which is used to create and express a space designed for a specific use. The bank consists essentially of a large circular banking room flanked by offices and chambers. Externally this can be seen in the cubical block that forms the center unit, with extensions front and rear that end in Ionic colonnades and pediments. Each of the rooms is vaulted in masonry; the banking room is covered by a saucer dome in brick, visible from the exterior, and lighted by a lantern over a central oculus.[161]

Roth cites the Ionic columns on the porches of Latrobe's Roman temple plan for Philadelphia's Bank of Pennsylvania of 1798-1800 as "among the first true Greek orders

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158 Samuel Blodget was the architect: "He was a gentleman, had plenty of time on his hands, and would not expect to be paid for the design. He was well traveled, had submitted a design for the U.S. Capitol, had spent a year in the District of Columbia as superintendent of public works, was friends with [other prominent] designers" of the period, and had helped to found two banks previously. See Kenneth Hafertepe, "Banking Houses in the United States: The First Generation, 1781-1811," *Winterthur Portfolio* 35, no. 1 (Spring, 2000): 16-17.

159 Hafertepe, "Banking Houses," 17-18, and fig. 7, a reproduced engraving of Blodget's bank building by William Birch, "Bank of the United States, 1795-97," originally published in William Birch, *The City of Philadelphia, in the State of Pennsylvania North America; As it Appeared in 1800: Consisting of Twenty Eight Plates* (Philadelphia: W. Birch, 1800), pl. 17.

160 On influences on Latrobe by his first European employer, John Smeaton, known for waterworks projects, see Garner, "Tanks and Towers," 208, and Fazio, "Benjamin Latrobe's Design," 232-47.

161 Roth, *American Architecture,* 122.

used in the United States."[162] Whiffen and Koeper confirm the Bank of Pennsylvania building as "the first use of a Greek order in America."[163] Latrobe was clear about his preference toward the Greek in a letter to Jefferson, in which he made this testament: "My principles of good taste are rigid in Grecian architecture."[164]

This discussion of the first bank buildings in the United States is important to my discussion of waterworks, for the bank as Greco-Roman temple introduced a style soon to become a staple not only for banks but for other key American building types, as well: government capitals, universities, churches, and, most pointedly here, waterworks.[165] Latrobe's prominent debut of his own brand of new neoclassical bank architecture in Philadelphia directly influenced his waterworks design: recall that his Center Square Water Works was his second U.S. commission after the Bank of Pennsylvania. Together, these two buildings mark the initial point on a timeline for waterworks in American architecture history. Latrobe's direct borrowings from and innovations upon neo-classical precedents from the 18th century made high cultural statements for public works, bank, church, and government building design, joining them all into a canon contemporary American architecture of cultural distinction.

British and French Influences on American Public Works Design

Clearly, then, waterworks architecture played a leading role in establishing a modern American identity, with the beginnings of a coherent urban image, throughout the 19th-century. The prominent architectural styles that housed other types of defining

162 Roth, *American Architecture,* 122. Fig. 4.21 shows Latrobe's watercolor rendering of his Bank of Pennsylvania. The work is held in the Papers of Benjamin Henry Latrobe at the Maryland Historical Society. Latrobe's bank was not the first in Philadelphia, though it did follow closely upon the Bank of the United States building by Samuel Blodget in about 1795. See Hafertepe, "Banking Houses," 16.
163 Whiffen and Koeper, *American Architecture,* vol. 1, 134.
164 Whiffen and Koeper, *American Architecture,* vol. 1, 130.
165 The first U.S. bank buildings are indebted to the architectural style of the Bank of England in London, whose first bank house was designed in 1734 by George Sampson. "Sampson's facades for the bank reveal a close study of the Palladian-style facade of Somerset House (then thought to be by Inigo Jones or his successor, John Webb) as well as a familiarity with the Palladian work of the last decade…. The Palladian style, however, was less influential on American banking houses than were the internal arrangements of the bank." See Hafertepe, "Banking Houses," 1-52, esp. 4-6 and figs. 3, 4.

institutions—economic, religious, government—also identified waterworks. Latrobe's Center Square temple pulls from an ancient classical vernacular common to pattern books circulating at the time; one imagines Latrobe must have been familiar, for example, with such 18th-century British publications as *The Temple Builder's Most Useful Companion* and the periodical *The Builder's Magazine*.[166] Round and octagonal temples at Athens, Rome, and other classical sites came to Europe in the 19th century with the first scientific archaeological expeditions; these yielded measured drawings of selected ancient structures. Noteworthy as early architectural sources for round and octagonal temple-style buildings were the Athenian Tower of the Winds (or *Horologion*, c. mid-1st century BCE), a water clock, and the Monument of Lysicrates (335-334 BC), a choragic monument, designed to display bronze prizes won by choral directors in dramatic contests. These structures were well-known in the 18th and 19th centuries: drawings had been published in 1758 by Julien-David Le Roy and in 1762 by James Stuart and Nicholas Revett.[167] One notes an 18th century French octagonal pump house, an early waterworks example of this form. **[Figures 17, 18, 19]** Roman models included the ancient round temples at Rome and Tivoli, widely emulated in neoclassical architecture, and of note specifically in the anchor object for this dissertation, the 1910 Sunol Water Temple, analysis of which is central to this dissertation. **[Figure 20, 63]**

In addition to representations of classical source buildings, architectural pattern books were in wide circulation, notably those by Asher Benjamin (1771-1845), who had been an assistant to Boston architect Charles Bulfinch, who assumed the Architect of the Capitol position after Latrobe. Benjamin published seven pattern books like *The*

166 Thomas Collins Overton, *The Temple Builder's Most Useful Companion, Being Fifty Entire New Original Designs, for Pleasure and Recreation; Consisting of Plans, Elevations, and Sections, in the Greek, Roman, and Gothic Taste* (London: Printed for Henry Webley, 1766); and John Carter and Andrew George Cook, *The Builder's Magazine*, published periodically in London between 1794 and 1817: "Consisting of designs in architecture, in every stile and taste, from the most magnificent and superb structures, down to the most simple and unadorned. Together with the plans, sections, and elevations, serving as an unerring assistant in the construction of any building, from a palace to a cottage."

167 Julien-David Le Roy, *Les Ruines des plus Beaux Monuments de la Grèce* (Paris, 1758, 2nd ed. 1770). James Stuart and Nicholas Revett, *The Antiquities of Athens*, 4 vols. (London: J. Haberkorn, 1762-1816); a supplementary volume was issued in 1830; cited in Hamlin, *Greek Revival Architecture*, 36. Thank you to Penelope Davies for clarification.

American Builder's Companion (1809), between 1797 and 1843, with multiple editions keeping the works in print into 1850s. Builders who could not travel relied on such books for models, styles, and trends. Benjamin's were not the first; other well-used volumes preceded his. Resurgences of interest in ancient writing on architecture kept Vitruvius' *Ten Books* at the forefront, as they did Andrea Palladio's *Four Books of Architecture* of 1570. These had been distributed in English in the first quarter of the 18th century, as had books on works of 17th-century British Palladian architect Inigo Jones. Other volumes popularizing images of ancient ruins had circulated in English since before the mid-18th century. The prominence of these "well-studied, well-proportioned, well-detailed, but rather conservative" patterns "helped spread the influence of the classic revival after 1820."[168] Important to this study, their dissemination appears to have played a significant part in moving architectural revival styles to the Western territories.

As a protégé of Smeaton in England, Latrobe drew upon architecture of eclectic European origins even as he initiated his own American Greek Revival signature style in Philadelphia. Longstreth's term "*academic eclecticism*" directly references the French and British academies' 17^{th-} and 18th-century neo-Palladianisms—one must attach the unavoidable proviso that Palladio himself was a sixteenth-century "revivalist," as were Italian Renaissance artists and architects of the various "rebirth" movements throughout Europe. From within and among continuous nestings of serial revivals—a more accurate term might be "refigurings"—of "original" ancient and classical source styles, rigid boundaries imposed by the language of historical "periods" begin to disappear. New variations derive from a constant refiguring of the "classical" for each ensuing culture that adopts it, even during antiquity. Roman refiguration of Greek art and architecture begets Hellenism; the Romanesque characterizes post-Imperial Late Antiquity; historians like the Gothic to stand as an independent structural miracle all its own; plethorae of regional classical revivals formulate the Italian Renaissance; and, interconnected momentums ground European neoclassicisms, such as British neo-Palladianism, the École des Beaux-Arts in Paris, and the "foreign" academies (such as the American

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168 Roth, *American Architecture,* 125-26.

Academy and the British School) in Rome. Finally, for the United States, the American Beaux Arts arises, exemplified in New York by McKim, Mead and White, and giving rise to the eclecticism of American historical revival styles. On this deep and far-reaching eclectic revivalist foundation, and each within its own quite specific context, Latrobe and other innovators created "new" American 19th-century neoclassical architectural style of Greek Revival, but even within that stylistic category, they presented new versions, innovative eclecticisms, new hybridizations. All are fresh and unprecedented yet each can sets itself apart with its own set of historical terms. Richard Longstreth's term "academic eclecticism" incorporates the whole, and assumes that the more prominent architects were working from a base of academic training (or indirect access to it) and conscious dedication to architectural history.

The contexts of period observers, critics, and historians also determine ways in which they have described, explained, and understood eclecticism in specific buildings. Latrobe's round water temple for the Philadelphia Center Square, for example, is taken by some as inspired by Ledoux, based on period adjacencies, currencies in taste, and formal likenesses.[169] In the case of Latrobe's work in New Orleans from about 1804 to 1820, a French cultural presence is direct and immediate, and may indeed have exerted its influences. One recalls that, as the major city associated with the purchase of the Louisiana Territories from France, the New Orleans City Council did business in French well into the 19th century. Latrobe described New Orleans as being primarily French, culturally. He lamented that "American" culture was rapidly overtaking over the Old World French styles of architecture in the city, "a replacement of good taste by bad." He observes that "the suburb of St. Mary, the American suburb, already exhibits the flat,

169 Garner and Roth both call the structure "Ledoux-inspired." Roth draws a comparison between Latrobe's Water Works and Ledoux's Barriere de la Villette in Paris (1760). See Garner, "Tanks and Towers," 208, and Roth, *American Architecture,* 126.

dull, dingy character of Market Street in Philadelphia…instead of the motley and picturesque effect of the Stuccoed [F]rench buildings of the city."[170]

Fazio's analysis of Latrobe's New Orleans lighthouse sheds light on the question of nuance in revival eclecticism for American architecture—in this case, a French-English eclecticism specific to early 19th-century New Orleans. His approach dissolves the either-or, "English-or-French," imperative into an open dialectic:

> Besides Smeaton's towers, the only lighthouse design that Latrobe ever praised in any of his writings was the Cordouan tower, located at the mouth of the Gironde River, which he singled out for its "magnificence and size."…While the design, as depicted by Claude Chatillon in c. 1612, might have been too highly articulated for Latrobe's taste, the tower's form in the 18th century had been distilled to a simple, battered base, and initial (and original) and tower stage with classically inspired ornamentation, and a relatively plain, truncated cone above. …In 1740, in the midst of a controversy over new lighthouse construction, the French Admiralty declared Cordouan to be an architectural standard. Lighthouses, they contended, had to "serve posterity" and therefore "should reflect the genius of the period and accord better with the dignity of the monarch who authorized their erection, thus continuing the national propensity to decoration that had been demonstrated at Cordouan." This attitude heavily influenced the French architectural community. …And not only can Latrobe's schemes be interpreted in the context of Cordouan, but they can also be compared to the work of his contemporary in France, Claude-Nicolas Ledoux, and slightly later to such designers as C.-P.-J. Normand and C.-J. Toussant. …While none of Latrobe's writings indicates an awareness of any of this work or even of Cordouan's legacy, this omission, rather than suggesting that he was uninformed about European precedents, reveals the unique vision of his design. It had not appeared full blown, as though coldly drawn from existing models. It had evolved in Latrobe's mind and on paper as a dialogue between structure and form, the respective interests of Smeaton and the French Neoclassicists.[171]

Here, Fazio aptly underscores nuance in a sophisticated English-French eclecticism feeding Latrobe's inventive design. At the same time, he singles out ways Latrobe's "original" American-style refigurings, especially of public works, "serve posterity" as historical revival designs.

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[170] Gary A. Donaldson, "Bringing Water to the Crescent City: Benjamin Latrobe and the New Orleans Waterworks System," in *Water-Supply and Public Health Engineering,* ed. Denis Fischbacher-Smith (Aldershoot, Great Britain: Ashgate, 1999), 198, 205.

[171] Fazio, "Benjamin Latrobe's Design," 238-39.

> Latrobe's first scheme was an isolated shaft whose plain exterior concealed the beginnings of structural innovation. Next came the visual merging of the tower and the keeper's house. And, finally, the tower and keeper's house were completely interrelated, both structurally and formally. The result was unique and unified. Latrobe had drawn upon his experience with Smeatonesque structure and the spirit of 18th century French models. But his design transcended both European practice and theory.[172]

Fazio's analyzes ways Latrobe's underlying artistic aim in public works was to marshal a transcendent "dialogue" between form and structure, clearly mindful of the relation between individual structures and their larger urban and cultural context.[173] When Latrobe records his impression of three prominent buildings on the New Orleans skyline, for example, he draws a clear distinction between two views: first, of each structure seen close up, and, second, of the group seen from a distance:

> 'In detail [they] are as bad as they well can be,' [even as] their symmetry, proportions, strong relief and solid mass produce…'an admirable effect when seen from the river or the Levee.'[174]

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172 Fazio, "Benjamin Latrobe's Design," 238-39.

173 Fazio, "Benjamin Latrobe's Design," 239.

174 Donaldson, "Bringing Water to the Crescent City," 390; Richard W. Longstreth, "Academic Eclecticism in American Architecture," *Winterthur Portfolio* 17, no. 1 (Spring 1982): 55-82. I can exaggerate my point by proposing that we pressure such an either-or imperative in another way, for example, regarding another rich field, of Mediterranean influence. In this case we might oppose variable terms. From when and where? Ancient Greek-or-Roman? Late Antique Spanish-or-Moorish? Early Renaissance Florentine-or-Sienese? High Renaissance Venetian-or-Roman? (Or to push the question even further, Padua-or-Brenta Palladian?) These are not new questions for art historians in general, but deconstructive questioning regarding historical "source" influences exposes a sophistication that reveals stylistic differences, which are important as a set of differences that defines a stylistic category to set it apart. Within that category we call on specific likenesses among specific examples to group them. It makes sense, within this analysis of waterworks in the larger context of 19th-century American historical revival architectural terms, to categorize Latrobe's brand as "Greek Revival." To scrutinize one branch of the style—that is, to expose the tensions that result from precise nuances between English and French influences, for example, and yet to insist on privileging British over French or vice versa—may go too far. We only need to analyze works well enough to expose the eclectic nature of "different" historical revival styles and permit us to create and discuss visual categories. To return to the British-French question with which I began: we do not need to "make up our mind" *between* French or English for this period in American waterworks, especially when discussing Latrobe. Enough scrutiny exposes the several contributions eclecticism requires to name and place a style. Any eclectic style can be named when it toggles in the balance between two (or more) different architectural types. This "toggling" inscribes combinations that together define a "pure enough" style. We can view Latrobian Greek Revival, then, as pure enough to be considered as a major style apart, on its own merits, as defining a group of differences from other neoclassical aspects. As such it becomes a major referent in discussions of other eclectic "historical revival" styles that depart from and/or respond to it.

Latrobe's ability to see, value, and produce nuance filed his leading edge as an inventive creator whose utilitarian waterworks were artistically significant architecture, active participants in 19th-century American urban image formation.

GREEK REVIVAL IN KENTUCKY: LOUISVILLE WATERWORKS (1860 AND 1893)

After Philadelphia, the waterworks at Louisville, Kentucky, capture an art historian's interest as an example of significant U.S. waterworks architecture. **[Figure 42]** The 1860 Louisville Water Works was a late Greek Revival, early Beaux-Arts, villa-style temple complex, comparable in general plan and architectural design to the Fairmount Water Works, although specific details differ. Corinthian column order and ornate theatricality at Louisville made this "almost Palladian" design a stark contrast against the relative restraint of Fairmount's early Greek Revival character.[175] The main works building was on a symmetrical axial plan composed of a central colonnaded pavilion temple bisected laterally by symmetrical wings with small end-cap temples. This villa building was centered behind a magnificent standpipe in the form of a monumental Doric column, its base surrounded by a Corinthian peristyle and its crown topped by an ornamental lantern large enough to function as the tower's belvedere. The moulded architrave of the round base temple carries a balustrade that incorporated ten figural statues. "Scowden's original plan called for ten urns—one over each column—rather than statuary," but in 1861, Charles Hermany, Scowden's assistant and immediate successor, placed ten statues, forged at a Brooklyn foundry.

> Seven of the statues were of figures from classical mythology, one was a typical piece of Victorian garden statuary (a young girl in a bonnet and ankle-length dress and a basket of flowers over one arm), and the other two are unknown.[176]

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175 Hamlin, *Greek Revival Architecture*, 249..

176 Scowden had brought his assistant, Charles Hermany, to Louisville with him. Hermany moved to Cleveland in 1853 from Pennsylvania to become Scowden's assistant engineer there. Scowden resigned from the Louisville position after the works opened in 1860, assigning Hermany as his successor. Hermany remained Waterworks Superintendent until he died in 1908. During his long tenure he implemented the first modern large-scale water filtration system which served as a prototype through the 20th century. See Yater, *Water Works,* 6-9, 16; and for quotation above, 38. See also Maurice Joblin, *Cleveland Past and Present: Its Representative Men* (Cleveland: Fairbanks, Benedict and Co., Printers, 1869), 436.

In 1890, a tornado and flood destroyed the complex, and the tower's collapse obliterated all statues but two, subsequently lost. When the waterworks was replicated *in situ* in 1893, new statuary, of different design, style, and figural content from the original, was installed. Specific details are unknown, except for the enduring description of one figure, a representation of an Indian with a dog. The new statuary's placement was finally completed as late as 1909.[177] Except for twin smoke stacks rising behind it, the design, like that of Fairmount, "clothed" the waterworks' "utilitarian purpose in a graceful classical exterior and capped it with a lighthouse-like observation area" accessible by a cast-iron, circular staircase that wound up around the standpipe to the domed observation lantern.[178] At the same time, the water company increased its capacity with a new rusticated brick Romanesque pump house adjacent to the Greek Revival complex; a third masonry pumping station was added in 1919. **[Figure 43]**

Both the original Greek Revival waterworks and its replicate provided an exemplar of the balance, measure, flourish, and taste of 19th-century American architectural style. The 1893 copy, completed in the year of the Chicago Exposition, consciously exhibits the full "White City" effect to which Daniel Burnham's fair aspired. Its timing in the course of American architectural development allowed the Beaux-Arts flourishes that set it apart in time and style from the earlier, more austere Greek Revival of Philadelphia's works.

GRAFF IN PHILADELPHIA, SCOWDEN IN LOUISVILLE: INFLUENCE AND INTERCHANGE

It is tempting to compare the two works on visual qualities alone, but evidence supports a close association not only between the two engineers at Philadelphia and Louisville and among waterworks engineers in a general, collegial sense, but also between the two cities as they gained recognition and status as leaders in urban waterworks advancement. Period evidence gives a strong impression that waterworks

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177 George Yater, *Water Works: A History of the Louisville Water Company* (Louisville, KY: Louisville Water Co., 1996), 38.
178 Yater, *Water Works,* 7.

technology and architecture made strong claims on public consciousness: waterworks and aqueduct systems were of great public interest and celebration—not in the least because they offered much-needed relief from the constant fire threat. Waterworks engineers from various cities consulted together regularly, and tended to show up for each other's projects at pivotal moments. This was true of Frederick Graff, Jr. and Theodore Scowden. For example, in 1857, a report from the Detroit Office of Waterworks shows that during 1855 and 1856, Scowden and Graff, Jr. were invited to experimental pump engine trials at Hartford and at Jersey City.[179] This occurred as Scowden was beginning his tenure in Louisville and as Graff began a major phase of Fairmount expansion and renovation. Clearly, the waterworks engineering community was a close-knit one, and within it, Graff and Scowden were sought for their expertise. In all, Graff, Jr. consulted on thirty-seven waterworks in his career.[180] As for Scowden, after working on canal engineering, his first waterworks superintendency was in Cincinnati; when he finished those waterworks, the city hired him to complete a survey of European waterworks, ancient to modern. After submitting his travel report, he joined the city of Cleveland as its chief waterworks engineer, then supervised new waterworks at Newport, Kentucky, before moving to Louisville in 1856 as Chief Water Works Engineer and completing the waterworks in 1860.[181] **[Figure 44]**

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[179] Also invited to the Hartford preview were George Bailey of Jersey City, Henry Cartwright of Buffalo, and Edward Dickerson and F.E. Sickels of New York City. Scowden did not attend the first trial, and Graff was "unable to remain" for the second. See Detroit Water and Sewerage Department, *Annual Report of the Board of Water Commissioners to the Common Council of the City of Detroit, Together with Reports of the Superintendent and Engineer, and Secretary, for the year ending December 31, 1856. Report to the Office of Waterworks, January 20, 1857*(Detroit: Free Press Printing House, 1857), accessed February 24, 2015, http://books.google.com/books?id=NnYgAAAAMAAJ, 13, 15.

[180] Gibson and Wolterstorff, "Fairmount Waterworks," 29.

[181] "In 1851 Mr. Scowden was commissioned by the city of Cincinnati, to make the tour of England and France for the purpose of examining the principles and workings of public docks, drainage, paving and waterworks. After returning and making his report, he resigned his post and came to Cleveland, for the purpose of constructing the waterworks now in operation in this city. The plan and designs were completed during 1852, and active operations commenced in 1853." See Joblin, *Cleveland Past and Present*, 436.

Of interest is a long letter Scowden wrote in 1857 to the editors of the *Louisville Courier*, a letter Frederick Graff collected in his personal scrapbook.[182] In the several-column newspaper piece, Scowden defended Louisville's waterworks project plans—a special election in the previous year had passed waterworks funding through stock sales, and in the face of apparent public criticism of his appointment, he unapologetically asserted his qualifications. Public resistance was not new. Since 1834, public opposition had kept Louisville's municipal waterworks for Louisville on hold, even after the Kentucky state legislature had given approval. By 1856, decades of project campaigns finally persuaded the public to approve funding through stock sales, but these were contingent upon several public demands, including retaining traditional public pumps.[183] Adjacent to Scowden's article in the same 1867 issue of the *Courier*, an equally long letter appeared describing the history and importance of Philadelphia's Fairmount Water Works.[184] The two newspaper pieces, taken together, supported not only a close association in the public mind between Louisville and Philadelphia waterworks, but also an active interest in the two cities' respective celebrity engineers. Moreover, Graff's conscious possession of the Scowden clipping evinces Graff's connection to Scowden, for he did not clip only the piece about Fairmount. This small constellation of variables demonstrates the value the two urban waterworks held in the cultural milieu.[185]

One cannot underestimate the importance of the belief among engineers and urban planners at this time that a modern American builder—of waterworks or any other

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182 Scowden's letter appears as "The Water Works: Engineer's Office Louisville Water Company, Louisville, March 3d [stet], 1857, To the Editors of the *Louisville Courier*," *Louisville Courier,* March 3, 1857. 88-1, 88-2, 88-3 to 89-1, Graff Scrapbook, Historical Collection, Philadelphia Water Department (PWD). A copy of this letter is in the Graff Scrapbook, 88-89, Historical Collection, PWD. Thanks to Adam Levine, Archivist, Philadelphia Water Department, for sending me a photocopy of the original newspaper clipping from Graff's scrapbook.

183 Yater, *Water Works*, 5-7.

184 Charles V. Hagner: "To the Press: The origins and early history of Fairmount Water Works, Schuylkill ane [stet] Lehigh navigations, and the introduction of anthracite coal," *Louisville Courier,* March 3, 1857, 89-1 to 89-5. See Graff Scrapbook, 88-89, Historical Collection, PWD.

185 I have come to similar conclusions working with Willis Polk's private scrapbooks in the archives of the California Historical Society in San Francisco. Many thanks to the CSH staff, especially to Alison Moore, an experienced Bay Area archivist who directed my attention to the rich material held there and in other local collections.

modern architecture—should be well-versed in waterworks around the world, their history, engineering, and architecture. This follows a "gentleman architect" tradition, an ideal famously embodied in Thomas Jefferson. The advantage of world travel and field study in an architect's or engineer's "training" was not a new practice at mid-century when Scowden made his European waterworks study. In 1818, Benjamin Wright, Chief Engineer of the Erie Canal, had sent his assistant engineer Canvass White to the British Isles to study over 2,000 miles of aqueducts and canals.[186] In the mid-1820s, William Strickland was assigned field work in England under the auspices of the Pennsylvania Society for the Promotion of Internal Improvements. In 1837, John B. Jervis wasted no time after taking the chief engineer post on New York's Croton Aqueduct in hiring as his principal assistant Horatio Allen; in 1835, after renowned railroad work in South Carolina, Allen had honeymooned abroad, specifically to study modern waterworks in England and France and ancient water engineering in Rome and Egypt.[187] Fayette Tower, New York City's Croton Aqueduct assistant engineer, also traveled to Fairmount waterworks and park on his honeymoon.

Theodore Scowden was vociferous in his valuation of world waterworks engineering and history. In his 1857 letter to the editor, he explains:

> My research has not been bounded by the limits of my own country, but I have visited all Europe, and there is not a water works of any importance in the world the dimensions and plan of which I have not accurately drawn to scale, which I now have in my office.[188]

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[186] See Wright's biography online: "Benjamin Wright," American Soceity of Civil Engineers, accessed February 24, 2015, http://www.asce.org/templates/person-bio-detail.aspx?id=11237.

[187] Koeppel, *Water for Gotham,* 225.

[188] Scowden, "Water Works," Graff Scrapbook, 88-3, Historical Collection, PWD. Also see Margaret Wheeler Hilliard, "The Louisville Water Works Pumping Station Number One" (M.A. Thesis, University of Virginia, 1981), Appendix A, 49-50. Hilliard's chronology of Scowden's career lists the following: "1851 – Sent to France and England to observe public docks drainage paving and water works by the Commissioners of Cincinnati; 1852 – Sent to Milwaukee to examine a pumping engine by Cincinnati. Then became chief engineer for the Cleveland Water Works which he designed and supervised until their completion in 1856; 1857 – Appointed chief engineer to design a new water works for Louisville." Hilliard cites Joblin, *Cleveland Past and Present,* and M. N. Baker, ed., *The Manual of American Water Works* (New York: The Engineering and News Publishing Co., 1888, 1889, 1890, 1891 and 1897). An 1881 history of the Cincinnati Water Works reports that while Scowden was in the process of building the Cincinnati works, the city tested its water quality, which it found to compare favorably against "the

One must surmise his European waterworks study to have influenced his image for the Louisville works, but a review of architectural values centered on a Greek Revival aesthetic in Kentucky, with the additional influence of Fairmount's prominent presence, must also have honed the Greek Revival focus. Even on this evidence, art and architectural historian Talbot Hamlin is not convinced that Scowden designed the works himself. The Chief Engineer's taste for historical architecture and his engineering expertise are simply not enough; the sophistication and detail he envisioned must have required assistance from an architect. Hamlin's reasoning convinces him to attribute the design to Kentucky architect Gideon Shryock (1802-1880), and this was confirmed, in the course of his research, when Hamlin learned of or was shown an elevation drawing, signed by Shryock, in a Shryock family document collection.[189] Another source confirms knowledge of Shryock-signed drawings for two Louisville waterworks buildings:

> The original office of the Louisville Water Works Co. on Third Street near Walnut, was designed by this architect, a drawing of this building still preserved having his signature. The Water Works buildings on the Ohio river, handsome specimens of Corinthian architecture, with a slender water tower of unusual beauty, are attributed to him by his eldest daughter, Miss Alethe Shryock. The company's records do not mention the name of the architect, however. [190]

Hamlin's waterworks attributions—the 1860 Louisville water complex to Shryock, and the 1812 Fairmount Engine House in Philadelphia to Mills—bolster my own questions regarding Strickland's involvement in waterworks design, especially for Philadelphia. The questions leading to these attributions pose important art historical queries for public

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celebrated Croton water" of New York City's aqueduct. See Thomas J. Bell, *History of the Cincinnati Water Works* (Cincinnati, OH: Robert Clarke, 1881), 41.

189 Hamlin notes that "the attribution of this group to Shryock has been questioned, since his name does not appear upon the tablet attached to the water tower. However, Mrs. Willis Field, Shryock's niece, owns a signed elevation of the waterworks office, which seems to make the attribution of the works themselves to him probable." See Hamlin, *Greek Revival Architecture,* 244-49 n. 16.

190 See Mrs. Elizabeth S. Field, "Gideon Shryock: His Life and His Work," *The Register of the Kentucky Historical Society* 50, no. 171 (April, 1952), 111-129. A footnote on the first page of the article reads: "Prepared for and read to the History Department of the Woman's Club of Central Kentucky, Oct. 30, 1920" (111). Field refers to herself ("the writer") in the article as the daughter of Gideon Shryock's younger brother, making Field Shryock's niece. She, then, is either the same person as Hamlin's source, Mrs. Willis Field, or both women were nieces of Shryock (121).

works history. The waterworks architecture I discuss made significant contributions to architectural history, even if the works have not played a prominent role in the historical discourse.

PHILADELPHIA & LOUISVILLE: UNTANGLING COMPLEXITIES OF MUTUAL INFLUENCE

The assertive Greek Revival waterworks design development at Philadelphia (1820-1872) and Louisville (1860-1893) present interesting historical exempla for public works aesthetics**.** Close comparison reveals complexity and nuance that complicate issues of influence—from an initial impression of direct one-way influence by the earlier structure on the later, to oscillations of mutual give and take over time. Each city, in its own way, showcased important Greek Revival design innovations, and the aesthetic eye of the nation—of the world, at times—was trained on the two cities through the 19th century. Local architects, urban waterworks chiefs, civic sponsors, and planning boards guided their city works toward major advancements, in technological and architectural modernism. These buildings were not victims of Hamlin's aesthetic "black out."

To this day, the Fairmount Waterworks are an important cultural landmark in Philadelphia. Throughout history and to the present day, one of the most popular views of the riverside city features the historic first municipal waterworks, with its mirror image gleaming in the water's surface in the foreground. In the late 1920s, the Philadelphia Museum of Art entered the scene, lording the crown of the hill above. **[Figure 35]** This image is accomplice to a truncated history. It leaves an impression that the Fairmount building—known to be an early-19th-century structure—is now what it always was, that it rose of a piece, in its full Greek Revival splendor. It is indeed difficult to grasp in such a view that the 1812 Federal-style Engine House, now a margin to the Greek Revival complex, once stood alone. It is harder still to unravel the various building stages of the Greek Revival complex, which took place over the course of fifty years, between 1820 and 1872. And, viewing the Louisville Waterworks, it is difficult to "see" that the present structure, from 1893, is a copy of the original destroyed works of 1860. The eye wants to assume that Louisville's 1860 works were directly influenced by Philadelphia's 1820 works. A selective comparative review of the timelines of both buildings, however, permits a more realistic picture of ways in which the two buildings influenced one another. My trained eye sees a mutual give-and-take of influence over the decades.

Scowden completed the Louisville waterworks, probably upon architect Gideon Shryock's design, in 1860—well after the first major expansion of the Philadelphia works in 1835 had added the dam crest promenade to the octagonal pavilion on the river. The Louisville works came within a decade of Scowden's work on the first Cleveland, Newport (Kentucky), and Cincinnati works, whose later updates he also planned. **[Figure 44]** The appearance of the Louisville works came nearly two decades after even New York City had completed its Croton Aqueduct in 1842 (the topic of the following chapter), with its arcaded High Bridge still under construction until 1848. So, any direct influence by the Fairmount works upon the 1860 Louisville design came from the second and third construction surges at Philadelphia, in the 1830s and again in the 1850s and 1860s. Indirect influence could have come from Graff's 1820 proposed drawing, if Scowden had seen it, and one might guess Scowden would have seen it. Even Scowden's design investigations and innovations at Cincinnati and Cleveland in the 1840s and 1850s came *after* the Fairmount expansion in the 1830s, as did Scowden's waterworks field research in Europe in the 1850s. Moreover, considering that Louisville's coherent, mature, and ornate Greek Revival design was initiated a dozen years *before* Fairmount's 1872 completion, one should consider that Louisville's 1860 waterworks may have borne considerable influence upon Fairmount's final form. This may be true even despite the apparently embedded assumption in the written record that Graff, Jr.'s primary intention was to honor his father's original 1820 plan for the building.[191]

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[191] In 1872 Scowden submitted a report to the City of Cincinnati in response to its request for him to assess the obsolescence of the very works he had built in the 1850s. Scowden recommended immediate replacement: "The consequences of delay are real, not imaginary; they present themselves too forcibly to be mistaken, for should any one or two of the Pumping Engines now in use become disabled, the city would be put on short allowance of water, which would seriously incommode private families, and materially damage the large manufacturing interests at stake. The loss and suffering incident to fire is impossible to estimate or foresee. The whole damage would not end there, for should the remaining Pumping machinery, doubly taxed and strained, become disabled, as the present Reservoir affords no storage, and the consumption of water being great, it would soon be exhausted, and the city would be

Louisville's works are similar enough in plan to Fairmount's—a symmetrical arrangement of a central colonnaded temple flanked by low intermediate wings end-capped by smaller-scale temple pavilions—to allow for Philadelphia as an initial influence. With this thought in mind, one considers that the Louisville central temple, much more grandiose in scale, execution and ornament than the 1820 Graff drawings proposed, now might be seen as a *precursor* to Graff, Jr.'s final, embellished upgrade for 1872. Fairmount's 38-column peripteral showpiece, with its two endcap temples in antis, and the broad dam promenade crowned with its octagonal pavilion, are much more than Graff, Sr. (and perhaps Robert Mills) could have bargained for. There is no space in this dissertation to launch the ante- and post-bellum analysis of Greek Revival architecture that suggests itself here. The final Philadelphia temple certainly retains the elegance and restraint of the original plan and of the early Latrobian Greek Revival. By contrast, the degree of ornamental detail on the Louisville works is consistent with stylistic developments in antebellum neoclassical architecture after mid-century. This is specifically and especially true for Louisville, Kentucky, a relative late-comer to Greek Revival, but a quick and thorough study once arrived. These two major neoclassical landmarks in waterworks architecture, then, were not isolated creations. Each city's waterworks influenced the other over the second half of the century. In the end, they are two discrete works. But together, they stand prominently as exemplars of an aesthetic clearly meant to consign waterworks to the canon of innovative achievements in American architectural history.

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totally deprived of a supply of water. Such a condition of things, though impropable [stet], is possible, and may doom Cincinnati to a fate no more impropable [stet] than that which recently laid a sister city in ashes." Scowden probably refers to the Great Chicago Fire of 1872, which the Chicago Gothic Revival pump house and water tower survived. See Theodore R. Scowden, *Special Report on the Extension and Enlargement of the Cincinnati Water Work* (Cincinnati, OH: Trustees of Water Works, 1872), 7.

CHAPTER 3

Allure of the Ancient: Manhattan's Waterworks History

As the Philadelphia Water Works evolved in the technological spotlight, the world was also watching New York City's waterworks developments in the 1830s and 1840s. The 1842 Croton Aqueduct was Manhattan's first successful solution to the problem of a long-term water supply, but this was by no means the city's first attempt to create a waterworks system.[192] From the time of the first European settlement at Manhattan island in the 17th century, water supply was a problem. A limited ground water source, which a "Tea Water" well tapped for Manhattan until the early 19th century, was inadequate to supply the island city's rapid growth northward. Chroniclers of New York City water system histories describe a maze of attempts to organize a single water supply system, but into the first several decades of the 18th century, haphazard efforts produced no result. In 1799, this appeared to change, when the Manhattan Company chartered "an act for supplying the city of New-York with pure and wholesome water."[193] The company held the water monopoly permitted by its charter for three decades without creating the system it promised, but it did produce a modest Greek Revival inspired waterworks structure. The 1801 Manhattan Company Reservoir boasted a shallow portico applied to a plain masonry above-ground storage structure, a new upgrade from a utilitarian metal tank. **[Figure 45]**

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192 For histories of New York City's water supply, see Kevin Bone and Gina Pollara, eds., *Water-Works: The Architecture and Engineering of the New York City Water Supply* (New York, Monacelli Press, 2006); Diane Galusha, *Liquid Assets: A History of New York City's Water System* (Fleischmanns, NY: Purple Mountain Press, 1999), which surveys major works of NYC water system development between 1837 and 1996; and Gerard T. Koeppel, *Water for Gotham: A History* (Princeton, NJ: Princeton University Press, 2000).

193 New York Legislature, Assembly, *Journal of the Assembly of the State of New York,* 22nd Session (Albany, NY: New York State Assembly, 1799), 261-63, quoted in Koeppel, *Water for Gotham,* 81 n. 17; and *Laws of the State of New York, Passed at the Twenty-Second Session* (Albany, NY: Loring Andrews, 1799), ch. 84, quoted in Koeppel, *Water for Gotham*, 85 n. 29.

THE MANHATTAN COMPANY'S WATER MONOPOLY: FAILURE TO OVERCOME INERTIA (1799 – 1830S)

Immediately after its 1799 founding, the Manhattan Company invited water system proposals, established a pump house site, planned a reservoir, and began laying a bored-log distribution pipeline. Designs for the reservoir ranged from a "Grand Reservoir" of five linked basins, to a square masonry structure, a million-gallon octagonal reservoir, and a lead-lined 250,000-gallon tank. Well-known architect-engineers presented designs.[194] The design finally built was a 100,000-gallon rectilinear reservoir with plain masonry walls, the street façade ornamented by a portico lintel featuring a sculptural relief of the sea god Oceanus, the Manhattan Company's trademark image.

> Although not nearly as grand as superintendent Browne had first envisioned, the Manhattan company reservoir was a sound and attractive structure that became something of a New York landmark. Built of stone and cement, and lined with clay and tar, the reservoir's outer walls rose nearly twenty feet in an area roughly fifty by one hundred feet. The side walls were vertical (soon adjoined by a house for the superintendent and a public bath concession he ran); the front wall sloped back from Chambers Street. The middle of the front wall was adorned with a portico of four Doric columns, surmounted by a statue of water-pouring Oceanus.[195]

This portico lintel made a Greek Revival architectural reference in ornament only. It resembled a porch, but being a simple reservoir, the structure had no entrance; this was a decorative feature applied to the skin of an otherwise unremarkable rectilinear stone storage structure. As New York's first waterworks flying a conscious historical revival gesture, this "embedded ornamentation" is important, but this was not a coherent

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[194] For example, the octagon design may have been an elaboration on a square reservoir originally submitted by Joseph Browne, Manhattan's waterworks superintendent. The 250,000-gallon idea came from John McComb, who co-designed City Hall in 1801 (opened in 1812) with French architect Joseph-Francois Mangin, who later built the first St. Patrick's Cathedral in 1809. "No plans exist of the reservoir, which was torn down along with the iron tank in the 1910s long after their active use." Koeppel, *Water for Gotham,* 98, 310 n. 66-67.

[195] Koeppel, *Water for Gotham,* 98.

architectural statement. Its significance is that it called aesthetic attention to a waterworks structure.[196]

Clearly, the Greek Revival aspect of this reservoir was nothing compared with Latrobe's Center Square works of the same year. **[Figures 46, 7]** Quite unlike the Manhattan Company faux portico's shallow sculptural frieze on a flat surface, the Center Square porticos set off depth and dimension in the cylindrical structure and serve a part-to-whole function within the building's formidable formal integrity. Moreover, they pinpoint the building as the literal centerpoint in the colonial city grid.[197] The Manhattan Company reservoir is noteworthy only as an innovation in above-ground water storage, not in formal building design. (It also serves as a simple litmus test of Philadelphia's architectural sophistication, pointedly in relation to the waterworks issue.)[198] In both

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[196] I adapt an idea from Bannister, adapting his term, "imbedded decorative feature" from his analysis of octagonal architecture: "Not only were domed rotundas imbedded as decorative features in all sorts of rectangular buildings, but some houses were compressed completely within cylindrical envelopes." I extrapolate beyond octagonal structures when I apply the term in my own discussion. See Turpin C. Bannister, "The Architecture of the Octagon in New York State," *New York History* 26, no. 1 (January 1945): 43-50. See the image in Koeppel, *Water for Gotham,* 98, as well as various images in the Philadelphia Museum of Art's *Fairmount Waterworks* exhibition.

[197] This, of course, was impossible in Manhattan, as the New York City Commissioners' Plan of 1811 was not commissioned until 1807. "Early Manhattan settlers obtained water for domestic purposes from shallow privately-owned wells. In 1677 the first public well was dug in front of the old fort at Bowling Green. In 1776, when the population reached approximately 22,000, a reservoir was constructed on the east side of Broadway between Pearl and White Streets. Water pumped from wells sunk near the Collect Pond, east of the reservoir, and from the pond itself,was distributed through hollow logs laid in the principal streets. In 1800 the Manhattan Company (now The Chase Manhattan Bank, N.A.) sank a well at Reade and Centre Streets, pumped water into reservoir on Chambers Street and distributed it through wooden mains to a portion of the community. In 1830 a tank for fire protection was constructed by the City at 13th Street and Broadway [and] was filled from a well. The water was distributed through 12-inch cast iron pipes. As the population of the City increased, the well water became polluted and supply was insufficient. The supply was supplemented by cisterns and water drawn from a few springs in upper Manhattan." See "History of New York City's Water Supply System," City of New York, accessed February 25, 2015, http://www.nyc.gov/html/dep/html/drinking_water/history.shtml. If the Manhattan Co. reservoir was on Chambers Street near the well at Centre and Reade, then the reservoir was facing or kitty-corner with the Civic Center area. The old Alms House had just been torn down there in 1797 and a new one begun in the same year; the site for the New York City Hall was chosen just after the turn of the century, and the building opened in 1811, so this square was an important center. Philadelphia's city grid was created in 1687 by William Penn; the grid for Manhattan Island was adopted in 1811.

[198] This dissertation cannot dwell on the general development of Greek Revival in New York, except to note a general sample comment from architectural history: "Thanks to the buildings of Latrobe, Mills, Strickland, Haviland, and Walter, and others known and unknown, Philadelphia became and long remained the fountainhead of Greek Revival architecture in the United States. Other cities drew on this source each in its own fashion. …In 1820 most New York designers were busy building the multitudes of narrow

buildings, the Greek Revival aesthetic stakes a claim on cultural status. As modest as it is in comparison with Latrobe's Center Square Water Works, the Manhattan Company reservoir illustrates a contemporary design motif employing historical revival architectural vocabulary to signify the high cultural value of water and the early industrial technology of modern urban water movement.

The Manhattan Company waterworks project was in the mind of Philadelphians when Latrobe was working on the Center Square structure. In 1799, a Philadelphia newspaper noted that "the Water-Works of the Manhattan Company progress with astonishing rapidity."[199] And New Yorkers kept abreast of Philadelphia's model system as the pace of its own water system development lagged. In 1805, during a yellow fever epidemic, New York's "resident physician" called Philadelphia's system noble, provident, and wise. In 1806, a Scottish cartographer compared the two cities' water supplies, praising Philadelphia's system while criticizing New York for having none despite the Manhattan Company's proposals and its reservoir.[200] The company never built a viable water supply system; instead, it focused on the burgeoning business of finance. By 1804, the Bank of the Manhattan Company—eventually Chase Manhattan Bank—had become "one of the nation's most powerful and influential financial institutions." For decades, the company maintained its legal monopoly on water development even as it

houses dictated by the unfortunately narrow lot sizes (20 ft. x 100 ft., 25 ft. x 100 ft.) laid out by the city's planners. Doric porticoes had no place on twenty-foot facades, but in their turn Greek details came to dominate the lovely interiors; later, the development of row housing (London Terrace, 1832; Colonnade Row, 1836) with common facades afforded opportunities for exterior decorations derived from the classical. Of the architects [for example] who designed for New York public buildings in the Greek Revival manner, the first important name is Martin Thompson, who built the Branch Bank of the United States on Wall Street (1822, its facade saved and now incorporated in the Metropolitan Museum of Art)…." See Jotham Johnson, Review of Talbot Hamlin's *Greek Revival Architecture in America*, *The Classical Weekly* 39, no. 5 (Oct. 29, 1945): 37-40; quotes above, 39.

[199] I. N. Phelps Stokes, *The Iconography of Manhattan Island, 1498-1909* , vol. 5 (New York: Robert H. Dodd Company, 1915-1928), 1370, quoted in Koeppel, *Water for Gotham*, 85-91. See especially the citations for July 22, August 30, and September 1, 1799, relating to the Manhattan Company and its waterworks. Some waterworks engineering industries centered manufacture in Philadelphia. For example, Manhattan Company developers pursued a preliminary contract for steam-pump engines by a prominent Philadelphia engine maker before deciding to use horse-powered pumps.

[200] For the examples from 1805 and 1806 in this paragraph, see Koeppel, *Water for Gotham,* 106.

failed to follow through on proposed water projects. This amounted to stagnant water planning for the city.[201]

ROUND AND OCTAGONAL TEMPLES IN AMERICAN ARCHITECTURE: MANHATTAN'S 13TH STREET RESERVOIR (1835) AND IMPLICATIONS FOR WATERWORKS HISTORY

In 1829, after three decades of stalemate, the situation began to change when the New York Common Council financed a water system for fire prevention. The 13th Street Reservoir became the centerpiece of the city's first attempt at a consolidated water system in response to the Manhattan Company's failure to deliver one. **[Figure 46]** Centered at the intersection of 13th Street and the Bowery, the 13th Street Reservoir opened in 1831 as the main reservoir for a log-pipe network that fed 150 street hydrants. It was a significant work of architecture: an octagonal, Greek Revival temple designed with high arched windows and a clerestory under a domed cupola. The Greek Revival shell housed an octagonal, iron water tank.[202] Each of the eight faces had three levels: the base was a half-arch topped by a simple moulding; a central rectangular window capped by a lintel adorned the middle third; and the top third consisted of a broad architrave. The corners of each face featured pilasters, and the shallow roof on the octagonal drum supported a square lantern.

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201 Koeppel, *Water for Gotham,* 101. See also 111-38 for Koeppel's 30-year summary of the Manhattan Company's failure to establish itself as a viable water provider. Koeppel argues that the company's lack of commitment to its chartered *raison d'etre* led not only to a return to ported and well water in the first decades of the 19th century, but also to delays in the development of the Croton Aqueduct, which was never a company project. The company administered projects from offices on Wall Street. Koeppel emphasizes the underlying aim as large-scale banking and investments. The act of law that incorporated the company included an unprecedented "surplus capital" clause, which allowed the organization to freely funnel capital into business ventures unrelated to its chartered purpose, even investment schemes that fell outside the company's stated mission, which was to supply water to the city. "The power to do anything legal with a company's capital was unheard of in American or English corporate law, which tended to restrict corporate entities to their specified purposes, such as [building and maintaining] canals, bridges, or roads. Only a handful of New York City business concerns was incorporated by the state between the Revolution and the end of the century: three insurance companies, one manufacturing company, and two banks, all of which had specific and limited mandates. By its 'surplus capital' clause, the Manhattan Company would be able to engage in practically any business it chose." See Koeppel, 83.

202 Koeppel's evidence points to a tank of a capacity somewhere between 230,000 and 300,000 gallons. See *Water for Gotham,* 137.

> Standing on high ground at the fringes of 1830s New York, the works eventually were housed in a handsome octagonal stone building and became a notable landmark. *The Family Magazine* of 1839 reprinted a scenic engraving of the "New York City Reservoir" and reported a favorable impression: "The whole building rises seventy-five feet above the ground to the top of the tank and is surmounted by a cupola, making an all one hundred feet. It forms a very picturesque object to boats passing through both the East and North Rivers." It was nothing so prideful as Philadelphia's famous Fairmount, but for Gotham it was a palace of civic virtue. … [T]he 13th Street system was the beginning of New York's public water supply.[203]

Koeppel's statement that the octagon signaled the 13th Street waterworks structure as a "palace of civic virtue" seems an apt characterization in 1835.[204] For a full understanding of the round water temple form and its heightened cultural resonances, one must consider the octagon in American architecture. Bannister pairs octagons and domed rotundas in the same design class as "cylindrical buildings" or "circular and polygonal plans."[205] Bannister also notes the importance of the rotunda—an interior domed drum—as a prototypical feature for Capitol architecture in the U.S.[206] The first notable octagonal domestic structure built in the United States was "The Octagon House" (1800), a Washington, D.C., mansion by William Thornton, later appointed the first Architect of the Capitol.[207] Given the date and prominence of this residence, it may have inspired the

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203 Koeppel, *Water for Gotham,* 138; see reservoir image on 136, fig. 25.

204 Koeppel, *Water for Gotham,* 138.

205 All quotations in the remainder of this paragraph are from Bannister, "Architecture of the Octagon," 46-47. Bannister notes Thomas Jefferson's early, prominent contributions: "while governor of Virginia, he proposed to remodel the governor's palace at Williamsburg into a square block dominated by a central rotunda hall. In 1792, he revived the idea by submitting it in vain in the competition for the new Presidential Mansion in Washington," not to mention his own Monticello.

206 "The domed rotunda became a particularly potent symbol in American governmental architecture when Dr. William Thornton adopted it as the culminating feature for the national Capitol, dominating the more prosaic rectangular blocks on each side. Henceforth there was hardly a state capitol, courthouse, or town hall that did not emulate its genuine effectiveness." See Bannister, "Architecture of the Octagon," 46-47.

207 For a brief summary of octagonal churches and schoolhouses, see Walter Creese, "Fowler and the Domestic Octagon," *The Art Bulletin*. 28, no. 2 (June, 1946): 89-102. See also Turpin C. Bannister, "The Architecture of the Octagon," 43-50. Bannister cites an immigrant Dutch Reformed trend in colonial America that produced about 20 octagonal churches, modeled in part on windmill design. Bannister also cites the octagon's use for war-related buildings: "the octagonal form eliminated blind corners, difficult to defend" (45-46).

octagonal design for the Manhattan Company reservoir in the 1830s.[208] Another prominent octagon, known in New York during 13th Street Reservoir planning, was Boston's 1814 "New South Church"—called the Octagon Church by its prominent architect, Thomas Bulfinch.[209] Since approval for Latrobe's Center Square round temple for Philadelphia followed just two years later, in 1799, Bulfinch's church may have influenced the octagonal design of both the Center Square temple and the 13th Street Reservoir. Finally, one cannot help but consider that the coherent 13th Street Reservoir Greek Revival temple design in an indirect way also paid tribute to Latrobe's Center Square Water Works temple.[210]

One must also consider the influence of the first three Architects of the Capitol, who between them worked on the White House, the U.S. Capitol building, and the U.S. Patent building—often considered the initial triumvirate of American Greek Revival public architecture. Each national architect—Thornton, Latrobe, Bulfinch—played a prominent role in creating America's first prominent octagonal, round, and domed temple buildings. Thornton's successful Capitol design in 1793 garnered him the post as first Architect of the Capitol. Latrobe became the second Architect of the Capitol in 1803,

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208 Both Thornton and the homeowner, Colonel John Tayloe, a wealthy plantation owner, ship builder and iron mine industrialist, were dedicated to supporting the 1791 L'Enfant radial plan for Washington, D.C. They built the Octagon House on its site at the acute angle created by the intersection of 18th Street and New York Avenue, two blocks from the White House. The home secured fame when President and Dolly Madison converted the home into the Presidential residence after the 1814 destruction of what we now call the White House during the War of 1812. While living in the Octagon House, President Madison ended the war by signing the 1815 Treaty of Ghent. In 1898 the home's architectural and historical prominence distinguished it as the first headquarters of the American Institute of Architects (AIA), when the organization moved its headquarters from New York City to Washington, D.C. See "History of the American Institute of Architects," The American Institute of Architects, accessed February 25, 2015, http://www.aia.org/about/history/AIAB028819. Since 1970 the Octagon House has been a house museum. Frank J. Metcalf argues that the home is not technically octagonal in plan, but I include it due to its *de facto* status as the first American octagonal residence. As such, it is one of the first important buildings to highlight the octagon—or the spirit of the octagon, if you will—as an American style. Conversion of the Octagon House into a state building as the Presidential residence heightens and secures its historical and aesthetic importance. See Frank J. Metcalf, "Octagon Houses of Washington and Elsewhere," *Records of the Columbia Historical Society, Washington, D.C.* 26 (1924): 91-105.

209 Metcalf, "Octagon Houses," 101-02. Bulfinch, a prominent architect-builder, designed the 1797 Massachusetts State House in Boston, which was modeled in part on Somerset House and the Wyatt Pantheon in London. Whiffen and Koeper, *American Architecture,* 130.

210 "Latrobe's handsome structure was torn down in 1829." See Gibson and Wolterstorff, "Fairmount Waterworks," 15.

immediately after completing the Center Square Water Works. Bulfinch succeeded Latrobe in 1818—adding building wings and dome—and remained in the position until it was abolished upon the Capitol's completion in 1829.[211] Judging from the prominence of their positions and their buildings, we must assume the three communicated through their design work.[212] Each architect designed several types of constructions, including public works.

In sum, a trend of using round and octagonal utilitarian structures had solidified by the first quarter of the 19th century.[213] In waterworks, there was not only Latrobe's Center Square round temple, but also his octagonal waterworks for New Orleans, which his son Henry built from his father's plans and probably completed between 1813 and

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211 See "History of the U.S. Capitol Building," Architect of the Capitol, accessed February 25, 2015, http://www.aoc.gov/history-us-capitol-building. Thomas Ustick Walter, a student of Strickland, practiced largely in Philadelphia but was appointed Architect of the Capitol Extension in 1851, after his plans for enlargement of the Capitol were accepted, making him "famous for having been the final designing architect on the United States Capitol and for adding the present House and Senate wings and the great dome which so magnificently crowns it." See Hamlin, *Greek Revival Architecture,* 81. Walter left the Washington position in 1865 after the Civil War. He became chief assistant to the architect of the Philadelphia City Hall from 1873 until his death in 1887. He had been one of the founders and was the second president of the American Institute of Architects. See "Architects of the Capitol." Purportedly, at Walter's suggestion, the society gained its name. See "History of the American Institute of Architects." By 1887, AIA chapters had been formed in Philadelphia, Chicago, Cincinnati, Boston, Baltimore, Albany, Rhode Island, San Francisco, St. Louis, Indianapolis, and Washington, D.C. The first West Coast meeting of the AIA was held in San Francisco in January 1910; a resolution was passed that supported the preservation and restoration of the California Missions

212 To unravel the maze of the Capitol building's development alone is to watch interconnections and responses between and among these prominent architects. They were at the forefront of the relatively small cadre of leading American architects at the time.

213 The octagon trend in the U.S. continued from the late 18th to the mid-19th century. See Creese, "Fowler and the Domestic Octagon," 89-102. Creese argues that by mid-century, the octagonal design had elevated to fad status in domestic architecture design**.** However, in "Architecture of the Octagon," Bannister claims there was a decline by 1825 in the "aesthetic prestige of the circle and the polygon." By "aesthetic prestige," he seems to mean the prestige conferred upon public or highly visible private structures. Bannister does not specify that the decline in prestige applies only to domestic buildings, but we can infer this qualification, since he goes on to argue that utilitarian buildings took on the style as it was declining in domestic architecture. My argument that historical revival forms do confer aesthetic prestige upon utilitarian structures, specifically water-related ones, still stands even in light of Bannister's assessment. Note that Creese's timeline for the endurance of the polygon extends farther into the 19th century than does Bannister's. Creese argues a resurgence in domestic polygonal plans came after O.S. Fowler's publication *A Home for All, or the Gravel Wall and Octagonal Mode of Building,* which grounded the trend, as well as Fowler's subsequently lucrative architectural practice. Neither writer specifies a timeline for the style preference in public works architecture.

1819.[214] Bannister's study of octagonal architecture in the U.S. cited no waterworks structures but discussed an increase in octagonal architecture for utilitarian use. He held up "cubic efficiency" as the advantage of the octagon:

> Deprived of aesthetic prestige, our geometric liet-motif was nurtured to new vigor by economic arguments. …Polygonal and circular barns appealed to many practical-minded farmers through the early nineteenth century. [They] appreciated the obvious advantage of the polygonal plan in that it contained a maximum store of hay within a minimum length of expensive exterior wall. …Substitute moppets for hay and the octagon became the most economical form for schools.[215]

To borrow from Bannister's argument, if one were to substitute water for hay or moppets, the advantage applied to reservoir storage as well. The fusing of utilitarian and aesthetic elements, and the choice of the octagonal form, gave this "handsome octagonal stone building" for the 13th Street Reservoir aesthetic, social, cultural, economic, and historical prestige.[216]

NEW YORK CITY'S 1842 CROTON AQUEDUCT: BUILT ON A FOUNDATION OF WATER ENGINEERING

In 1829, the same year Manhattan's 13th Street water system went into planning, the city's Common Council coupled its water and fire committees to thoroughly investigate water sources for a future Manhattan aqueduct.[217] By 1833 the Croton River attracted central focus. In 1836, John B. Jervis became Chief Engineer of the Croton Aqueduct.[218] He was one of several leading waterworks engineers who gained their

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214 Gary A. Donaldson, "Bringing Water to the Crescent City," 195-210.
215 Bannister, "Architecture of the Octagon," 47-48.
216 Koeppel, *Water for Gotham,* 136-37.
217 Koeppel, *Water for Gotham,* 136. The superintendent of the 13th Street system was Samuel Stevens, who later, in 1840, became the chairman of the board of water Commissioners, and remained so through completion of the Croton Aqueduct. See Koeppel, 248. "The 13th Street works were sold off by the city during the 1840s and gradually torn down." See Koeppel, 292.
218 David Bates Douglass was the engineer the city hired to begin aqueduct development. "From 1833 to 1836, he conducted surveys and determined the course and basic shape for a Croton Aqueduct and planned many of its prominent structures, before disputes with Water Commission Chairman Stephen Allen led to his firing as chief engineer." Douglass exhibits a sampling of a hydraulic engineer's education at that time: he graduated from Yale College in 1813 in Civil Engineering, then joined the Army Corps of Engineers, and trained at West Point, where he returned in 1815, after wartime service, to teach natural and

experience working primarily on transportation canals (as well as on railroads, roads, and other large-scale civil engineering projects).[219] He apprenticed under Benjamin Wright on the Erie Canal, with Canvass White as his principal assistant by 1818. In 1825, the year of the Erie "Big Ditch" dedication, Jervis took a job as assistant on the Delaware and Hudson Canal to Wright, the canal's new chief. In 1833, Wright departed to become the chief engineer for the Chesapeake and Ohio (C&O) Canal,[220] and Jervis succeeded his mentor as chief engineer on the Delaware and Hudson. In the job, he pioneered both aqueduct and railroad bridges.[221] Jervis also distinguished himself in 1833 as chief engineer for the hundred-mile Chenango Canal, an Erie adjunct.[222] His Schoharie Creek Aqueduct bridge, in Fort Hunter, New York, was a 14-span, masonry-arch canal and tow

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experimental philosophy. West Point was in 1815 "the only American college then offering formal engineering education." See Koeppel, *Water for Gotham,* 156-59; 157, fig. 28.

219 Koeppel cites Jervis's civil engineering and hydraulics sources as follows: "As far as printed guidance, there were no books on American civil engineering, and precious little on European hydraulics in English, Jervis's only language. His major reference was the *Treatise on Waterworks for Conveying and Distributing Supplies of Water,* a summary of European hydraulic works, theories and formulae just published in 1835 by Charles S. Storrow, a young and soon to be distinguished engineer who had studied at Harvard and in Paris. Jervis also referred frequently to his copy of late Scottish professor John Robison's four-volume *System of Mechanical Philosophy,* first published in 1804; Robison offered and refined the water flow mathematics of his continental contemporaries, including France's Pierre DuBuat and Baron Riche de Prony, and Germany's Johann Albert Eytelwein." See Koeppel, *Water for Gotham,* 193.

220 The C&O Canal is a 185-mile transportation canal that parallels the Potomac River on the Maryland shore, from Cumberland, Maryland south to Washington, D.C., passing through Harpers Ferry at the confluence of the Shenandoah and Potomac Rivers. The C&O Canal had 11 aqueduct bridges, four of which were masonry arcades. The longest and most ambitious was the Monocacy Bridge, with its seven arches; the others had three arches apiece. See "WHILBR: Western Maryland's Historical Library," Western Maryland Regional Library, accessed February 25, 2015, http://www.whilbr.org.

221 For an engineering biography of Jervis and the specifics of his initial planning after being appointed Croton Aqueduct chief engineer in 1836, see Koeppel, *Water for Gotham,* 185-98. Koeppel reports that the railroad bridge on the Delaware and Hudson Canal "brought Jervis into the pioneering development of locomotives. The locomotive *Stourbridge Lion,* procured in England by Jervis's assistant Horatio Allen (1802-1899) at Jervis's instructions, became the first steam locomotive operated in America when Allen drove it on company track in 1829." See Koeppel, 188.

222 Koeppel, *Water for Gotham,* 188-89. According to Koeppel, "Jervis's great innovation for this work was the construction of rain-fed reservoirs to supply the canal's summit. Using a rain gauge and runoff sluice of his own design, Jervis determined that 40 percent of the rainfall was retained in artificial reservoirs; this landmark of American hydrology upset the European theory that only a third of rainfall remains after evaporation and soil absorption."

path bridge, built as a river crossing for an expanded portion of the Erie Canal from about 1839 to 1841.[223]

As his principal assistant on the Croton Aqueduct, Jervis hired Horatio Allen, a prominent railroad engineer, who in 1835 had honeymooned abroad to view modern waterworks in England and France, and ancient works in Rome and Egypt.[224] Allen brought this experience to the Croton Aqueduct when he took the assistant's job in 1838. Koeppel comments: "That Allen was willing to take a subordinate's role on Croton suggests just how important the Croton project was in American engineering."[225] Allen worked alongside assistant engineer Fayette Tower (1817-57), whom Jervis hired in 1837. Tower's "obligatory" honeymoon tour of Fairmount took place just after the second major expansion and renovation.[226] In 1843, the year after the Croton Aqueduct opened, Tower published a book on the project, which he illustrated with his own drawings of its architectural features.[227] His writing reveals the romanticism of the age as

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223 Donald C. Jackson, *Great American Bridges and Dams* (Washington, DC: Preservation Press, 1988), 128-29.

224 "Jervis assumed the chief engineer's salary of $5,000, and from October 12, 1836, the Croton was his to build. …The line on Manhattan had not been determined; there were no engineering plans for the dam, ventilators, waste weirs, culverts, supporting walls, masonry in tunnels, valley crossings on Manhattan, or the receiving and distributing reservoirs and related piping; Douglass [the prior chief engineer] had not drawn specification and contract forms. …As to the Harlem crossing … Jervis found few details for the high arched bridge that Douglass grandly had envisioned. 'It was easy to propose a bridge,' Jervis later wrote, but to make specifications from the tops of the arches to the depths of the river 'was quite a different thing.'" See Koeppel, *Water for Gotham,* 189-91. Consult Koeppel's Chapter 9, "The Work Begins" (185-217), for a detailed chronicle of events leading to and surrounding Jervis's appointment and his work on the Croton Aqueduct. To gauge the scale of the project and its growth over time, labor statistics are helpful. In 1836, the aqueduct employed 21 workers (191); in 1837, 390 workers were on the line by the end of June, with 1200 employed by the end of December and reports of an expected labor force of 3,000 by Spring 1838 (201, 212); in June 1839, the labor force comprised 4,206 men. Koeppel touches on many details of labor on the Croton but laments a dearth of direct primary evidence from laborers themselves: "Of the many thousands of Irish immigrants who put in time on the aqueduct line, few left a record of their lives." See Koeppel, 208. As a representative sampling of labor news, Koeppel summarizes one uprising by laborers during Croton construction and touches on several deaths of Irish workers on the job, noting that one such worker's body "was conveyed to a Hudson River steam boat by three hundred of his countrymen for burial in New York." Koeppel, 207-209. Throughout his text, Koeppel cites from narratives regarding Croton laborers he has discovered in the course of his extensive primary research.

225 Koeppel, *Water for Gotham,* 225.

226 On this point, Koeppel quotes from the letters of Fayette Tower, in the private collection of Helen Tower Wilson. See Koeppel, *Water for Gotham,* 85-91, 241 n. 73.

227 Koeppel, *Water for Gotham,* 215. Tower reported in a March 7, 1839, letter to his mother: "I shall have charge of some very interesting work…—splendid arches of masonry to support the Aqueduct." See

he describes the Croton watershed's rugged topography. One excerpt reveals contemporary conceptions of landscape as source for water and of technology as tamer of nature:

> Leaving Sing Sing the road pursues a northerly direction, winding through lovely groves opening at intervals with a view upon the glorious Hudson, then closing again leaving the imagination to perfect what the eye did not catch of the picture….Leaving the valley of the Hudson, the road winds along diverging here and there to approach some neat cottage and view the beauty of its gay parterre in front; then climbing the steep ascent to its summit it plunges into the landscape beneath, and thus it continues until you come into the "wild region of the Croton." …This work when completed will compare with anything of the kind in this country or in Europe, and I think it will be visited by foreigners not only as a model but as an illustration of what the ingenuity of man led on by the pure light of science can accomplish, and they will admire the gigantic undertaking and the boldness of conception….I shall devote myself to the work and let my whole mind be upon it and I shall be happy to have my name identified with the work tho in a small degree.[228]

CROTON AQUEDUCT'S HIGH ARCADE (1838 – 1848): TRANSPORTATION CANAL CROSSINGS AS PRECURSORS TO AQUEDUCT BRIDGES

By the end of 1838, "Jervis and the Commissioners had contracted the entire Croton Aqueduct," leaving only one major feature to finalize: the High Bridge, which would carry the aqueduct pipeline over the Harlem River to Manhattan.[229] The bridge was contracted in 1839 but remained incomplete until 1848, many years after the aqueduct opened in 1842.[230] The High Bridge was a running arcade bridge, a

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Koeppel, 235.Tower illustrated his 1843 book with an engraving of the Clendening crossing as a pastoral landscape. Koeppel's caption for the reproduced illustration reads: "Drawn by Fayette Tower for his Croton book, the engraving is notable for the foreground portrayal of tranquil farm life, suggesting the aqueduct's harmony with nature; an identical but unpublished ink drawing of the crossing done a year earlier shows the foreground as an empty land with broken fencing and sparse trees." See Koeppel, 258, fig. 41.

228 Koeppel, *Water for Gotham,* 206-07. Once again, Koeppel draws from the letters of Fayette Tower, 1834-37. See Koeppel, *Water for Gotham*, 328-29 n. 43-50, for full citation. See also Fayette B. Tower, *Illustrations of the Croton Aqueduct* (New York: Wiley and Putnam, 1843).

229 Koeppel, *Water for Gotham,* 231.

230 "[T]he High Bridge contract was made with Timothy Ferrell, Samuel Roberts, Arnold Mason, and George Law. …Ferrell dropped out of the work in 1840. …Work on the High Bridge propelled [George Law] to his fortune and dubious fame." He was a contractor whose wealth, and later his social and political

recognizably Roman-Revival aqueduct structure.[231] **[Figures 49, 50]** Jervis had designed and built several canal bridges before, one an impressive Roman Revival arcade for the Erie Canal. **[Figure 51]** Extensive experience working on canal bridges enabled Jervis not only to evaluate previous bridge designs for the Croton's Harlem River crossing, but also to create his own. He submitted two plans, a low and a high bridge.[232] To cross the Harlem at grade-level would require a bridge in an all-new scale for the U.S. "Stone arch

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prestige, began with regular work on Pennsylvania canal works between 1824 and 1837. He moved to New York in 1837 to begin work on the Croton Aqueduct Mill River crossing and later the High Bridge. In 1837, Law consulted with John Abert on Abert's Potomac (or Alexandria) Aqueduct, the eastern extension of the Chesapeake & Ohio (C&O) Canal over the Potomac River from Georgetown into Virginia. Jervis's temporary bridge crossing was in place over the Harlem River when the aqueduct opened in 1842. Donald C. Jackson, *Great American Bridges*, 136, lists a completion date of 1842 for the Harlem River High Bridge, while Koeppel claims 1848 as the completion year. See caption for Jervis's portrait, Koeppel, *Water for Gotham,* 186, fig. 30. See also Koeppel's caption, 256, fig. 40: "Drawn by Fayette Tower for his [1843] Croton book, this [High Bridge] view looks south down the Harlem River, with the Manhattan highlands on the right; Tower's illustration predates the completion of the bridge by five years. A popular subject for scenic painters, the bridge is the only original aqueduct structure remaining on Manhattan, though its river arches were replaced with a single steel span in the 1930s." Neither scholar cites any sources for his date claim. See the Library of Congress Historic American Engineering Survey (HAER) entry for the Harlem River High Bridge: "Upon completion High Bridge was 1420 feet long and 136 feet high (from the bottom of the river). Sixteen piers created fifteen arched openings of which eight were 80 feet wide and seven were 50 feet in width. Its remaining portion is the most readily visible section of the Croton Aqueduct standing today." See "Old Croton Aqueduct, Harlem River Crossing, Spanning Harlem River, Bronx, Bronx County, NY," Library of Congress, accessed February 25, 2015, http://www.loc.gov/pictures/item/ny1175/.

231 In *Great American Bridges,* Jackson explains that "in 1937 five arches over the river proper and the adjacent railroad tracks were replaced by a single steel-plate girder arch, which provided greater clearance for ships and barges" (136). For additional images, refer to "Old Croton Aqueduct." Regarding the scant primary evidence for similarities between Jervis's High Bridge design ancient and Roman aqueduct bridge design, see Jackson, 136.

232 Jervis based the low bridge on Canvass White's and John Martineau's plan to siphon the aqueduct pipeline downward, closer to the river's surface level, where it would cross the river on a low embankment and rise back up to grade-level on the opposite embankment. The high arcade bridge was inspired by David Douglass's previous idea for a masonry arcade that would carry the aqueduct across the river at its relative grade-level. "Douglass imagined Croton water entering Manhattan in dramatic fashion. Many years after his departure from the project, the crossing took shape much as he envisioned: a towering bridge spanning the Harlem between natural rock abutments, supported in the Roman style by a series of semicircular arches on piers sunk deep into the river bed and the rising plain on the Westchester shore. The grade-level bridge would be 'a work of considerable labour and expense, but by no means of paramount difficulty,' Douglass avowed, citing a half-dozen larger modern arched bridges in Europe. 'With such examples of enterprise and skill before us, many of them undertaken for objects far less important than that of supplying the city of New-York with water, we may certainly look upon the design of the Harlem aqueduct without fear.' Still, although he specified the works needed, Douglass provided few engineering details." See Koeppel, *Water for Gotham,* 160-61. Internal quotations are apparently from Douglass' 1833 report to the water Commissioners. See also Koeppel, 159 n 53.

bridges, of course, had been pioneered in grand style by the ancient Romans and refined in modern Europe, but there were no successful models in America of the dimensions required at the Harlem." Jervis' design was larger than the one Douglass, his predecessor, had proposed.[233]

Jervis waffled between his two designs. At first, he favored the low embankment bridge with a single central arch over the river to allow for navigation: this would be easier, quicker, and cheaper to build than a high bridge. The economical cost for the low bridge appealed to the Commissioners, but a volley of legal challenges to the low bridge design centered on its potentially negative effects on river navigation and on the possible development of Harlem as a separate city from Manhattan. Changes in elected officials, land purchases, easement disputes, and bid contracting decisions on other aqueduct sections further delayed bridge approval. In 1838, Frederick Graff, the widely respected chief engineer of Philadelphia's Water Works, weighed in on the High Bridge debate, writing in support of Jervis's low bridge design: "The plan you have adopted in passing over Harlaem [stet] River with iron pipes, is, in my opinion, preferable to the high aqueduct; the manner you have planned the whole structure, together with the arrangement of the pipes cannot but succeed to give a copious supply of water."[234] In addition to providing further evidence that waterworks engineers were both aware of and even involved in other projects, this comment also suggests Graff's singular focus was on

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233 Jervis considered problems other bridge sites had suffered. "Jervis was well aware of troubles with two of the country's most notable waterworks bridges. The Erie Canal crossing of the Genesee River at Rochester had been accomplished with eleven Romanesque arches fifty feet wide; when it was completed in 1823, the structure, 802 feet long, was the longest stone arch bridge in the United States. Unfortunately, local sandstone was used for its construction and ten years later fear of collapse had induced Canal Commissioner Bouck to ask Jervis to examine its design. By the late 1830s, a new bridge was built, which, like its predecessor, was less than thirty feet high. At Schenectady, near the eastern end of the Erie Canal, two low, unarched stone bridges crossed the Mohawk River—one of them, 1,118 feet long, rested on twenty-six piers, the longest bridge of any type in the country—but both bridges had proved costly to maintain, and in 1835, consultant Jervis had urged without success that they be replaced with a new canal segment along the Mohawk. …[P]ier work of comparable depths [to those Jervis proposed for the High Bridge] had been accomplished recently for a railroad bridge over the Schuylkill outside Philadelphia, and for the Potomac Aqueduct in Washington, …[but,] as with the Erie Canal bridges, neither the Philadelphia nor Washington bridge approached the size of the Harlem crossing. …The six-piered Schuylkill railroad viaduct, opened in 1834, was 984 feet long, thirty-eight feet high, and built of wood." See Koeppel, *Water for Gotham,* 213-14, 330 n. 68.

234 Koeppel, *Water for Gotham,* 221.

engineering practicality and not on aesthetics, supporting my doubt that he was responsible for the architectural design of his own Fairmount Waterworks.

Despite the controversy, in 1839 a new State Assembly passed a bill requiring the Water Commissioners to approve the High Bridge as the aqueduct crossing. Jervis designed the High Bridge to accord with the legislated dimensions: **[Figures 49, 50]**

> This design called for a bridge slightly below grade level, carried on fifteen arches: eight arches eighty feet wide and a hundred feet high across the river (the minimum required by law) and seven arches fifty feet wide over land (one on the steep Manhattan shore, six on the rising Westchester plain) leading to natural abutments. In dropping the arches to the legal minimum and the top of the bridge to 114 feet above tide and twelve feet below the grade of the aqueduct, Jervis abandoned masonry conduit in favor of a siphon [of multiple pipes laid side-by-side across the bridge].[235]

Despite the final assessment that a low bridge and inverted siphon were advisable from the standpoint of cost, safety, time, and navigation ease, the Commissioners approved the High Bridge on the basis of its aesthetic value—what Donald C. Jackson calls "symbolic importance"—concluding that "so far as architectural display is involved… the high bridge has the preference."[236] The higher cost of this decision resulted in the omission of

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235 Koeppel, *Water for Gotham,* 238. The approved bridge, at 12 feet below the aqueduct grade level, required the pipeline crossing the bridge to be a shallow inverted siphon. Jervis first planned twin 48-inch pipes, but finally built the siphon as three 36-inch pipes. Bids for the Harlem High Bridge project were advertised in June 1839. Koeppel reports that "Jervis's redesigned high bridge would take five years to build and cost $836,623, including a standard 10 percent for contingencies…[,] a bit less massive and $100,000 less expensive than the high crossing Jervis had planned a year and a half earlier…" For a narrative summary of the aqueduct's expenses, see Koeppel, 243-44. Jervis's original plan called for a high bridge that "would be 1,450 feet long and rise 138 feet above high tide. It would consist of a series of sixteen arches, of eighty-foot spans across the river and fifty-foot spans across the rising plain on the Westchester side. The pier arches would be supported on piers with foundations sunk as deep as thirty-two feet below the river's surface." Koeppel, *Water for Gotham,* 213.

236 "Semi-Annual Report of the Water Commissioners, from the 1st of July to 30th December, 1837, inclusive," *American Railroad Journal and Mechanics' Magazine* New Series 1 (1838): 84. Donald C. Jackson adds that Jervis "could have built a pressurized siphon to carry the aqueduct under the [Harlem] River; however, as documented by historian Larry Lankton, he recognized the symbolic importance that a large masonry span could hold for the people of New York, who were financing the expensive aqueduct project. Consequently, he opted for a bridge rather than a siphon." See Jackson, *Great American Bridges,* 136. Jackson does not cite his specific Larry Lankton source. My search shows that Lankton wrote three works on the Croton Aqueduct, two under the title *Manhattan Life Line: Engineering the Old Croton Aqueduct, 1833-1842*. The first is Lankton's 1977 University of Pennsylvania Ph.D. dissertation; the second is a book published in Washington, D.C., in 1979 by the Historic American Engineering Record (HAER). Lankton also authored the 185-page HAER text on the Old Croton Aqueduct's history. In 1977,

another above-ground arcade bridge on the Croton Aqueduct, which the Commissioners had earlier approved explicitly as "an ornament to the city"; they reported regret in being unable to afford both.[237] Allen, Tower, and Jervis all remarked on the aesthetic value of the high arcade bridge. Allen called the work "great" and "magnificent" in his memoirs. Tower, too, characterized the work as "the greatest in the country," even as he qualified this praise, calling the bridge "too great and uncalled for…just for Architectural beauty."[238] Jervis commented on an apparent reversal of his prior approval of a low bridge: "I cannot say by any means that I regret this—as you know Engineers are prone to gratify a taste for the magnificent when there is a good reason for the execution of prominent works."[239] He repeats this sentiment in his *Reminiscences*: "It was natural that an engineer should incline to a work that would give prominence to professional character as a work of art."[240] He had lamented earlier restrictions during the aqueduct's planning stages, concluding that "originality was regarded as subservient to success."[241] With Latrobe and Scowden, Jervis preferred a bridge that combined engineering

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the Public Works Historical Society in Chicago published Lankton's 30-page *The "Practicable" Engineer: John B. Jervis and the Old Croton Aqueduct.*

237 The Commissioners' Report estimated the High Bridge would add $1.18 million to the aqueduct's cost and take five years to build. Adding support to the Commissioners' consideration of aesthetic value of aqueduct structures, the following appeared in the same report: "The Commissioners were in hopes, as they had abandoned the idea of crossing the Harlaem River with an aqueduct bridge, that they would have been enabled to recommend the building of a similar structure for carrying the water over the Manhattan Valley; a work that must have been an ornament to the city and a credit to the Corporation, as well as to the individuals having charge of its execution; but the vast difference in the cost has put it entirely out of the question, and they have accordingly adopted the plan of carrying the water over the valley by pipes or inverted siphons." See "Semi-Annual Report of the Water Commissioners," 87.

238 Koeppel, *Water for Gotham,* 238-39.

239 Koeppel, *Water for Gotham*, 221, 237. Koeppel cites Nelson Manfred Blake, *Water for the Cities: A History of the Urban Water Supply Problem in the United States* (Syracuse, NY: Syracuse University Press, 1956), 157. The legislature gave Jervis the task of deciding between a high bridge design (of which his was greater in height than the legislature had mandated) *or* an inverted syphon tunnel on a lowbridge. A more extreme inverted syphon, a tunnel passing beneath the riverbed, was eventually accomplished for the second, or "new," Croton Aqueduct (constructed 1893-1906). "A tunnel would be a new challenge. There was no completed underwater tunnel anywhere in the world, and Jervis was well aware of the ongoing trouble building the first one that would eventually succeed. In London … Marc and Isambard Brunel thad been working on a twelve-hundred-foot passage under the Thames since 1825." The Thames tunnel was complete in 1841, the year before the Croton Aqueduct opened, and was a success: "the trains of the East London Railway still run through it," notes Koeppel (237, 333 n. 59).

240 Koeppel, *Water for Gotham,* 238-39.

241 Jervis quoted in Koeppel, *Water for Gotham,* 193.

soundness and architectural aesthetics in equal measure, defining it as displaying "professional character."

The bridge stood as the most ambitious arcade bridge in the U.S., but it was hardly the first. Jervis drew not only from his own experience but also from the work of other engineers on major bridges in the U.S. and Europe. His own Erie Canal arcade bridge served as an outstanding object not only for study but also for innovation. **[Figure 51]** Innovation and new technology resulted when existing waterworks forms changed to suit new functions. In this instance, canal design transformed as it was put to new use in aqueduct design. The transportation of passengers and goods on a viaduct of water lends its form to a canal that transports water: water is now itself a product, in the form of urban water supply, and the technological design is now an aqueduct, not a transportation canal.[242] The Croton and other aqueducts historically changed the terms that defined uses for canals and their bridges, or canal crossings. Major pertinent examples come not only from the Erie Canal in New York, but also from the Pennsylvania State Canal, the Delaware & Hudson Canal, and the Chesapeake and Ohio (C&O) Canal in Maryland and Washington, D.C. Many innovators who began their careers on canal systems went on to prominent careers in urban aqueduct design. In addition to Jervis, the list includes several

242 Bridge design is important to aqueduct history in any age: aqueduct bridges are employed to permit a canal or pipeline to cross sudden elevation drops in ground level along a waterworks route, most often where the aqueduct needs to cross over a river or a valley. The aqueduct gradient—that is, the gradual downward angle that keeps water flowing with gravity continuously from source to terminus—must be maintained evenly along the entire route. A gravity system, which involves no pumping, requires the aqueduct to cross a chasm either on a bridge or through a siphon to keep water flowing on its engineered downhill gradient. The Croton Aqueduct High Bridge over the Harlem River combined the two: a shallow pipeline siphon ran along the top of the aqueduct bridge. The first aqueduct bridges in history, built in ancient Rome, took the form of an arcade, that is, a series of arches carrying a narrow water channel along the top. In appearance an aqueduct arcade appears much as an arched bridge today carries road or train traffic; the aqueduct arcade is different in that it is engineered on a downhill gradient, that is, the apparently "level" bridge actually is angled downward at the lowest percentage of grade possible to keep the water flowing at a reasonable speed to its destination. Some ancient Roman arcades ran for miles across uneven terrain or over valleys to maintain the waterway's even gradient into the city. American canal or aqueduct bridges, for the most part, permitted a canal or pipeline to cross over rivers, roads, or other waterways. See my discussion of an analogous conceptual change for ancient Roman aqueduct development, in which a change in technological reasoning leading to innovations in water technologies required a change in cultural thinking, in Rina Faletti, "Aqueduct as Hegemonic Architecture: A Case from the Roman Republic," in *Ideas of Water from Ancient Societies to the Modern World,* series 2, vol. 1 of *A History of Water,* eds. Terje Tvedt and Terje Oestigaard (London: IB Tauris, 2010), 147-91.

of Jervis's key assistants: Theodore Scowden, who designed and built waterworks for Cleveland, Cincinnati, and Louisville; and John Roebling, who invented wire cable suspension and designed the Brooklyn Bridge.

After the Croton Aqueduct was completed in 1842, Jervis worked on bridges by John A. Roebling.[243] Roebling's importance to this study emerges as much from his waterworks projects as from his writings, which explicitly consider the aesthetic and cultural implications of public works design. His earliest work included aqueduct bridges, but Roebling scholars have generally neglected the waterworks in favor of his better known rail and roadway bridges.[244] In fact, Roebling's first suspension span was an aqueduct crossing—a seven-span wood bridge he built in 1844 to carry the Pennsylvania State Canal over the Allegheny River to Pittsburgh.[245] **[Figure 52]**

> The Allegheny Aqueduct was the first bridge of any kind built by Roebling, who previously had done general civil engineering—mostly railroad surveys—and manufactured wire rope for haulage on the inclined planes of the Pennsylvania

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243 On Roebling's canal work, consult Robert M. Vogel, *Roebling's Delaware & Hudson Canal Aqueducts*, No. 10 in Smithsonian Studies in History and Technology (Washington, D.C.: Smithsonian Institution Press, 1971). Roebling became the Brooklyn Bridge chief engineer in 1867 and worked on its design until his death of tetanus after an accident at the bridge abutments in 1869. Roebling's son, Washington, succeeded his father as chief engineer for the Brooklyn Bridge, completing the project between 1870 and 1883, with direct if unofficial expert assistance from his wife, Emily Warren Roebling. In 1872, Emily Roebling assumed the project's acting management for the last ten years of work after Washington suffered paralysis by caisson disease, or the bends, a decompression illness that struck him during underwater caisson work on the Brooklyn Bridge's Manhattan pier. See Richard Weingardt, *Engineering Legends: Great American Civil Engineers* (Reston, VA: American Society of Civil Engineers, 2005), 55-60. See also Montgomery Schuyler, "The Brooklyn Bridge as a Monument," in *Roots of Contemporary American Architecture*, ed. Lewis Mumford, (1952, repr. New York: Dover Publications, 1972), 159-68; and Richard G. Carrott, *Egyptian Revival: Its Sources, Monuments and Meaning, 1808-1858* (Berkeley, CA: University of California Press, 1978), 124 n. 19: "The elder Roebling considered an emphatic Egyptian style for the Brooklyn Bridge (1857)." See also David G. McCullough, *The Great Bridge* (New York: Simon and Schuster, 1972), 218.

244 A significant example of this omission comes in David P. Billington's analysis of aesthetics in structural engineering, *The Tower and the Bridge: The New Art of Structural Engineering* (New York: Basic Books, 1983), 72-82. Billington mentions the Allegheny canal bridge as Roebling's first suspension bridge, but does not discuss the significance of it or any of Roebling's aqueduct bridges as water works structures. Moreover, in a summary of Roebling's achievements, Billington ignores the Delaware & Hudson Canal bridges. Billington published his book in 1983, but he does not cite Robert M. Vogel's 1971 work on Roebling's waterworks spans. This current study seeks to round out the waterworks aspect, which has so far been relatively absent from this engineering and architectural history.

245 Billington, *The Tower and the Bridge,* 72-82. Also see Vogel, *Roebling's Delaware,* 1, 4.

> state and other canal systems. The aqueduct replaced and was erected on the piers of a seven-span timber structure that had been damaged by ice.[246]

The destroyed crossing determined Roebling's design for the Pittsburgh aqueduct bridge, "a wooden structure on seven stone piers [that] had served…from 1835-1844," and which had been wrecked in collision with "freshets," flood waters which in winter carried ice floes. Roebling's contract required that he repair and re-use the existing seven piers in the new structure. Roebling's principal contribution to suspension bridge engineering was a cable-spinning process: "a practical method of constructing the cables by spinning in place the individual wrought-iron wires of which they were composed, compacting them finally into a cylindrical, virtually solid cable, in which each wire carried its full proportional load."[247] In Roebling's written specifications for his new Allegheny wire-rope bridge, Gibbon says the engineer created what are "still the basic principles for today's suspension bridges," the element that made the Brooklyn Bridge—as well as Roebling's predecessor bridges—an American crowning glory.[248] **[Figure 53]**

Gibbon points out that the first cable suspension transportation bridge in the U.S was built not by Roebling but by his French rival, Charles Ellet, Jr., who constructed this first suspension span over the Schuylkill River, adjacent to Philadelphia's Fairmount Waterworks, in 1842.[249] **[Figures 54, 55]**

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246 Vogel, *Roebling's Delaware,* 10.

247 Vogel, *Roebling's Delaware,* 10. On the "major engineering feat" of Roebling's Allegheny wire-rope suspension aqueduct, see Donald L. Gibbon, "How Roebling Did It: Building the World's First Wire-Rope Suspension Aqueduct in 1840s Pittsburgh," *JOM* 58, no. 5 (May 2006): 20-29, accessed February 25, 2015, http://www.tms.org/pubs/journals/jom/0605/gibbon-0605.html. See especially Gibbon's description of rope walks (long winding extents of linear wharf spaces where rope for shipping was manufactured), which makes explicit the association between hemp rope and wire rope. Rope walks were of high cultural importance, even once they were obsolete. Boston's rope walks were among the last things destroyed in Boston in the process of landfilling the city's Back Bay.

248 Gibbon, "How Roebling Did It."

249 The first suspension bridge in California, the old Bidwell Bar Bridge, came within a decade of the Ellet Bridge. In 1853, it was transported to California from New York around Cape Horn, and was completed in 1856 in its place spanning the Feather River. The bridge threatened to be inundated with the construction of the Oroville Dam in the 1950s, so the bridge was moved to a historic spot nearby, adjacent to a settler cabin and "The Mother Orange Tree of Butte County," which was planted there in 1856. See "Old Suspension Bridge," California Office of Historic Preservation, accessed February 25, 2015, http://ohp.parks.ca.gov/ListedResources/Detail/314.

> The French system was used whereby the cables were constructed on land, then dragged to the site and elevated into position. But Roebling contended that in this process the wires in the cable got dislocated and bulged out, assuring that the stresses on the cable would not be equally distributed under load…. In contrast, all of Roebling's bridges used cables 'spun in place.'[250]

The location for the Ellet span heightened the historical-cultural importance of the Fairmount area in Philadelphia. This was further enhanced by the fact that the Ellet Bridge was contemporaneous with the famed Croton Aqueduct. The Schuylkill River bridge crossing gained broad landmark status with a series of famous bridges at that location. The original bridge was the first covered, clear-span, laminated-wood bridge in the United States, called the "Colossus" in its time, the product of prominent bridge-builder Louis Wernwag.[251] **[Figure 10]** The Ellet suspension bridge that replaced the "Colossus" was replaced in 1875 by the Callowhill Street Bridge, an iron truss bridge with an embedded ornamental arcade.

Roebling also designed a series of aqueduct bridges for the Delaware & Hudson Canal between 1847 and 1850. His four suspension bridge canal crossings were of nearly identical design: low-profile wooden structures with long, shallow suspension cable spans strung within the wood truss work. In these structures, Roebling perfected his invention of wire cable spun *in situ* during suspension bridge construction.[252] Vogel

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250 Gibbon, "How Roebling Did It."

251 Later, from 1835-37, Wernwag worked with Benjamin H. Latrobe II (1806-1878), son of Benjamin Henry Latrobe (1796-1820), to build a Harpers Ferry covered railroad bridge in an Egyptian Revival mode. The same style choice persisted in all subsequent renovations and additions to the Harpers Ferry bridge, through 1851. he bridge was a Civil War casualty. For a broader art-historical context, see my section in this chapter on Egyptian Revival architecture in the United States. Also see Weingardt, *Engineering Legends* 53-60; Henry Grattan Tyrell, *History of Bridge Engineering* (Chicago: The G.B. Williams Co., 1911), 135-37, accessed February 25, 2015, http://books.google.com/; and Richard G. Carrott, *Egyptian Revival: Its Sources, Monuments and Meaning, 1808-1858* (Berkeley, CA: University of California Press, 1978), 104-05. Throughout my discussion of Egyptian Revival design in architecture, I draw generously from Carrott, whose conceptual analysis of historical revival styling conforms with my own, especially as regards waterworks structures and cultural values that historical revival design embodies and reveals

252 See Vogel, *Roebling's Delaware,* 4-5. See images in which cabling is visible within the wood truss work: fig. 33 (26); fig. 43 (32); and esp. fig. 56 (41-42), with Roebling's elevation of suspension aqueduct design. See also fig. 12 (11). The image, a view of Roebling's Delaware Aqueduct bridge, is from William Cullen Bryant's etching collection, *Picturesque America,* vol. 2, and depicts one of these trussed aqueduct suspension bridges, a four-span example in the cited image. Vogel's caption reads: "At a time when public works wrought less havoc to the landscape than today, engineering structures could frequently be

comments on the visual impact of Roebling's Egyptian Revival stone towers of his Niagara Railway Suspension Bridge (1851-1855), and in his designs for the Pittsburgh bridge towers. Roebling himself referred to these bridge towers as "the pyramids."[253] He wrote explicitly about the social and cultural role of art and aesthetics in public works architecture: "Public works should educate public taste….In the erection of public edifices, therefore, some expense may and ought to be incurred in order to satisfy the artistic aspirations of a young and growing community."[254] For Roebling, technology, especially those technologies developed in the design and building of public works

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appreciated for their visual as well as their technical contribution, even in an area as scenically hallowed as the upper Delaware Valley." It might be argued that public (or civil engineering) works projects did *not* necessarily wreak less havoc on any landscape at any time in history when compared with any writer's "today." Public and civil engineering works have as their principal aim to reapportion, reposition, and/or remove natural resources and landscape/natural features, in order to be able to participate in the pecuniary economy. They by definition wreak havoc on resources and upon the landscapes in which they occur. Works developed at such sites in effect completely transform the landscape, physically, visually, and from a *use* perspective. The use transformation means transforming them from one use to another, so that in the process their social, economic and/or cultural value is transposed: from "useless" to "useful", and vice-versa, relative to the point of view on what the use of the landscape *should* be. Regrettably, there is not space in this dissertation to elaborate the point.

253 Note images in Vogel, *Roebling's Delaware*, 5, fig. 5; and 20, fig. 25. "[Roebling] estimated weights and costs for rendering in both marble and cast iron what he termed the 'pyramids.'" See Carrott, *Egyptian Revival,* 104-05: "Isambard Kingdom Brunel's Clifton Bridge design of 1831, in England, is the first example of an 'Egyptian' suspension bridge…. It involved a 'scheme having a span of 702 feet, and low pylons erected high up on the rocks in an Egyptian style, they were to be encased in metal, decorated with hieroglyphics showing the various stages in the building of the bridge, and topped by sphinxes.' …Brunel wrote officially of the project in terms of the grandeur of the style's being appropriate to the grandeur of the site….The most obvious instance of this in the U.S. was the railroad bridge over the Potomac at Harpers Ferry," whose original design was by Benjamin Latrobe II (the Philadelphia waterworks engineer's son) and Louis Wernwag. Wernwag also designed the 1912 "Colossus" Bridge across the Schulykill River in view of the Fairmount Waterworks in Philadelphia. See Lee H. Nelson, *The Colossus of 1812: An American Engineering Superlative* (New York: American Society of Civil Engineers, 1990). After the "Colossus" Bridge burned in 1838, its 1842 replacement was the first suspension bridge in the U.S. by French bridge engineer Ellet. Carrott contributes that "among other North American examples of suspension bridges employing Egyptian forms (piers, obelisks, or pylons): Charles Ellet, Jr.'s Fairmount Bridge near Philadelphia of 1841; E.W. Serrell's Lewiston Suspension Bridge over the Niagara River of 1850-51; the Covington-Newport Bridge over the Licking River in Kentucky, 1854; J.A. Roebling's double-level wonder at Niagara Falls, 1852-1854; a bridge over the St. John River in New Brunswick of ca. 1853, probably by E.W. Serrell…; and another Canadian example over the Desjardin Canal at Hamilton of about 1855." See Carrott, *Egyptian Revival,* 104-05.

254 John A. Roebling, *Annual Reportof the President and Directors to the Stockholders of the Covington & Cincinnati Bridge Company: For the Year Ending Feb. 28, 1867* (Trenton: Murphy & Bechtel, 1867), 27-28, quoted in Billington, *Tower and Bridge,* 80. Billington notes that an abridged form of Roebling's report was published that year in several issues of the journal *Engineering.* See *Tower and Bridge,* 282-83. My citations come from the text of Roebling's original 1867 report, whose focus on aesthetic and cultural values is more completely developed than in the *Engineering* version.

structures, contributes to "a higher spiritual culture."[255] David Billington classifies Roebling's suspension bridge work as an exemplar of "the supreme goal of structural engineers—to unite beauty and utility in urban public design."[256] Many hydraulic engineers such as Roebling, Jervis, and others of their era—even Latrobe—gained initial experience working on transportation canals, which provided practical know-how directly applicable to their subsequent work on water supply systems.

Once he was in charge of the Croton Aqueduct, Jervis consulted with his former boss, Benjamin Wright, who had supervised the Erie Canal with its eleven aqueduct crossings. Wright was later chief engineer on other canals employing arcade aqueduct crossings, such as the 185-mile C&O Canal on the Potomac River from Cumberland to Washington, D.C. The C&O featured eleven aqueduct bridges, four of which were masonry arcades. The most ambitious of these was the seven-arch Monocacy Bridge; the others had three arches apiece.[257] Later, an eastern extension of the C&O Canal crossed over the Potomac from Georgetown on an aqueduct bridge, permitting a canal extension along the Virginia riverbank to the canal's terminus at Alexandria. Jervis corresponded with John Abert, engineer of this Potomac (or Alexandria) Aqueduct bridge, about the Harlem River High Bridge crossing.[258]

Four Roman Revival arcade spans were initially planned on the Croton Aqueduct, but the High Bridge was the only one built. Jervis considered a second multi-arched bridge for the Mill River aqueduct crossing farther upstream, but this "presented the most challenging engineering on the second division":

> The riverbed was over seventy feet below the grade line of the aqueduct, and the hollow through which the river ran was some three hundred feet across. Jervis had spent much time analyzing the options before rejecting a multi-arched bridge (as first proposed by Douglass) in favor of a massive embankment with two sixteen-

[255] Billington, *Tower and Bridge,* 82.
[256] Billington, *Tower and Bridge*, 78.
[257] See "WHILBR: Western Maryland's Historical Library," Western Maryland Regional Library, accessed February 25, 2015, http://www.whilbr.org.
[258] Koeppel, *Water for Gotham,* 209-11 n. 61, 241 n. 72.

foot culverts (later reduced to one of twenty-five feet) for the river to pass through; it would be the highest embankment on the entire line.[259]

A third multi-arch aqueduct bridge for the Sing Sing valley crossing had been promoted by Jervis's predecessor, Douglass, but Jervis rejected this design in favor of a solid masonry wall with a single arched opening over Sing Sing Creek.[260] Jervis commented: "the work in [the Sing Sing] arch has no superior in comparison with other arches of this size."[261] At the end of 1837, the completed Sing Sing section drew high public interest. A newspaper report assessed the Sing Sing crossing as "the most astonishing specimen of art and ability of man."[262] The *Hudson River Chronicle* highlighted the massive work's aesthetic value: "It is su[r]prising to observe how beauty and solidity are blended in the

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259 See Koeppel, *Water for Gotham,* 212, 215, for images. See an image of the rejected Mill River multi-arched bridge design from a loose original engineering pencil drawing (n.d., but presumably before 1841), at "Old Croton Aqueduct, Mill River Culvert, U.S. Route 9 at Sleepy Hollow Cemetery," Library of Congress, accessed February 26, 2015, http://www.loc.gov/pictures/collection/hh/item/ny1176/. A drawing of the completed Mill River bridge and culvert can be found in Tower, *Illustrations of the Croton Aqueduct*, 104, pl. xv. For photographs showing the Mill River embankment and culvert, see "Aerial View Showing Mill River Culvert," Library of Congress, accessed February 26, 2015, http://www.loc.gov/pictures/item/ny1176.photos.124887p/resource/.

260 "To cross the 536-foot-wide valley at Sing Sing, Jervis abandoned Douglass's elaborate multiple-arch bridge concept for long, narrow, solid stone walls on either side of a single, elliptical arch, in a 'plain and substantial style of architecture.' With a span of eighty feet, the arch would have a vertical height of twenty-five feet, seventy feet above the stream. Jervis recognized that even this single arch was susceptible to a problem that had plagued elevated masonry aqueducts from ancient Rome to America, including the High Falls Aqueduct carrying the Delaware and Hudson Canal, and the Little Falls Aqueduct carrying the Erie, with which he was intimately familiar. The problem was leakage from the waterway and destructive freezing and expansion in the supporting structure; though it had been laid with the best hydraulic cement, Little Falls showed frost damage just a dozen years after its completion. Jervis found the answer in a pioneering work of the great Scottish engineer Thomas Telford. At the beginning of the century, Telford had used fixed cast iron plates in the bottom of the Chirk Aqueduct on the Ellesmere Canal in Wales; the canal had never leaked. Engineers had fabricated similar troughs on a later Scottish canal with similar results. 'After much reflection,' Jervis concluded that 'the aqueduct over heavy arches, after being made of the best hydraulic masonry, should be lined with cast iron, impervious to water.'" See Koeppel, *Water for Gotham,* 197-98. Jervis lined the arches—not the aqueduct channel—on the Harlem River High Bridge using this method. Telford built one of the earliest noteworthy suspension bridges in Europe, over the Menai Straits, finished in 1825. See Montgomery Schuyler, "The Brooklyn Bridge as a Monument," in *Roots of Contemporary American Architecture*, ed. Lewis Mumford, (1952, repr. New York: Dover Publications, 1972), 159.

261 John B. Jervis, *Reminiscences of John B. Jervis, Engineer of the Old Croton* (Syracuse: Syracuse University Press, 1971), 128-29, quoted in Koeppel, *Water for Gotham*, 242 n. 75.

262 Koeppel, *Water for Gotham,* 239 n. 66. The Sing Sing arch keystone, fitted in August 1839, was celebrated with parties thrown by the lead contractor. Koeppel, 241 n. 74. Fayette Tower's publication on the Croton Aqueduct included an engraving of the "enormous…Sing Sing arch that was the pride of Sing Sing and remains a tourist attraction." From caption in Koeppel, 242, fig. 37.

construction of this stupendous work….[B]etter or finer cannot be found in the United States, than that now being done on the Croton Works."[263] The fourth planned arcade bridge was to have crossed the Clendening Valley, the last above-ground feature in Manhattan before the aqueduct entered the receiving reservoir at York Hill.[264] Jervis's process of conceptualizing, planning, proposing, and finally rejecting three arcade bridge designs culminated in the Roman Revival High Bridge.[265] Once water delivery into Manhattan was secured with the Croton Aqueduct's completion, focus shifted to designing and constructing the two reservoirs—the York Hill receiving reservoir at 90th Street, and the Murray Hill terminal distributing reservoir at 5th Avenue and 42nd Street.[266]

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263 Koeppel, *Water for Gotham,* 212. Koeppel quotes Alexander Wells' *Hudson River Chronicle,* Nov. 14, 1837. The article describes this Sing Sing section: "A wall some fifteen thick is carried to nearly thirty feet in height, composed first of layers of large flat stone, compactly laid, and then a course of stone pounded to the size of pebbles, that every crack and crevice are filled up; and upon this is a thick laying of stone and water cement, that the whole may become as one solid rock." High public interest also focused on the aesthetic value of a tunnel near Sing Sing. When workers broke a tunnel through a hill, a journalist notes: "the passage, 375 feet long, twelve feet across, and eight feet high, became an immediate attraction. 'The tunnel was handsomely lighted,' reported the *Westchester Herald,* 'and a large number of our citizens in a body performed the subterranean trip each way.' Tunneling had taken six months, with as many as twenty-five men working in shifts day and night. After the public viewing, the popular contractors set out a banquet at their Sing Sing lodgings." See Koeppel, 218-19.

264 That valley, just west of Ninth Avenue, was 50 feet deep and 1,900 feet long. The following gives an idea of the massive scale of even a single element of the aqueduct, and the ways in which it altered the local landscape. "[L]ined with iron in a similar fashion to that in the Sing Sing arch, [the brick aqueduct conduit] would be carried along an elevated bridge, hollowed again like the Sing Sing structure, and featuring a series of arches to accommodate six future cross streets and sidewalks; two arches twenty-seven feet across would cross the widest of these streets, 96th Street, with fourteen-foot arches over sidewalks on either side. From the Clendending Valley, the final mile of brick conduit would curve down to the northwest corner of the upper of two linked basins of the receiving reservoir at York Hill, a great rectangle covering thirty-five acres of rocky open land that would later be in Central Park." Today, that receiving reservoir is buried beneath the expanse of Central Park's Great Lawn, located between 89th and 91st Streets. See Koeppel, *Water for Gotham,* 215.

265 To carry the aqueduct over the river while the High Bridge was under construction, Jervis built a cheap, temporary, low embankment bridge. In spite of ongoing economic and political controversies,…the decision to go forward with the temporary Harlem crossing was judged by the *New York Whig* as of 'inestimable advantage' in providing both water and income to service the debt sooner than otherwise expected. In a counterpoint to the *Herald*'s plaint about the lack of Roman grandeur, the *Whig* observed that the ventilators along the aqueduct route "rise up like pyramids." The paper pronounced the whole work "as durable as stone and water cement, in the hands of skilful workmen, can make it. The structure will endure for the ages."Koeppel, *Water for Gotham,* 245.

266 "The distributing reservoir contract (Section 97) went to Thomson Price, who bested Law and eight others with a bid of $360,710." See Koeppel, *Water for Gotham,* 231. To get an idea of comparable size for

EGYPTIAN REVIVAL: THE AQUEDUCT'S MURRAY HILL TERMINAL RESERVOIR (1842)

The terminal reservoir for the 1842 Croton Aqueduct, the Murray Hill distribution reservoir, was in Egyptian Revival style. Jervis designed it to be "the display object of the works on Manhattan."[267] **[Figure 47, 48, 61]** Its solid-wall mass stood completely above-

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contemporary reservoirs, consider that the receiving reservoir had a planned capacity of 150 million gallons and the distributing reservoir 20 million gallons; "by contrast, the total capacity of the reservoirs and tanks of the Manhattan Company and the 13th Street system was no more than half a million gallons." See Koeppel, 215. "At 420 feet square and containing 20 million gallons of water in two basins, the Murray Hill reservoir would be a fraction of the size" of the 150-million-gallon receiving reservoir." See Koeppel 215-17. In 1839 Jervis had moved Tower from the remote upper Westchester aqueduct sections to the Manhattan sections, assigning him to the Clendening Valley bridge, the last above-ground feature before the York Hill receiving reservoir. For an image of the receiving reservoir, see Nathaniel Currier's [1842] engraving in Koeppel, 274, fig. 44. Note that the York Hill reservoir is of similar basic engineering design as the Murray Hill distributing reservoir, if markedly different in style and size. To help complete the York Hill receiving reservoir, Fayette Tower "joined current fourth division first assistants James Renwick, Jr., and Edward Tracy." See Koeppel, 236 n. 53, and 215, for the topography of the aqueduct's Manhattan features, from the Harlem River crossing at 173rd Street to the 42nd Street reservoir. All aqueduct work proposals for Manhattan used "street locations that existed as yet only on paper." See Koeppel, 214.

267 Koeppel, *Water for Gotham,* 217. Of interest in the Egyptian Revival discussion is the cultural importance of the style and location of the New York City Croton Aqueduct's Murray Hill distribution reservoir. The waterworks' initiation of the cultural value of this plot of land in New York is confirmed and heightened by P.T. Barnum's choice to place his Crystal Palace adjacent to the Croton reservoir site. **[Figure 61]** "By the early 1850s New York had grown to sufficient size and prominence that the city decided to host a major exhibition of the type that London had recently pioneered. Such early exhibitions were forerunners of the later world's fairs. The 'Exhibition of the Industry of All Nations' opened on July 14, 1853, in a sparsely developed part of the city. Fortieth and Forty-second streets bounded the fair's four-acre site to the immediate west of the Croton Distributing Reservoir, on the other half of the long block the reservoir occupied, facing 6th Avenue behind the reservoir. The property had historically been open land that had served as a potter's field. In 1847 the potter's field was designated a city park, and named Reservoir Square. It is now Bryant Park, and lies behind the New York Public Library, the structure that replaced the reservoir when the New Croton Aqueduct rendered it obsolete. In 1853-54, New York's first 'world's fair,' the Crystal Palace Exhibition, took place on the site." See "Bryant Park, Early History," Bryant Park Corporation, accessed February 26, 2015, http://www.bryantpark.org/about-us/history.html. Also of interest to the Egyptian Revival discussion, regarding contemporary cultural interest in things Egyptian: in 1842, the year in which the reservoir opened, Barnum purchased two mummies from the museum collection of Philadelphia artist Charles Willson Peale; the painter had first exhibited the mummies at his Philadelphia museum in 1826. Carrott traces the earliest mummy exhibit to the eighteenth century, where "there was a mummy at the first-known American museum, that at Charleston, South Carolina. In 1823 the Massachusetts General Hospital owned and exhibited a Theban mummy with its coffin." According to Carrott, these mummies were among the earliest Egyptian artifacts placed on exhibit in the United States, but major collections of Egyptian art and artifacts came on display in the U.S. primarily between 1823 and the 1850s. Carrott also notes: "In 1835 when the Egyptian Revival was already at flood tide, Joseph Smith, the Mormon prophet, purchased two mummies recently arrived in New York from Paris. In the chest of one was a papyrus which Smith claimed as part of the *Book of the Dead.* One copy was printed in 1842, another with comments in 1844. It will be remembered that the Prophet had already translated the *Book of Mormon*, through the miraculous Spectacles, which had been written in 'hieroglyphics' (1830)." See Carrott, *Egyptian Revival,* 48.

ground, upon two city blocks (four acres) facing 5th Avenue between 40th and 42nd Streets, and extended back for half the long city block that stretched between 5th and 6th Avenues, leaving the adjacent two city blocks of space open behind it.[268] It was a rectilinear masonry structure with broad promenades around its perimeter at the open-air water-surface level. In the most basic terms, "Egyptian architecture is [usually] thought of as a series of frontal pylons with doorways at their centers."[269] The design for the Croton reservoir exemplified this idea[270]:

> The reservoir's sloping masonry walls were on average forty-five-and-a-half feet high, allowing for a water depth of thirty-six feet and a waterline 115 feet above mean tide, some fifty-one feet lower than the water level up at the Croton Dam. The adornment of the reservoir's outer walls, beveled at one to six, would be Egyptian, with raised pilasters at the corners and temple-like entry doors in midwall pilasters. An Egyptian-style cornice would ring the top of the reservoir's walls, some seventeen feet wide, where there would be an iron railing to create a public promenade.[271]

Art Historian Richard G. Carrott describes the reservoir as "monumentalizing,"

> with massive corner towers, and imposing center pylons on three of the four sides. In extent and impressiveness it is on a scale, even, of ancient Egyptian monuments, covering two entire city blocks, rising to over fifty feet in height, and

[268] This open space is currently known as Bryant Park, on the Avenue of the Americas between 40th and 42nd Streets. Today, the park backs onto the New York Public Library replaced the reservoir after it was demolished in 1900. The library opened in 1911.

[269] Carrott, *Egyptian Revival,* 114. In Carrott's historical analysis, Haviland's penitentiary building, the New York City Halls of Justice, or "The Tombs" (1835-38), marks the apex of American Egyptian Revival, and might be considered as having a direct influence on Croton Aqueduct reservoir styling. See Carrott's complete analysis of "The Tombs," Appendix III, 146-92.

[270] Carrott defines five criteria for phases of 19th-century American Egyptian Revival period styles. "There are three formal aspects of the Egyptian Revival style, plus two further categories not strictly formal but based on stylistic criteria. Although a basic development may be observed from one of these phases to the next, it should be remarked that at the point of maturity of the movement all five existed concurrently. These divisions are: pseudo-Egyptian in which motifs are applied to a common classical core; the horizontal phase in which the entire form is specifically Egyptian; the vertical phase in which there is a merging of the Egyptian vocabulary with Gothic proportions. The two parenthetical aspects are: provincial work in which there is a stiffness and crudeness with extreme simplification; and finally, 'Egyptianizing' examples in which specific details are not archeologically pure Egyptian, but whose total effect echoes an Egyptian feeling or aesthetic." See Carrott, *Egyptian Revival,* 61. Refer to Carrott's images to clarify this explanation. For readers interested in Egyptian Revival impulses within American landscape painting, Carrott's text includes a brief survey of architectural examples for each of his categories, drawing parallels with analogous examples from 18th and 19th century painting. See Carrott, 61-63.

[271] Koeppel *Water for Gotham,* 215-17.

having a capacity of twenty-one million gallons…J.B. Jervis, the probable designer…employ[ed] undecorated horizontal torus moldings and cavetto cornices along with a marked batter to the walls. Admired in its day for the solid durability and finish of its masonry, the reservoir was also referred to as an ancient temple, an illustration of what art and science can accomplish."[272]

Carrott comments in detail on the choice of Egyptian Revival design in relation to the Roman Revival arcade chosen for the High Bridge:

> …while aqueducts inspire thoughts of Roman engineering, the control, storage and distribution of water somehow seem more related to the Nile with its yearly life-giving floods, and the lands' irrigation-based economy. These aspects of the ancient Nilotic civilization were known since antiquity, and revived through the various hydraulic projects of Mohammed Ali who hired European engineers to deal with these problems in the 1830s.[273]

To help him with the Croton Reservoir, Jervis promoted a young James Renwick, Jr. (the future influential architect), who had worked as a first assistant on the Croton Aqueduct.[274] The distributing reservoir was completed with Renwick's assistance and probably under his supervision, but the evidence is not direct; the reservoir's Egyptian

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[272] Carrott, *Egyptian Revival,* 107, 124-25 n. 24-25.

[273] Carrott, *Egyptian Revival,* 106.

[274] Koeppel, *Water for Gotham,* 236, 333 n. 53. James Renwick, Jr. had graduated from Columbia College in 1836 in Engineering, where his father, James Renwick, Sr., was a professor. Jervis first hired Renwick, Jr. indirectly: he was an existing assistant on the Croton Aqueduct with one of its initial "resident" engineers, Peter Hastie. In 1837, Jervis hired Hastie to do aqueduct surveys, and his assistants were "familiar to Jervis: second assistant James Renwick, Jr., was the nineteen-year-old son of Jervis's friend and business associate [James Renwick, Sr.]; first assistant William Jervis was a younger brother of the chief." Earlier in Jervis's career, during the early 1830s, when he had served on the Mohawk and Hudson Railroad in upstate New York, he got to know James Renwick, Sr., who was one of the railroad's directors, a Columbia College Engineering authority, and co-founder in 1818 of the West Point Foundry Association, which fabricated locomotive engines. West Point was the first U.S. college to have a formal Engineering program. See Koeppel, *Water for Gotham,* 185-98, 200, 327 n.31.

Revival design is attributed by historians variously to Jervis or to Renwick.[275] Within the context for this study, Renwick is noteworthy as another major American architect who began his career working on water supply structures and who had a strong background in engineering. Renwick is also of interest to this study for his pivotal role in the development of California architecture.[276]

To understand factors that likely influenced the reservoir design, one must study the work from within the broader context of American Egyptian Revival in the first half of the 19th century.[277] Carrott analyzes ways in which 19th-century culture valued Egyptian architecture, and he discusses ways in which those values may have applied to suspension bridges and waterworks structures.

> … [T]here was a distinct feeling for not simply the great *age* of Egyptian monuments, but, in addition, their strength, solidity, and immortality in the face of the ravages of time. Thus there was the concept that, in order to be viewed today, the structures of this extreme antiquity must have been built in such a manner as to last for eternity…The attitude, then was that great age did not imply fragility, but, rather, dependable and reassuring permanence. This is in contrast to the

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275 Carrott directly addresses the ambivalence in the historical record on the question of Renwick's involvement in the design and construction of the Murray Hill Reservoir: "As Ms. Selma Rattner (who is currently working on Renwick) has pointed out to me, there is really no firm evidence that the design of the distributing reservoir on Murray Hill was conceived of by Renwick. His name is not mentioned by Tower or even Jervis who was the chief engineer of the entire project. It is probably the latter who *designed* the structure while Renwick *supervised* its erection, which would at least account for the latter's rather detailed drawings in the metropolitan museum sketchbook. In point of fact, in B.J. Lossing, *History of New York City* (New York, 1884), 674, there is a brief biography of Renwick, presumably in consultation with him as he was still alive then, in which it is stated that as assistant engineer he "supervised" the building of the distributing reservoir. Of course, he could have assisted Jervis in the initial concept, but his authorship really would seem to stem only from tradition rather than demonstrable fact. All of which is rather too bad as it would have made a nice chronological beginning to the career of an architect most noted for his French high gothic cathedral some ten blocks away. I am extremely grateful to Ms. Rattner for having saved me from some sloppy scholarship which I should have been more careful about initially." Carrott, E*gyptian Revival,* 124-25 n. 24.

276 Renwick gained prominence in Washington, D.C., as architect of the Empire-style Corcoran Gallery of Art building across the street from the White House on Pennsylvania Avenue (1857-74, now the Renwick Gallery, the Smithsonian American Art Museum's craft and decorative arts museum); the Oak Hill Cemetery Chapel, also for William Wilson Corcoran; and the Smithsonian "Castle" building. He designed two prominent churches in New York City, Grace Episcopal Church (1846) and his best-known work, St. Patrick's Cathedral (1858-78). Renwick's later architectural protégées in California included John Wellborn Root and Bertram Goodhue, both prominent in the development of California architectural styles around the turn of the century.

277 Quoted phrase in Carrott, *Egyptian, Revival,* 130. Note Carrott's remarks here regarding "significant patterns" that indicate cultural values. See also Carrott, 63.

> eighteenth-century idea that ruins showed time's, or nature's, inevitable conquest over the petty works of man…With sentiments such as these it is possible to conceive of the style's being also appropriate to the structures of the new technology.[278]

From within Carrott's historical scheme for the stages and types of Egyptian Revival expression, the 42nd Street reservoir is a fine example of the "archaeological" style. It is not necessarily tied to a specific ancient structure as its direct source but rather to representations depicted in "the vitally important publications that appeared after the Egyptian campaign of 1798-1799, and the succeeding occupation which ended in 1802."[279] The most successful Egyptian Revival buildings for Carrott are "carefully archeological in both detail and form."[280] He points out that "the Egyptian style is particularly logical for an unfenestrated building," and as a case in point, the art historian identifies John Haviland's New Jersey State Penitentiary, or "The Tombs," as exemplary of Egyptian Revival's maturity in the U.S., peaking in 1838. In form and detail, "great expanses of unrelieved masonry serve to emphasize…heavy weightiness and gravitational solidity [which] combine…to press the structure earthwards … [with a] sense of space-displacing mass." Carrott describes a "minimum of movement" in the structure, resulting in a "flat plane" enhanced by its "heavy, unrelieved roof-line" with a "ponderous cornice…projecting for emphasis" so that "its total effect is horizontal. …[T]he masonry is not intended to be viewed as individual blocks of stone with mortar,

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278 Carrott, *Egyptian Revival,* 103-05.

279 Carrott, *Egyptian Revival,* 25. It is outside the scope of this project to discuss archaeological source historiography for the Egyptian Revival, or for any Revival style discussed in this dissertation. For the Egyptian variety, readers may begin with Carrott's Chapter 2, "Sources and Stimuli," 21-46, esp. 25. For a discussion of revivalism debates regarding Rome vs Greece in Piranesi, see Carrott, 22-24, 32; and on deQuincy, see Carrott, 28, 53. See also Harry B. Evans, *Aqueduct Hunting in the Seventeenth Century: Raffaello Fabretti's De Aquis et Aquaeductibus Veteris Romae* (Ann Arbor, MI: University of Michigan Press, 2002) and Claudia Lazzaro, *The Italian Renaissance Garden: From the Conventions of Planting, Design, and Ornament to the Grand Gardens of Sixteenth-Century Central Italy* (New Haven, CT: Yale University Press, 1990). See especially chapters on water, landscape, and culture: "Nature and Culture in the Garden," "The Source for Florence's Water in the Boboli Garden," "Tivoli's Ancient Waters Revived," and "The Flower of Them All: The Villa Lante at Bagnaia."

280 Carrott, *Egyptian Revival,* 31. Carrott also calls this "consciously archeological" (35).

but rather, as one unified plane or sheath to give the effect of a solid geometrical entity."[281]

> It is also in [Haviland's] work that we encounter the classic phase of the movement, and the one that produces its most Egyptian aspect in which the horizontalizing elements are emphasized. In the 1830s this was not unusual.[282]

Architectural historian Talbot Hamlin also counts Haviland as a central figure in the development of an American architectural style through his innovations with revival styles, citing examples of Haviland's earlier, Greek Revival buildings.

Egyptian Revival structures embody several stylistic characteristics and cultural values that apply to waterworks.[283]

> Egyptian was particularly tempting in that its very stylistic features are ones, as in the case of suspension bridges, which are especially suited to the engineering demands of the projects themselves. The walls of a reservoir have to be thickest at the bottom and may gradually taper upwards. This is admirably expressed by the batter design of an Egyptian wall.[284]

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281 From "In form and detail" to the end of the paragraph, all quoted segments come from Carrott, *Egyptian Revival*, 66-67.

282 Carrot, *Egyptian Revival,* 66. For a listing and partial description of Haviland's complete *oeuvre*, refer to Carrott's appendices: Appendix I: Obelisks; Appendix II: Monuments; Appendix III: The New York City Halls of Justice and House of Detention ("The Tombs"), 139-92.

283 Carrott argues that the Egyptian Revival was "a vehicle for Picturesque attitudes." This applies in general to waterworks under discussion here. Carrott explains that "Piranesi and Caylus' argument that Egyptian architecture was of an antiquity more ancient than the Antique was an appealing one for Americans…. But along with this exotic romanticism was a principle which was more formal than iconographic, the quality of variety. As in Europe, Egyptian interiors helped to give interest, or variety, to romantically picturesque houses." This applies to the more assertive and coherent formal aspects of the waterworks under discussion here, which becomes clearest when we consider Carrott's definition of "the most advanced concept of the Picturesque," in architecture: "the idea of an eclectic ensemble of separate buildings unified through similarity of materials and scale, …to be viewed all together." Carrott shows this to be working as early as 1829 in residential architecture. Carrott creates a separate category for public and business structures, the "commercial picturesque," which he finds was more popular in the United States, even when "its beginning can be traced directly to England and specifically to the first of these structures there, the Egyptian Hall in Piccadilly" of 1829, an idea that Carrott follows to American in the form of a plan for an "ideal city" called Hygeia to be built across the river from Cincinnati. This grand idea failed, "but the Egyptian style continued to be used for commercial architecture at least until the middle of the century." This usage fits conceptually into "two basic patterns. On one hand the style exemplified the ideals of Romantic Classicism. On the other, it served the purposes of the Picturesque. For the former it expressed sublime sentiments in a geometrically simple manner, while for the latter it provided variety of form. These principles, known in Europe, were more completely expressed in the United States," particularly in commercial and public architecture. See Carrott, *Egyptian Revival,* 55-57.

284 Carrott, *Egyptian Revival,* 106.

Many aspects of Carrott's description of "The Tombs" apply to Jervis's Croton Aqueduct distribution reservoir. Like "The Tombs"—and like all exemplary Egyptian Revival architecture—the reservoir "has been pushed out to the extreme edges of the entire city block in which it is placed. In this manner, by the sheer weight of measurements, it has a distinctly horizontal accent … [and its proportions] are impressive because they are of a vaster scale than the human one."[285] Water structures in this style, like the Croton reservoir, are monumental in scale, simple in basic plan and elevation, and relatively plain in surface detail. By contrast, the interior workings and the networked system as a whole are often complex and intricate to a remarkable degree. The aspects of complexity and intricacy are not visually evident in the simple but massive exteriors that house them.[286] The "consciously archaeological" Egyptian style of large-scale waterworks architecture features a "space-displacing mass" and a "ponderousness" that applies to formal analysis of large-scale water storage structures like Croton reservoir.[287] The characteristics of such a large-scale mass are what make the Croton reservoir an ideal example of the thoughtful use of the Egyptian Revival style.[288]

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[285] And therefore, I argue, sublime in effect. See Carrott, *Egyptian Revival,* 66-68. Carrott's assessment of "The Tombs" makes the structure apt for direct comparison with the reservoir. They are contemporary structures—the prison was finished in 1838, the year before work on the reservoir began—and they are of the same type—both are major works of utilitarian architecture in the Egyptian Revival style. We can argue "The Tombs" to be a direct precursor to and immediate influence upon the reservoir. Hamlin looks more closely at Haviland's earlier Greek Revival architecture, seeing the Egyptian work—even the Tombs—as secondary. Between the two architectural historians' assessments of the industrial/utilitarian architecture, Haviland emerges as important to the history of both revival styles. The Collect pond was filled in beginning in 1811; Five Points neighborhood was a slum by 1838 when Tombs construction began there. Wikipedia says Dickens commented on the prison architecture: "'What is this dismal fronted pile of bastard Egyptian, like an enchanter's palace in a melodrama?', asked Charles Dickens in his American Notes of 1842." See "Charles Dickens," Wikipedia, accessed February 26, 2015, https://en.wikipedia.org/wiki/Charles_Dickens,; and "*American Notes,*" Wikipedia, accessed February 26, 2015, https://en.wikipedia.org/wiki/American_Notes.

[286] Consider, for example, comments by A. J. Davis (1803-1892) about his own design for a cemetery monument in c. 1840: "Not for an individual. It ought to be simple in its form, and sublime by its magnitude and solidity. It should be constructed so that even in ruins it would serve to testify to posterity the sense which the age had of the event it commemorated." In the first half of the 19th century, Egyptian-inspired architecture "seem[ed] to speak of eternal duration;" it evoked "sublime timelessness through great size and massive solidity." Carrott, *Egyptian Revival,* 53-54.

[287] Carrott, *Egyptian Revival,* 66.

[288] The honor of the first Egyptian Revival design in the U.S. belongs to Benjamin Latrobe's 1808 project for a Library of Congress interior. See image in Carrott, *Egyptian Revival,* pl. 97. Latrobe's Library of

Egyptian Revival was popular for funereal monuments as well, and there is one prominent example that may have been a model for the Croton Reservoir. Historical revival funerary markers date to a rural cemetery movement beginning in 1825, with the first American rural cemetery at Mount Auburn in Cambridge, outside Boston. That cemetery's Mt. Auburn Gate of 1831 is a possible design precursor to the Croton Aqueduct.[289] Experiments with cemetery monuments addressed "a new architectural problem" brought on as urban population growth outpaced the capacities of burial spaces beneath church floors and in small church graveyards. Cities bought large tracts of land outside cities, and following from a late 18th-century European Romantic tradition, designed them as "pleasant wooded parks." A cemetery like the Mount Auburn Cemetery served as "an important cultural center."

> The rural cemetery movement was one more example of a new architectural problem which appeared in the early nineteenth century. Possibly *because* it was an innovation without the tyranny of specific traditional prototypes, it invited a "new style." Just as the show place for experimental and prophetic architecture in the later nineteenth century was to be at the various international expositions, so the new kinds of building types served as settings for unconventional and "progressive" architectural manifestations in the first half of the century. With the iconography of the Classical and Gothic firmly established, it would seem that the adventurous and inventive architect seeking an original solution for such a new category would turn to a relatively unfamiliar style. Revivalism being the language of the time, the innovating dialect appears as Egyptian—that fashion known, but not exploited heretofore. On the other hand, there would have to be, of course, some sort of rationale for it; some logical excuse. Thus, in this case, the

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Congress project—in conjunction with many other examples including his first bank and his Center Square waterworks, both in Philadelphia, and both mentioned in this dissertation—brands the architect's innovation as a new American historical revivalism. Carrott suggests that Latrobe may have introduced his student, Strickland, to the Egyptian Revival style, which Strickland used for several buildings. "If [Latrobe] introduced [Strickland] to the style, he himself must already have been exposed to the possibilities of exotic revivals through his own master in England, S.P. Cockerell (1754-1827), the architect of the "Hindoo" Sezincote (1803) (executed, of course, after Latrobe's departure for America). Latrobe chose to use the Egyptian styling as an interior articulation for one room in an otherwise classical Capitol building. Although [the Library of Congress] project was never executed, it remains the first example of the [Egyptian Revival] style in America, and one of the earliest in the world, having been designed four years before P.F. Robinson's London Museum," an important early Egyptian example from 1812.See Carrott, 62, 64, pl. 11.

289 See images in Carrott, *Egyptian Revival,* pls. 57, 58, of Mt. Auburn Gate, 1831, Jacob Bigelow (1786-1879).

> Egyptian Revival answered ambivalent needs: those for originality, and connections with tradition.[290]

In cemeteries, to design monuments within pastoral settings became a cultural tradition that provided a comforting solution to this problem. By setting up a visual discourse that associated with cultural standards of the beautiful and the sublime, the practice also continued a discussion of neoclassical architectural "dialects" within revivalism, what Carrott calls "the language of the time."

In 1836, an architectural writer declared that "the Egyptian style, from the largeness of its parts, is capable of the highest degree of sublimity" among ancient styles. Carrott notes that Dowson was not the first to make this exclamation about Egyptian architecture, "but his expression of it is significant in view of the popularity in America of the *Architectural Magazine*, in which the essay appeared."[291] In 1840, American architect A.J. Davis, whose cemetery gate projects Carrott argues "most successfully realized … [the] concept of sublime Romantic classicism in the Egyptian manner," emphasized overwhelming size and unrelieved simplicity with a restricted use of ornament. He wrote of structures in the style: "It ought to be simple in its form, and sublime by its magnitude and solidity. It should be constructed so that even in ruins it would serve to testify to posterity the sense which the age had of the event it commemorated."[292] Carrott defines the sublime effect in architecture this way: "when austere geometry of form, sharp precision of delineation, and severe simplicity of surface are combined with overwhelming scale, massive bulk and primordial composition, sublimity is achieved."[293] Further, he observes: "in suppressing the triangular pedimental shape of Greek architecture, and the curves of Roman domes and arches, Egyptian Revival architecture limits the morphological choices to trapezoids and stepped corbels.

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290 Carrott, *Egyptian Revival,* 86-88.

291 Dowson defined four architectural categories, more or less inspired by landscape ideals of the time: Grand, Magnificent, Sublime, and Beautiful. J. Dowson, Esq. "Essay on the Metaphysics of Architecture," *Architectural Magazine*3 (1836): 245-49, quoted in Carrott, *Egyptian Revival,* 52. The essay appears online at George Mason University's Center for History and New Media website, accessed February 26, 2015, http://chnm.gmu.edu/egyptomania/sources.php?function=detail&articleid=15.

292 Carrott, *Egyptian Revival,* 53.

293 Carrott, *Egyptian Revival,* 53.

The block-like result with overhanging cornices to counter the battered walls presents architectonic forms of, curiously enough, a decisively rectilinear, rather than a trapezoidal, effect."[294] Davis specifically analyzes funerary monuments, but their descriptors also apply to the large-scale Croton reservoir, which generated a sublime response. Carrott rightly places architectural problems that include landscape as part of their solution within pastoral traditions, but waterworks also deeply activate the sublime. Egyptian Revival architecture and iconography at rural cemetery sites is important to consider within the waterworks discussion. Waterworks structures, too, were monumental-scale architecture, and of necessity they were placed within a larger landscape context, which had the effect of activating both the pastoral and the sublime. These sites, like cemeteries, meant to (and successfully did) convey symbolic values. Moreover, water systems presented spatial and structural problems that invited novel styles for architectural design. Waterworks were "structures of the new technology."[295]

Long before the Croton Aqueduct's Murray Hill reservoir, the earliest American example of a waterworks structure incorporating an Egyptian Revival style was an Albany reservoir and pump house from 1811 **[Figure 56]**. The Croton reservoir offers a close visual comparison, which suggests the Albany work was a model. This waterworks structure predates the Croton reservoir by three decades, and yet, as Carrott's analysis indicates, the Albany reservoir and pump house was "a surprisingly early" eclectic structure combining an "Egyptian" battered wall enclosure with a "Moorish" pump house centered inside it.

> There are single gateways on each of the four sides of the former with heavy cavetto cornices and strongly accented batters. Matching Egyptian tower-piers with the same features mark the four corners. In the center is the mosque-like

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[294] Carrott, *Egyptian Revival,* 54.

[295] Carrott, *Egyptian Revival,* 103-05. In regard to the application of Egyptian Revival styling to other "structures of the new technology," bridges and railroad stations, Carrott points out that "the iron horse had not yet proved itself as a safe mode of transportation with its infernal and terrifying steam, smoke, and speed…. [and] over and above [the] question of 'taste' there were functional reasons for the use of the use of the style, notably the adaptability of the pylon form and that of the Egyptian pier to suspension techniques. The combination of modern technology and ancient Egypt became an international motif for bridges with notable examples from Italy to Russia."

> pumping building with its bulbous dome surmounted by a spire and the Muslim crescent.[296]

The Albany Reservoir is different from most of the objects in Carrott's analysis of American Egyptian Revival architecture, as it "places such Egyptian motifs as battered doors and windows, cavetto cornices, and winged orbs among otherwise Muslim features as the minaret, bulbous dome, crescent, and cusped arch."

> But [Robert] Lugar considered these all of the same vocabulary, believing 'Egyptian' and 'Turkish' to be one. Indeed, as we have seen, he states, 'mixing one style with the other, as is frequently seen, makes us think but little of the mind that thus invades every idea of common sense.' Carrott argues: "with 'few and bold details' the drab, utilitarian plan for such a structure becomes an object of 'taste,' grandeur, or even sublimity with a modicum of expense. The transformation is accomplished in this manner with the appeal to economy—a familiar reason for using the style."

Carrott compares the early 1811 Albany reservoir with the completed 1842 Croton reservoir in terms of their Egyptian Revival formal features: "In plan and elevation [the Croton reservoir] is markedly similar to the Egyptian portion of the Albany example, although considerably more monumentalizing."[297]

The Albany Reservoir may also be considered as a part of what Carrott calls the "commercial picturesque" use of the style,[298] which the art historian defines as a category of architecture within a field of "new technological constructions"—that is, utilitarian and commercial buildings designed in Egyptian Revival style. Identifying trends in railroad station, suspension bridge, and waterworks design, Carrott argues that the structures express cultural value from within a specific "commercial picturesque" aesthetic, combining historical revival details and picturesque American traditions into a specific architectural aesthetic category. Carrott singles out waterworks (and other utilitarian)

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[296] Carrott, *Egyptian Revival,* 106. Carrott qualifies this early-19th-century structure within an American picturesque architectural tradition of "exotic romanticism": it admired "an antiquity more ancient than the Antique" and exhibited a formal preference for "the quality of variety." See Carrott, 54-55.
[297] Carrott, *Egyptian Revival,* 107.
[298] Robert Lugar, *Architectural Sketches for Cottages, Rural Dwellings, and Villas in the Grecian, Gothic and Fancy Styles* (London: T. Bensley for J. Taylor 1805), 25, 10, pl. xxxvi, quoted in Carrott, *Egyptian Revival,* 106-07.

structures from within a larger context, emphasizing their importance at the time. Such structures are material illustrations of two of the "new technological constructions," important elements of an American architectural aesthetic within a historical revival tradition. At a glance, the waterworks demonstrate feats required by engineers to create new technologies able to subdue into human terms the overwhelming nature of bodies of water, in scale, velocity, volume, and visual effect. At the same time, the buildings intervene in cultural norms of perception by engaging a new category of the sublime: they are manmade objects that appear to meet the vastness of works of nature, that is, bodies of water, topographical masses, and landscape extents. Materially and visually, then, these structures mediate the American riverscape's patent outmaneuverability by exhibiting a human capability to cross and/or harness them:

> Thus, while the New York reservoir is an example of understood and appreciated "archaeological" Egyptian Revival characteristics, the earlier and later waterworks are within the realm of picturesque eclecticism. Here again, in this category, the style was employed for a new building type which called for original and free solutions. The faint iconographic echoes as to the reason for the style were bolstered by practical and functional ones of greater import.[299]

Carrott's analysis of waterworks as exemplars of Egyptian Revival styling is important to this study because the Egyptian Revival style, as Carrott reads it, specifically addresses a set of historical and formal characteristics that defines a visual aesthetic for waterworks. In 1842 when the Croton Aqueduct opened, Egyptian Revival style was at its height. Summarizing the arc of the Egyptian Revival style's formal development, Carrott points to the latest structures, from the mid-to-late 1840s, judging that they

> represent a closing of a cycle that starts with pseudo-Egyptian monuments in which Egyptian details are applied to an otherwise non-Egyptian Revival structure; and ends with the Egyptianizing group that applies non-Egyptian detail to an otherwise Egyptian core. The paramount formal qualities of the ancient style, space displacing mass and geometric simplicity conceived of in terms of unbroken size, have been distilled out and synthesized into the reservoir of mid-nineteenth-century architectural forms. If the pseudo-Egyptian phase evokes

[299] Carrott, *Egyptian Revival,* 107-08.

> Egypt in a "literary" or associative manner, then the Egyptianizing evokes Egypt in a "conceptual," or formal-aesthetic sense." [300]

The Northern Liberties and Spring Garden Waterworks in Philadelphia (1844-45) is a visually fascinating late Egyptian Revival pumping station structure unconnected to a reservoir—and therefore with "no demand for massive Egyptian walls"—which Carrott supposes must have inspired the Spring Garden Egyptian styling. **[Figure 57, 58, 59]** The Spring Garden waterworks structure sat on the banks of the Schuylkill River just upstream from the Fairmount Waterworks site, beyond Lemon Hill. The building, which was "a rather nondescript Georgian with dormers and a Villa-style ventilator, has applied to it a weirdly monumentalizing Egyptian doorway, battered and with a cavetto cornice. The necessity for a high chimney stack, an element decidedly foreign to the original inspiration for the house, has been solved strikingly by designing the stack as a huge water plant, a papyrus-bud column."[301]

One can categorize these Egyptian Revival waterworks structures from the 1840s in the "picturesque eclecticism" phase. The Spring Garden building exemplifies the more rococo phase and represents an unabashed eclecticism, which even Carrott describes as "odd." The Croton Reservoir stands out as having "understood and appreciated Egyptian characteristics," in the more authentic "archaeological" use of the nomenclature. Either way, this style—and historical revival styling in general for waterworks—becomes a solution to the "new problem" of large-scale water harnessing and delivery for urban

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[300] Carrott, *Egyptian Revival,* 73.

[301] Carrott, *Egyptian Revival,* 107-08. The pump house of the district of Spring Garden was located just upriver from Fairmount, beyond large open riverside areas, Sedgeley Park and Lemon Hill, which bordered Fairmount to the north. The Spring Garden district pump house, along with the facilities of all other waterworks districts, were subsumed by the city of Philadelphia in 1854, during its municipal consolidation. In 1851, Graff, Jr. had proposed the area between Fairmount and Spring Garden be developed into rural parks in 1851. The city had purchased Lemon Hill in 1844, "convinced that this was an opportunity to see that the land immediately above the works…would be protected from industrial growth." Benjamin Latrobe had built at least one mansion on the estate property. Graff, Jr.'s 1851 proposal to protect the adjacent property from industrial pollution by developing it for recreation gained public support by 1855. In 1867, when the Fairmount Park Commission was established, water superintendent Graff served as a commissioner and prepared its 1870 report declaring that "the encroachment of industries on the water supply was the reason for the establishment of the park." See Gibson and Wolterstorff, "The Fairmount Waterworks," 31-33, esp. Graff's Lemon Hill and Sedgely Park development proposal showing the location of Spring Garden on 33.

areas, using new styles to house and mark innovative new technologies as well as stamping those buildings with the brand of time-honored water engineering.

> If "new" science called forth the use of Egyptian motifs as the "respectable" garb of stability, durability, and dependability; "old" science conjured up the style as the symbol of ancient secrets and knowledge.[302]

Jervis's Murray Hill reservoir was not only admired in its time for its durability, solidity, and massive masonry; it was also explicitly called an ancient temple, "an illustration of what art and science can accomplish."[303]

According to Carrott, American Egyptian Revival architecture "represents a significant pattern of early 19th-century formal and iconographic attitudes. It is a well-defined material for the investigation of changing value concepts in architecture, an episode in the history of taste, an effort to identify the sources and nature of some of the romanticisms of the 19th century."[304] Carrott argues that the Egyptian Revival is "less obvious" than the Greek, Roman, and Gothic Revivals, but he still classifies it as "a descendant of European attitudes which provided it with a pedigree of respectability and tradition" even when new forms of architectural arrangement were evolving for plan, elevation, decorative accent, and space conception. Close study of attitudes and associations evoked by revival styles divulge symbolic, emotional and philosophical meanings, and disclose societal and cultural values the stylistic treatments achieved. Applied to water and its movement at this time, it sheds light on the meanings and importance of water during 19th-century urban development.

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302 Carrott, *Egyptian Revival,* 108.

303 Carrott, *Egyptian Revival,* 107; 124-25 n. 24-25. Carrott cites Philip Hone, *Diary, 1828-1851* (New York: Dodd, Mead, 1927), 610, and Tower, *Illustrations of the Croton Aqueduct*.

304 Carrott, *Egyptian Revival,* 130. Moreover, "it has been shown that enough examples were erected or planned to preclude any temptation to dismiss an Egyptian-style monument as an isolated instance of exotic *bizzarria.* It was considered sufficiently important for critics to write about it, characterizing its style and attributes; and for architects to design and build in it domestic, commercial, and public buildings. The interest on the part of these professionals, and their patrons, in the archeological sources further attests to the seriousness of their intent. It is noteworthy that there were no architectural "follies" in the Egyptian style."

The 42nd Street Egyptian Revival reservoir was the locus of the opening ceremonies for the Croton Aqueduct on July 4, 1842.[305] In the month before the aqueduct's public opening ceremony and parade, the Water Commissioners and engineers Jervis, Allen, and French walked the length of the underground conduit. It took them three days: they "entered the Aqueduct at its mouth at the Croton River and pursued the examination…under ground to Harlem river, a distance of thirty-three miles." Two weeks later, they boated the aqueduct conduit in eighteen inches of water released for the test run of the system from the Croton Dam to Harlem, "aboard the *Croton Maid*, a sixteen-foot wooden skiff designed for the occasion." Passing the initial upstream test, the following week, a further water release traveled across the Harlem River's low crossing for the first time and as far as the 89th Street receiving reservoir at York Hill, where 20,000 people were on hand to celebrate. On July 4, as scheduled, the water reached the terminal 42nd Street Murray Hill distribution reservoir for an all-day celebration beginning with a ceremonial release at dawn and culminating in a city parade. **[Figure 60]** Fayette Tower gushed at the sight, reporting: "I stood on the topmost wall of the reservoir and saw the first rush of the water as…[it] entered the bottom and wandered about, as if each particle had consciousness." Koeppel reports that "by day's end, twenty-five thousand New Yorkers had visited the reservoir, each offered 'a glass of the water cooled with ice.'"[306]

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305 See the Croton inaugural publications of 1842-43: Croton engineer Fayette Tower's *Illustrated Croton Aqueduct*; and chief engineer John B. Jervis' *Description of the Croton Aqueduct* (New York: Slamm and Guion, 1842); and Charles King's *A Memoir of the Construction, Cost and Capacity of the Croton Aqueduct…Preceded by a Preliminary Essay on Ancient and Modern Aqueducts* (New York: Charles King, 1843). King's introduction, "Preliminary Essay on Ancient and Modern Aqueducts," 1-82, presents a world survey on the history and value of water systems, which King implies are motivated by a reverence for and worship of water (1-2).

306 All quotes in this paragraph, Koeppel, *Water for Gotham,* 273-77. On the day of the Croton Aqueduct's official opening, both Manhattan's 13th Street Reservoir and the Manhattan Company reservoir tank were dry. Worried about fire threat of the celebratory fireworks, at the mayor's request, the water Commissioners approved diversion of Croton water to fill the downstream city reservoirs. The distribution system was not yet complete below Murray Hill. As a consequence, when the Murray Hill gates were opened to divert the water to the city's other two reservoirs, "the water failed to enter the mains because no ventilating pipes had yet been placed in them. Workers quickly made the attachments, and by late morning the Croton entered the city limits, proclaiming its presence in unsuspecting neighborhoods by 'the roaring whistle' of escaping air. By afternoon, the 13th Street Reservoir was brimming, and the water pressed south

The Murray Hill terminal reservoir was a technical and cultural success. Its battlement promenade, which one observer believed would be in place for centuries, became an immediate and central public and artistic attraction. **[Figure 47, 48, 61]** It remained so until the reservoir's demolition at the turn of the 20th century, which made room for the New York Public Library, still standing on the former reservoir site. Similarly, the York Hill receiving reservoir, at 89th Street, far north of Murray Hill and the city proper, became the city's newest "fashionable place of resort," where sampling the water—described as "clear,…sweet and soft,…a wholesome temperance beverage"—was considered to be "in the fashion." Within the year, the city's first Croton-fed decorative fountains opened in Union Square and at the Park at City Hall. Former New York mayor Philip Hone reflected: "Nothing is talked of or thought of in New York but Croton water; fountains, aqueducts, hydrants and hoses attract our attention and impede our progress through the streets. …Water! Water! Is the universal note which is sounded through every part of the city, and infuses joy and exultation into the masses…"[307]

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by evening to the Manhattan Company tank, housed in a three-story building." See Koeppel, 276-77. The first fountains in New York to receive Croton water were by James Renwick in Union Square and the Bowling Green. See *The National Cylopaedia of American Biography* XI (New York: James White & Co., 1909), s.v. "Renwick, James." This source reports that Renwick "superintended" the distribution reservoir at Fifth Avenue and 42nd Street."

307 Koeppel, *Water for Gotham,* 277, 281-82. All contemporary observations in this paragraph come from former New York mayor Philip Hone's 1842 diary entries. See also George H. Rappole, "The Old Croton Aqueduct," *Water-Supply and Public Health Engineering*, ed. Denis Fischbacher-Smith (Aldershot, Great Britain: Ashgate, 1999), 183-93. "The original Croton served the city for only fifty-one years from 1842-1893 when the New Croton Aqueduct was complete and brought into service. By 1968 the Old Croton Aqueduct was closed down and deeded by the City to the Taconic State Park Commission for use as a public walkway. In recent time, the efforts of interested people have resulted in the designation of the entire Old Croton Water system as a National Historic Civil Engineering Landmark" The New Croton Aqueduct's massive masonry dam (1892-1906) stood about three miles downstream from the Old Croton Dam and Gatehouse; its reservoir inundated the older structures, which have remained under water except for a brief period when 1955 Croton River flooding required draining the reservoir to complete structural repairs to the New Croton Dam. See Christopher R. Tompkins, *The Croton Dams and Aqueduct* (Charleston, SC: Arcadia, 2000), and Donald C. Jackson, *Great American Bridges and Dams* (Washington, D.C.: Preservation Press, 1988), 126-28. See also Diane Galusha, *Liquid Assets: A History of New York City's Water System* (New York: Purple Mountain Press, 1999), which surveys major works of New York City's water systems development between 1837 and 1996. Note that also in 1906, the Committee on Rivers and Harbors of the House of Representatives introduced a bill prohibiting further water diversion and hydropower production on the Niagara River in New York, and Canada, in order, in the language of the bill, '"to prevent the further depletion of the waters flowing over Niagara Falls, and for the adoption of proper regulations to preserve the said cataract as near as may be in its natural condition."' Editors

Clearly, historical revival styles functioned culturally in waterworks, extending and highlighting their importance beyond their utilitarian use as a water storage and distribution facilities. They made early visual and historical statements that reveal cultural ideas about the value of water in nineteenth-century America.

"WEST" AND "FRONTIER" IN THE 19TH CENTURY: IMPLICATIONS FOR WATERWORKS

In 1801, when Philadelphia opened the Center Square Water Works temple in the government center of town, Thomas Jefferson was assuming the Presidency. Within two years, the President had made the Louisiana Purchase, opening vast territories west of the Mississippi River. Latrobe was soon appointed by the President as Architect of the Capitol. In 1804, the Lewis and Clark Expedition began its traverse of the trans-Mississippi Louisiana Purchase and the unopened territories beyond the 100th meridian. The Mississippi River was already on the map, since river and canal commercial transportation was the norm at the time. Louisiana Territory legislation included an act to build a federal lighthouse at the mouth of the Mississippi River to ground the U.S. claim to the Louisiana Purchase—and to the Mississippi and beyond. Latrobe headed the project under the auspices of the office of the national architect; later, Latrobe's son worked on the project as well.

The four-year transition period from 1801-1804 marks a broadening of "territorial" vision regarding urban development and its requirements by bringing an unprecedented water supply and distribution system to one of the nation's major cities. This millennial period also signals that the nation as a whole was under the urgent business of conducting major expansion along large-scale territorial lines, opening the century with the "opening of the West." What "the West" meant began to change

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commented: "The lines are now sharply drawn between those who wish to exploit Niagara Falls for commercial purposes and those who are determined that its scenic beauty shall be preserved." See "Help Save Niagara Falls," *The Outlook* 82, no. 16 (April 21, 1906): 865-66. The piece is one of many that constituted a continuing public and political debate in 1906 about Congressional discussion considering imposition of limits on water diversion for water and power supplies over both the Canadian and American sides of Niagara Falls. Limits on water diversion were calculated as being necessary if the Niagara were to continue as viable natural waterfalls and a national scenic wonder.

considerably from that time forward, and Philadelphia's contribution to the growth and development of major urban water management systems in America introduced both a new kind of industry and a perpetual redefining of "The West" in America: in Philadelphia, for example, at the time of the conversion of Fairmount Waterworks from steam to water power, industry and commerce were crucial for economic development with other East Coast states. "Linkage and trade with the developing western lands on the Ohio River" were key.[308]

Ohio and then Chicago were defined as "the West" until the Louisiana Purchase opened the territories west of the vaster Mississippi River watershed and confronted the potent Great Plains and Rockies beyond. Water technology innovations transformed "the West" on a scale commensurate with that of the expansive landscape, the variable terrain and the combination of weather and topography that defined the volume, location, and quantity of the water available for urban growth and industry. All contributed to a unique architectural presentation of waterworks for the American West. This survey allows us to move historically, culturally, and geographically from the debut of significant waterworks on the East Coast to that of the West.

One significant event makes clear the ways in which waterworks development in urban centers to the East become directly pertinent to California and the West. In 1872, the City and County of San Francisco hired Theodore Scowden—waterworks guru for Cleveland, Cincinnati, the two Kentucky cities of Newport and Louisville, and engineer/inventor of note—to survey, map, assess, and report on the future water supply of San Francisco's greater watershed.[309] Scowden submitted his thorough surveys, maps,

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[308] Gibson and Wolterstorff, "Fairmount Waterworks," 23.

[309] A summary of Scowden's career appears at "Biographical Dictionary of Cincinnati Architects," Architectural Foundation of Cincinnati, accessed February 26, 2015, http://oldsite.architecturecincy.org/dictionary/S.html. An 1851 publication, *Sketches and Statistics of Cincinnati* lists Scowden as the Engineer for the City Water Works, and quotes a technical report he presented to the Trustees before 1851 It can be found online at Charles Cist, "Sketches and Statistics of Cincinnati 1851," Internet Archive, accessed February 26, 2015, http://www.archive.org/stream/cu31924032302733/cu31924032302733_djvu.txt. Scowden's Cincinnati tenure, beginning in c. 184, is described in some detail in Maurice Joblin, *Cleveland Past and Present: Its Representative Men* (Cleveland, OH: Fairbanks, Benedict & Co., Printers, 1869). Oddly, Scowden's early Cincinnati work is omitted from a detailed *History of the Cincinnati Water Works* (Cincinnati, OH: Robert

and reports to the City and County of San Francisco in 1874 and 1875.[310] Also between 1872 and 1875, Scowden was under hire by the City of Cincinnati to upgrade the waterworks he had built around mid-century. In his Cincinnati report, Scowden summarizes what he refers to as second-generation American urban waterworks systems—that is, works original to the early-to-mid 19th century, which in the second half of the century begin to be modernized, upgraded, enlarged, or replaced. Scowden reports:

> All cities of any magnitude in the country appear at this time to be awakened to the importance of an abundant and uninterrupted supply of water. New York, Boston, Philadelphia, Baltimore, and various other cities of the East are directing their attention and energies to that end. Water supply or extension of their Works, at a cost variously estimated at from five to ten millions of dollars each, are being prepared or are in progress. In the West, St. Louis has taken the lead in erecting new Water-works, recently put in operation, which when completed, will cost some five millions of dollars. Chicago and Cleveland are making extensive additions to their Water-works, while Pittsburg is preparing to build Works on a large scale for that city. Milwaukee, stimulated by urgent necessity, and the example of other cities, is actively engaged in the same direction. With respect to Cincinnati, it may be justly said that the present Water-works, though inadequate, are good of their kind; no fault attaches to them, except they have outlived their usefulness, the city has outgrown them.[311]

Clarke, 1881) by Assistant Superintendent Thomas J. Bell, who does not place Scowden in Cincinnati before 1872. I have not located any Scowden reports or hard primary evidence of any of his mid-century work at Cincinnati. The following of Scowden's published reports survive: *Report to the Common Council of Cleveland, on the Subject of Water Works…* (Cleveland, OH: J.W. Gray & Spear, 1853); *Concise Statement Giving the Dimensions, Capacity and Extent of the Important Details of Cleveland Water Works…* (Cleveland, OH: 1855); *Report on Water Works to the Common Council of the City of Newport, Kentucky* (Cincinnati, OH: Times Steam Book,1870); *Special Report on the Extension and Enlargement of the Cincinnati Water Works* (Cincinnati, OH: Trustees of Water Works, 1872); *General Map of the Surveys for the San Francisco Water Supply* (San Francisco: George H. Baker,1874). In 1875, Scowden authored three separate reports, each of which included a *City Water Supply Map*, based on three of his surveys, in which he analyzed feasible development of future water supply sources for San Francisco: the three watersheds he analyzed for these reports were those of Crystal Springs Reservoirs; Clear Lake; and Calaveras Reservoir.

310 At the time, San Francisco's water supply was being managed privately by the Spring Valley Water Company. In spite of San Francisco's relatively early study of its water resources with Scowden's initial work there in the 1870s, the city of San Francisco did not take control of its own water supply until sixty years later. In 1934, it bought out Bourn and the Spring Valley Water Company, and in the same year, the city opened its controversial and long-awaited Hetch Hetchy Aqueduct, bringing a vastly increased water supply to San Francisco from the Sierra Nevada Mountains, 150 miles distant.

311 Scowden, *Special Report on the Extension,* 6. Scowden's 1872 report adds urgency to the necessity that motivated the city of Cincinnati to commission it in June 1871, as the Great Chicago Fire of October 1871 renewed national municipal awareness of a water supply as a fire-fighting tool.

Scowden does not mention the western frontier in his 1872 report. One suspects he completed it before embarking on his research for San Francisco, an experience which certainly widened his vista westward. But clearly, the West was looking East, judging from his hire by San Francisco. Scowden—and all of the established waterworks in urban America—were certainly in the sights of California's primary city as it looked back across the western expanse for guidance as its own burgeoning metropolis faced growing urban water needs. Scowden brought broad and specific experience from his work in waterworks development for several major growing cities in the East, and San Francisco appeared poised to lap it up. California inherited influences from the East and used them to explode possibilities for waterworks systems development in the 20th century.

PART 3

ARCHITECT AS "SPECIALIST IN PUBLIC-UTILITY ARCHITECTURE": 19TH-CENTURY ACADEMIC ECLECTICISM AND WATERWORKS FOR NORTHERN CALIFORNIA[312]

Utility is not enough.

--Mark Daniels, California Landscape Engineer, 1922[313]

Industrial buildings find they may be as beautiful as temple and palace, and, strangely enough, beauty follows strength and power.

--Ralph Stackpole, San Francisco artist, 1923[314]

312 "Spring Valley's New Building," *San Francisco Water* 2, no. 1 (January 1923): 12.
313 Mark Daniels, "Beauty and the Utilities," *San Francisco Water* 1, no. 1 (January 1922): 15.
314 Ralph Stackpole, "Dixon's Spring Valley Mural," *San Francisco Water* 2, no. 4 (October 1923): 5.

CHAPTER 4

The Round Water Temple at Sunol: Unraveling Polk's Design Process

Tracing urban waterworks architectural design in the U.S., from the 1801 Philadelphia municipal water works in Center Square to the 1910 temple for San Francisco's water supply, is crucial for understanding California's architectural inheritance. This is related to ways in which the 19th century encompasses both the "opening" and the "closing" of the American "frontier," as it was constructed in the discourse beginning with Turner's 1893 thesis. To treat as if bookends the 1801 Center Square Water Works temple from Philadelphia and the 1910 Sunol Water Temple for San Francisco permits a comparison that reveals cultural values that relate water, architecture and landscape. These relationships are specifically American and particular to California. **[Figures 62, 63, 64]**

For an art historian, the 1910 Sunol Water Temple is California's most historically compelling waterworks structure. It is a visual anchor in time. **[Figure 65]** This round peripteral temple, set upon a raised dais, features 12 Corinthian columns supporting a terracotta tile roof. Topped by a finial featuring a typical sea creature that was a central figure in Willis Polk's iconographical program for the Spring Valley Water Company, the circular roof is divided into 12 red-tiled panels, each with its corresponding wooden ceiling panel painted with Arts and Crafts/Mission-style female figures, all handling water. Substantial wooden rafters in a Mission-style mode support the roof sections at their seams, each aligned with a column. **[Figure 66]** Standing upon the raised temple platform, shaded by the roof, visitors could gaze up between the columns at the ceiling ornamentation. Even more impressive was the view down into the roaring waterworks below. There, the water supply, released from the Sunol Filtration Gallery on one side and from the Pleasanton Aqueduct pipeline on another, cascaded into ceramic-tiled basins and funneled into the aqueduct pipeline beneath the temple.

Located about 30 miles from San Francisco (to the southeast and across the Bay), the Sunol Water Temple has in local lore stood as a testament to the ancient work that inspired it, the round temple at Tivoli, near Rome.[315] **[Figure 67]** That ancient temple, encircled by 18 Corinthian columns and topped by a circular terracotta tile roof, stands on a precipice where the Anio River plunges into cascades. The temple has signaled the town of Tivoli since early antiquity as a cultural water center. The round temple dates to the Late Republic, during the first century BCE. It emphasized the status of the Anio River as water source for all of ancient Rome's major long-distance ancient aqueducts starting with the third aqueduct of Rome, the Aqua Marcia of 144 BCE.

Associations between the ancient Tivoli temple and the modern Sunol Temple inspired thoughts about the value of water and city's water system since the Spring Valley Water Company commissioned it in 1910.[316] Like the round temple at Tivoli, the Sunol Water Temple marked a principal waterway for its time, serving as a prominent symbolic marker for an important urban water site. Joined with its landscape, it created a cultural landmark and served a social and political role for the water company and its owner, William Bourn. Physically, the Sunol Water Temple marked a central point of confluence for three water sources. It sat atop a subterranean filtration gallery that channeled gravel-filtered spring water into the Temple's underground works. Here the

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[315] The round temple at Tivoli is sometimes referred to as the Temple of Vesta at Tivoli. In popular parlance, round peripteral temples are often identified as Vestal temples, first after the proper Temple of Vesta in the Roman Forum, a round temple with special sacred significance in ancient Roman history, with Etruscan origins as early as the 6th century BCE. See John N. N. Hopkins, "The Cloaca Maxima and the Monumental Manipulation of Water in Archaic Rome," *Aquae Urbis Rome: The Waters of the City of Rome*, no. 4 (January 2007): 6, fig. 4, accessed February 26, 2015, http://www3.iath.virginia.edu/waters/ Journal4Hopkins.pdf. Note in Figure 4 the archaic location of the Temple of Vesta in the future Roman Forum, but also a Temple of Venus Cloacina. The "temple of Venus Cloacina, located just north of the Cloaca Maxima, may originally have been built in appreciation of the purification after the Roman-Sabine war. [B]ased on the goddess' purification of the two tribes, her name and epithet, Cloacina, which was later absorbed into the name of the Cloaca Maxima could be translated as Venus the Purifier. Further still, the word cloaca is often tied to the Latin *cluere*: to cleanse with running water." For previous quotation, see John North Hopkins, "Reflections of Expansion: The Cloaca Maxima and Urban Image in Tarquin Rome" (M.A. Thesis, University of Texas at Austin, 2004), 20-21, figs. 1, 16, 18. The specific religious purpose for the round temple at Tivoli is not known. Considering its siting, it has indisputable associations with water and religious reverence for water. In this dissertation, I will refer to it as the round temple at Tivoli, or the Tivoli temple. In the modern period, it has always been identified a well-known symbol of Ancient Rome related to water.

[316] In 1927, Edward F. O'Day, editor of the Spring Valley Water Company's magazine, *San Francisco Water*, included a photograph of the Round Temple at Tivoli to illustrate an article on European fountains. See Edward F. O'Day, "Fountains Dispersed Abroad," *San Francisco Water* 6, no. 3 (July 1927): 2.

channeled spring water combined with another source upon its arrival through the underground Pleasanton Aqueduct pipeline, which transported pumped water from artesian well fields about 10 miles upstream. The site of the Sunol temple gathered runoff from Calaveras and Alameda Creeks, which collected behind a weir at this Sunol confluence, forcing water to collect on the surface above the Sunol gravel beds, where it percolated down into the filtration gallery.[317] The entire water supply funneled through the temple works into the Sunol Aqueduct pipeline, which wound down Niles Canyon, down to the bay shore, and then through a Trans-Bay Crossing tunnel. On the other side

[317] The Pleasanton Well Fields were deep gravel beds at the confluence of the combined natural watershed of the lower, or western, mouth of the Livermore Valley. Beginning in 1898, the Spring Valley Water Company began sinking "artesian wells" into the gravel beds. Ultimately nearly 100 water company wells drew water from as deep as 700 feet in an area of about 1,000 acres. See typescript copy of "Mr. Schussler's Report [on Pleasanton Wells]—February 4th, 1911," Box MB-045, folder "Spring Valley Water Company Pleasanton Pumps; Two reports from Herman Schussler to W.B. Bourn (1910, 1911)," Documents Archives, San Francisco Public Utilities Commission (SFPUC). The water pumped up from the individual wells initially flowed into the surface water supply into the creek running between the well fields and the Sunol Gravel Beds, near where the Sunol Aqueduct began. The 1909-1910 Pleasanton Pumping Station housed the new mechanisms for pumping water from the 100-plus wells in the Pleasanton Well Fields, feeding it into a pipeline that conveyed it a few miles downstream to the confluence of the Alameda Creek and the supply provided by the gravel beds at Sunol. The company's 1909-10 expansion of the system fully upgraded this underground watershed by making underground pumping more efficient. The combined waters of the Alameda watershed, which came from these Pleasanton wells, from the water filtered through the Sunol gravel beds, and from surface creek drainage, met in the "crypt" basins beneath the Sunol Temple. At the bottom of this "crypt," forty feet under the surface, all the Alameda water funneled into the Sunol Aqueduct pipeline. The aqueduct pipeline traveled to the east bay shore, where it was submerged beneath the bay, and then onto the Peninsula to its storage terminus, the Crystal Springs-San Andreas storage reservoir system. By the 1940s, the Pleasanton Well Fields had been over-pumped and pumping was suspended indefinitely. Beginning in the 1990s, SFPUC started selling parts of the property for suburban development; the most recent sales were made within a few years of this writing. A portion of the well fields landscape is still undeveloped at the time of this writing, but there is no trace of the unprotected structures like Polk's Pleasanton Pumping Station No. 1, which still remained on the property when the utility company sold it. See Warren D. Hanson, *San Francisco Water and Power: A History of the Municipal Water Department and Hetch Hetchy System* (1985, repr., San Francisco: City and County of San Francisco, 1987), 16. In popular terms, the Alameda watershed's Sunol Aqueduct provided "half" of San Francisco's water supply. For example: "Half of San Francisco's water supply flows through the Water Temple [at Sunol] every day." See Edward F. O'Day, "The Architecture of the Water Temple," *San Francisco Water* 1, no. 3 (July 1922): 4. Another example: "In 1884 the Spring Valley Water Company constructed a 44-inch diameter steel pipe line between its Crystal Springs reservoir in San Mateo County and its University Mound distributing reservoir, in the eastern part of San Francisco. This pipeline, which is now carrying 50 per cent of San Francisco's water supply, follows near the shore of San Francisco Bay. It is laid in a trench over the various ridges and on pile trestles across the bogs." See T. W. Espy (Assistant Chief Engineer, Spring Valley Water Company), "Spring Valley Water Co. Moves 44 Pipe Line for San Francisco's New Bay Shore Highway," *Western Pipe and Steel News* 6, no. 1 (January 1929): 1-2.

of the Bay, it continued by pipeline until it released into the Crystal Spring Reservoirs, about 30 miles south of San Francisco. **[Figures 156, 157]**

Before the Spring Valley Company hired Polk to build the Sunol Temple and the Pleasanton Pumping Station, no prominent architecture existed in the company's Alameda Division. In the 1880s, the initial 45-mile, trans-bay aqueduct system was built. Between 1908 and 1913, after William Bourn's post-earthquake purchase of the water company, the aqueduct's technology underwent major renovations that paralleled reconstruction efforts after the 1906 earthquake. The Spring Valley modernization plan included a dedicated program of "dignified" architectural treatment for its new and renovated facilities. At Sunol, this meant two new temple-style structures, both consigned to Willis Polk, the San Francisco architect who managed Daniel Burnham's San Francisco offices. In the press, Polk's advocacy for sophisticated architectural design came in part through his vociferous contempt for provincialism among San Francisco architects and their buildings. Polk believed San Francisco's urban image should project a dynamic visual and structural energy, but he criticized local architects and the public for accepting poor quality design. Both in the local press and in his essays for *The Wave*, Polk paraded witty and often vitreous sarcasm, but he also exhibited a spirit of earnest critique as he singled out buildings and architects for pointed criticism. He joined other prominent California architects interested in modernizing the city with sophisticated architecture.

The first new temple-style structure commissioned to Polk, the Pleasanton Pumping Station, stood alone on the remote plain of the Pleasanton Well Fields about 10 miles north of Sunol. Under development since the 1880s, the Well Fields numbered nearly 100 wells in the deep gravels of the confluent Livermore Valley flood plain. After flowing ten miles downstream through a narrow creek valley, the terrain opened into the bowl of the Sunol Valley. In these two valleys, deep gravel beds doubled as artesian aquifers that stored hundreds of acre-feet of subterranean water at a time. At Pleasanton the gravel beds reached depths of 1,000 feet over as many open, sprawling acres; at Sunol the confluent valley was 700 feet deep in water-logged gravel. At Sunol, the confluent waters slowed before forcing their way through the winding cliff-walled Niles Canyon and out toward the San Francisco Bay marshes. Much of the underground water from the gravel beds was diverted by pipeline, first into the 19th-century underground "crypt" works at Sunol. The "crypt" was a series of three tiered basins below ground level, and directly beneath the temple's base, that collected and directed the water in a cascade down 40 feet into the mouth of the Sunol Aqueduct. The 44-inch pipeline was the trans-bay mechanism for water diversion to San Francisco's storage reservoirs at Crystal Springs in San Mateo County.[318]

Until William Bourn directed a technological and architectural modernization, the underground "crypt" works at Sunol were unmarked on the surface.

> Originally this cascade was housed in a rude shed.... Display...of the water was impossible except by dropping flaming newspapers through the trap-door of the shed.
>
> President Bourn appreciated the desirability of a more dignified treatment of this important point of water control, and the idea of a temple took form in his mind.[319]

Bourn hired Polk to replace the "rude" utilitarian structure with a "dignified" neoclassical "temple." **[Figures 65, 68, 69, 72, 74, 83]**

IONIC TO CORINTHIAN IN FIFTY VARIATIONS

Polk's first Greek Revival waterworks for Spring Valley, the Pleasanton Pumping Station, was an understated rectilinear temple with an engaged peripteral Ionic arcade.[320]

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318 From the subterranean base of the Sunol Water Temple works, the Sunol Aqueduct pipeline threaded through the Niles Canyon and onward downstream, to its bay shore outlet, the Irvington Portal. Here the pipeline emerged and crossed the bay in part submerged and in part on an aqueduct bridge: it does so today, although the routes to and from the bay crossing have altered in the last century. On the opposite Peninsula shore, the pipeline ran underground to the Pulgas Tunnel, which emerged on the western face of the hills at Crystal Springs Reservoir in San Francisco's Pilarcitos-San Mateo Creek watershed, in San Mateo County. There, aqueduct pipeline emptied its contents into the Crystal Springs Reservoir storage system. From here it was pumped into San Andreas Reservoir and San Francisco's urban distribution reservoirs.

319 O'Day, "Architecture of the Water Temple," 4-5.

320 SFPUC archivists have uncovered only two photographs of the Pleasanton Pumping Station, historically attributed to Polk. A photography of the Ionic-style Pleasanton Pumping Station appeared on the cover of *San Francisco Water* in 1922. See O'Day, "Architecture of the Water Temple," 11, and cover. Later, Editor O'Day commented: "In that structure he expressed himself fully, richly. In addition he designed for

[Figure 70, 71] A letter by building contractor D.B. Farquharson confirms a high quality aesthetic was ordered for this "first class" structure.

> Regarding proposed work for Pump Building at Pleasanton, the cost of same could be reduced about $200.00, or $220.00 by substituting a wooden cornice, window trim, panel, etc. in place of plaster and cement. This would be supplied in Redwood. The cost could be [further] cut down by reducing the coat of painting,

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Spring Valley the Central Pumps on Sloat Boulevard, the Pleasanton Pumping Station, and the Spring Valley Building in Mason Street." See Edward F. O'Day, "Editor's Note to 'Willis Polk' by Bruce Porter," *San Francisco Water* 3, no. 4 (October 1924): 12. For the meager evidence on the Pleasanton Pumping Station, see photos of the Livermore Valley, the location of the Pleasanton wells and Pumping Station, and their captions: "Pleasanton Pumping Station is situated at the outlet of Livermore Valley. Hereabouts Spring Valley has in operation some seventy-five wells to draw water from the underground gravels which are fed from a drainage area of 400 miles. …This supply is pumped to the Water Temple, and flows with Calaveras and Sunol water to the Sunol Aqueduct…. The pipe-line to the Water Temple at Sunol has a capacity of twenty million gallons per day. …" Excerpted from photo captions in "The Water Supply of San Francisco," *San Francisco Water* 5:1 (January 1926): 6-7. The Sunol Temple's underground waterworks basin, called the "crypt," was visible beneath the center of the Temple as a three-level cylindrical gallery open to the air. The three levels corresponded to water entering from two sources: water cascaded into the middle basin from the southwest, through the gravel beds filter gallery; the upper basin filled from the Pleasanton Wells pipeline entering the Temple from the northeast, and whose supply was pumped by the new 1909 Pleasanton Pumping Station. When it reached the Sunol Temple site, the Pleasanton pipeline ran beneath the ornamental entrance gates at the carrefour and under the line of the driveway to the Temple. This combined supply dropped into the lower basin, which funneled it into the Sunol Aqueduct pipeline running to the southwest to the Peninsula on the other side of the Bay and into terminal storage at the Crystal Springs Reservoirs. See also O'Day, "Architecture of the Water Temple," 3-5. No corresponding evidence conclusively proves that the Pleasanton Pumping Station Willis Polk designed and built is in fact the 1909 Pumping Station No. 1 listed in the 1914 inventory, or that this building is also the one pictured in three existing photographs in the SFPUC's photographic archives. However, I find existing evidence to be suggestive enough to draw this conclusion, until conflicting or confirming evidence should surface. The *Inventory* of 1914 lists Pleasanton Pumping Station No. 1 as being constructed in 1909, and detailed materials listings show the building to have been in a neoclassical design. Dimensions and details seem to match the building as photographed. The materials description and photograph of the Pleasanton Pumping Station attributed to Polk corresponds in design idea with Polk's Sunol Temple; the only materials from the *Inventory* not depicted in existing photographs (which post-date construction by several years in one case, and by more than a decade in the second) are 80 linear feet of cast iron fencing, and a 35-light window measuring approximately 4' x 11': I must assume the window to have been a clerestory window on the west face of the building, the side of the building not pictured in the three existing photographs. I cannot account for the fencing. By 1913, two other Pumping Stations, #2 and #3, were associated with the Pleasanton Wells. The 1914 *Inventory* indicates Pumping Station #3 was made of corrugated metal; *Inventory* materials lists for Pumping Station #2 includes interior mechanical contents only. The materials listing for Station No. 1 in the *Inventory* indicates neoclassical details corresponding to the Pumping Station photographs. See Leonard Metcalf, *Inventory of the Physical Properties and Structures of the Spring Valley Water Company in San Francisco, San Mateo, Santa Clara and Alameda Counties, California, as of December 31, 1913* (San Francisco: Spring Valley Water Company and the City of San Francisco, 1914), 85-86, 89. See also Hanson, *San Francisco Water & Power,* 16, and "Chronology," a timeline printed inside the book's front and back covers. The photographs of the Pleasanton Pumping Station are held in the Photography Archives, SFPUC.

> but we presume a first class job is wanted, and we would not care to be responsible for any of this work done at a less figure than submitted.[321]

Polk certainly planned the Pleasanton Pumping Station and the Sunol Water Temple in tandem. He meant the smaller pumping station to complement the water temple centerpiece, much as Philadelphia's 1801 Schuylkill engine house complemented Benjamin Latrobe's Center Square Water Works temple. Like that small workhorse pump house on Latrobe's system, Polk's Pleasanton Pumping Station disappeared in the historical record, while the Sunol Water Temple took the spotlight as a tourist spectacle. By exposing the subterranean drama of the water's rush into the works, it housed aspects of the sublime, while the architecture of the temple form "dignified" the engineering feat with a valued aesthetic. **[Figure 72, 83]** This transformed the site from one of bare utility to one of high-status cultural display: of water, of architecture, of landscape, and of the architect himself. *San Francisco Water* gushed that the temple was motivated by Polk's "a passionate devotion to Greek and Roman models."[322]

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321 D.B. Farquharson, Per J. Black [hand-signed by Black] to Spring Valley Water Co., Millbrae, Cal., August 20, 1910, Box MB-046, Folder "Spring Valley Water Company Pleasanton Township (1908-12)," Documents Archives, SFPUC. Fahrquharson's letter would indicate that the building was completed in 1910, concurrently with the Sunol Temple. This conclusion goes against the *Inventory* claim of a 1909 construction date. I surmise Farquharson's comments refer to pricing presented to him in an estimate of August 8, 1910, in which the following elements are planned for what appears to be a renovation of a prior pump house. Box MB-046, Documents Archives, SFPUC, also contains a blueprint of a survey showing the location of Pleasanton Well Fields and the location of three pumping stations, although these are not identified by number. See also engineering drawing E-7 of the Pleasanton Pumping Station, July 28, 1909, Documents Archives, SFPUC. Compare photo with drawing in the print image of an Aug 20, 1910 letter re: Pleasanton Pumping Station in the Documents Archives, SFPUC.

322 O'Day, "Architecture of the Water Temple," 4-5. It seems clear that from the first issue in January 1922, one of the magazine's goals was to advertise the company's new office building on Mason Street, of which Willis Polk was the architect. Every magazine cover in the first twenty issues of *San Francisco Water* except one depicted waterworks structures by Polk. See, for example, the Sunol Water Temple (v.1, no.1); the Central Pumping Station (v.1, no. 2); the Pleasanton Pumping Station (v. 1, no. 3); and Polk's perspective rendering of his new office building design (v. 1, no. 4). This article appeared in 1922, more than a decade after the temple opened, but the piece had multiple promotional purposes. It appeared in the inaugural year of the water company magazine, which itself corresponded with the company's plans to build a company headquarters high-rise, with Polk as its architect. **[Figure 73]** Magazine covers pictured several Polk buildings for the water company, which I will discuss. Polk had been in the public eye for decades by the time he built the waterworks buildings I examine in this dissertation. He was known as the face of Daniel Burnham's architectural practice in San Francisco after the 1906 earthquake. His public status heightened after he completed the 1910 buildings for the Spring Valley Water Company, and increased again when he gained the appointment in 1912 to head the Architectural Commission for the

Over the course of a year, Polk reportedly created up to fifty variations for the temple.[323]

> Mr. Polk's first design provided a roof supported on twenty-four columns, with a balustrade as a guard-rail surrounding the crypt. This scheme varied but slightly in principle from the final design, but from first to last studies representing some fifty variations of the idea were evolved. …
>
> In the course of study all the round temples in history were referred to, their proportions and details analyzed for comparison with those under consideration for the projected design.
>
> The final design of the Temple in detail was inspired by the famous classic Temple of Vesta at Tivoli, near Hadrian's Villa. This temple, like the Temple at Sunol, rests above a magnificent cascade….[324]

One remnant of evidence for Polk's design process is an illustration published in the company magazine. It is a narrow, horizontal strip depicting a row of nine slightly different temples (I will call this illustration the *temple series image*). **[Figure 76]** This temple series image illustrates "significant steps" in Polk's "progress of design" for the final temple.[325] The image provides a starting place for piecing together Polk's otherwise-unknown design process. This process becomes easier for a researcher when considered alongside five surviving Water Temple drawings by Polk. Comparison of this evidence suggests that each of the temple versions in the series probably had its own set of detailed

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Panama-Pacific International Exposition of 1915. See for example, "The Panama-Pacific Exposition Architects [From the *Western Architect*]," *The Architect and Engineer of California* 28, no. 3 (April 1912): 67. See also "Noting Progress on the World's Fair," in *Pacific Gas and Electric Magazine* 4, no. 5 (October 1912): 170. A photograph of the members of the Architectural Commission of the Panama-Pacific Exposition appears in a monthly World's Fair progress update. Willis Polk stands next to architect Arthur Brown. All committee members are listed in the caption. From then on, he was consistently a public persona in San Francisco until his death in 1924.

323 I have reconstructed the water temple's design history from the Document Archives at the San Francisco Public Utilities Commission (SFPUC). Most important among this evidence are seven surviving Willis Polk architectural drawings of the Sunol Water Temple and its apurtenances, previously unpublished. Six of these drawings are numbered Job 52, Sheets 1, 2, 4, 5, 6, all dated in 1910, all with Willis Polk's signature, some with hand-written revisions. One, a drawing of the text tablet for the gatepost, is not signed by Polk and is dated 1911. My reconstruction of the temple's history also relies on O'Day, "Architecture of the Water Temple," 3-5. As I point out in my text, this article narrates the Sunol Water Temple's "evolution" in architectural design, siting, and construction. This evidence offers insight into the architect's design process and permits sound new interpretations of the Temple's architecture. With historical details reintegrated, the building itself suggests cultural contexts, functions, and values for its time, which have been examined by no historian to date, in print.

324 O'Day, "Architecture of the Water Temple," 4-5.

325 O'Day, "Architecture of the Water Temple," 3-5.

drawings. Each drawing in the series image is a careful, academic rendering; together, the group is consistent in scale, style, detail and finish. Surviving architectural drawings by Polk verify the two design explorations for the Sunol Temple. **[Figures 74, 75]** Three Polk plans from January and February 1910 detail a 16-column Ionic temple with a smooth-surfaced dome and oculus.[326] Two drawings survive for Polk's final temple design, the 12-column Corinthian temple.[327] **[Figures 66, 69, 75]**

Magazine editor Edward F. O'Day clearly had access to the complete set of drawings, and probably to the architect as well.[328] The temple series image displays the two distinct design types for Sunol in a sequence. First in the series is the Ionic temple design topped by a smooth, white dome with oculus. O'Day describes Polk's first design effort as a 24-column temple, but this design appears neither in the temple series image, nor in surviving drawings: the first image in the temple series shows a 20-column Ionic domed temple, with relatively short columns on a broad base. Second in the series appears the Corinthian temple with red tile roof topped by a figural finial. In the temple series image, the first variation on this theme was a 16-column Ionic temple design; the final temple has 12 columns. This final design appears ninth, or last, in the temple series image. The three images preceding it show refinements to the design in height, scale, proportion, and ornamental details. **[Figure 76]**

The temple series image and Polk's existing drawings make clear that the architect was working to maximize ways in which the temple visually "filled" the space around it by heightening the sense of interplay, proportion, and visual movement among the architectural elements. In other words, it appears Polk was working to increase the temple's *visual* volume. Proportion is crucial in a building with column orders, and Polk

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326 Three plans for this 16-column, Ionic temple design survive. Two signed plans (Job 52, sheets 1-2) are dated January 12, 1910. They were drafted between January 9 and 12, and are initialed by the drafters. A third drawing (Job 52, sheet 4), unsigned, undated, and unapproved, is labeled "first revision of sheets no. 1 and 2." See original plans held in the Documents Archives, SFPUC.

327 The plans for the 12-column, Corinthian temple design are the signed and approved drawings of January 29, 1910, are held in the Documents Archives, SFPUC.

328 The only reason I have any doubts about O'Day's access to direct discussion with Polk is that the writer does not quote the architect. O'Day's career is characterized by his interest in interviewing his subjects. I give examples elsewhere in this dissertation.

employed several strategies in the course of the design phase to refine proportional balance. First, he wrestled with columnation. He reduced the number of columns from 24 to 16, and finally to 12. Here Polk worked to increase *lateral space*, reducing the number of columns to create wider spacing on a same-diameter base. This created maximal expansion of negative space between columns, which effects an expansion of apparent volume and breadth. Polk also worked to enhance stature, amplifying *vertical space* by increasing the height of the columns and varying the number and rise of podium steps. Taller, more widely-spaced columns permit freer visual movement along and within both positive and negative spaces in peripteral segments. Polk's decision to change the column order from Ionic to Corinthian added flutes to the shafts, and, combined with the upward orientation of ornamental acanthus leaf flourishes on the capital, the whole served to draw the eye continuously up along the columns to the capital ornamentation, the coursing of roof tiles, and the finial details. **[Figures 69, 76, 77]** Polk's change in roof profile and material from a smooth concrete dome to a segmented red tile roof was a major achievement toward increasing the temple's visual volume, especially with the inclusion of the ornamental finial. The curved terracotta tile roof is laid in 12 triangular segments. The open joint where two roof segments adjoin is articulated by a single line of tile that aligns with the timber rafter beam directly under it and which is supported by a column. The relationship of these elements enlivens a sense of upward movement and enhances perception of height. All lend to the design's appearance of cohesiveness, stability, and unity.

This combination of elements creates a compelling and lively, almost spiraling, vertical movement around the temple, particularly along the upper third of the structure. **[Figures 65, 68, 77]** This movement rewards the gaze as it reaches the finial spire, ornamented with sea creatures whose upward-flashing tails create a lively curve and whose gaping mouths rest upon a shell-like cascade of water and foam. **[ADD FIGURE]** The sea creatures are a stabilizing mechanism for the base of the tripod-like finial as it flutes upward like a vessel. Below the "lip" of this vessel shape appear roaring lion heads, each poised above a sea creature. The lions are arranged in the typical classical manner at the outermost edge of the finial vessel's "eaves," suggesting their traditional function as gutter spouts. I say the finial is *tripod-like*: even though there are four sea creatures and lion heads on the finial, at any given vantage point from the ground a viewer can see only three at once; this contributes to a sense of pyramidal balance.[329]

The sea creature used by Polk and sculptor Arthur Putnam to adorn Spring Valley Water Company works was a familiar period feature of American buildings. The sea creature, commonly termed a dolphin in contemporary literature of ornament, was a well-known iconographical feature, appearing in such late-19th-century ornament guides as Franz Sales Meyer's *Handbook of Ornament*.[330] It called up immediate references to famous waterworks on the Grand Tour, such as Bernini's fountains in Rome. This Baroque sculptor's first free-standing fountain with explicit water iconography was the Fontana del Tritone in the Piazza Barberini in Rome, created to display the water of the new aqueduct, Aqua Felice, at its public terminus. The creature also appears in Rome's famed Piazza Navona, whose three 17th-century fountains, the Fontana del Moro, Fontana del Nettuno, and Fontana dei Quattro Fiumi, feature similar sea creatures in water-related iconographical schemes. In 1927, *San Francisco Water* editor O'Day dedicates an entire issue of the magazine "to the dignity of water as it is expressed in world-famous fountains and well-heads" The issue features a long article about European fountains illustrated with Italian examples that display the sea creature, which he calls "finny monsters."[331] **[Figure 78] S**culptural ornamentation on Spring Valley Water Company

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329 At certain points only two sea creatures are visible from the ground; even this provides a sense of solid base for the finial; never does one see all four sea creatures at once. My own experience at the Temple, and apparently that of its photographers, is that one seeks a vantage point that includes three sea monsters on the finial: every photograph I have seen of the temple includes a view of three sea monsters on the finial.

330 See Franz Sales Meyer, *Handbook of Ornament: A Grammar of Art, Industrial and Architectural Designing in All Its Branches for Practical As Well As Theoretical Use* (1892, repr., New York: Dover Publications, 1957). For lion heads as spouts, 74-75, 185; for dolphins, 86-90; and for finials: 175-79.

331 O'Day, "Fountains Dispersed Abroad," 1-16. For "finny monsters" caption and photographs of fountains that include the sea creature, see 6-8. For a comprehensive study of water-related architecture and iconography of Rome, see Katherine Wentworth Rinne, *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City* (New Haven: Yale University Press, 2010); and Katherine Rinne, *Aquae Urbis Romae: The Waters of the City of Rome,* Institute for Advanced Technology in the Humanities, University of Virginia, accessed February 28, 2015, http://www.iath.virginia.edu/waters/.

buildings, examples of which I will discuss, regularly included the sea creature dolphin. One characteristic pose was the tail-up-mouth-down pose from the Sunol temple finial; another common variation featured the sea creature's tail winding up along the trident of Triton, Neptune, or Poseidon. The figure underscored the cultural and historic heft of architectural water display in mytho-religious iconography from antiquity. **[Figure 165]**

Focused on this level of detail, one can forget that even as the architect seemed to work freely to enhance the temple's proportions, he was locked into the restriction of the temple's fixed footprint: the circular foundation had to inscribe the waterworks "crypt" below ground. **[Figure 74, 83]** Both the Ionic and the Corinthian designs appear solid and grounded, but the achievement of the final Corinthian temple design lives in the appearance of heightened stature and expanded space Polk achieved around and within the temple. The dual sense of uplift and expansion contrasts dramatically with the inward and downward pressure the smooth Ionic dome exerts. The final temple design appears conclusively to be the most statuesque and stable, and the most cohesive, formally and historically, of all the designs pictured in the temple series image.

Today, one has grown so accustomed to the existing red tile-roofed Corinthian temple design that it seems implausible that Polk first designed a smooth-domed Ionic temple for the site; only later did he decide on the Corinthian design. In my analysis of the primary record, I find the evidence for an initial Ionic intention to be persuasive. **[Figure 70, 71]** The slightly earlier Pleasanton Pumping Station and the earlier architectural drawings of the Sunol Temple, both in the Ionic order, suggest strongly that Polk intended the Alameda Division system architecture to present a coordinated, Ionic design scheme. Together they marked the sources of the Sunol Aqueduct, and together they recorded in architecture the 1910 modernization of the Alameda County watershed supply and trans-bay conveyance system. This sheds light on Polk's (and probably Bourn's, and the water company board and shareholders') intentions. An Ionic design worked for the little Pleasanton Pumping Station temple, but it fell apart under the complex requirements of technology, architecture, and landscape for the Sunol site. Polk's Corinthian design was the more striking design for the Sunol site. O'Day claims in his 1922 article that the two designs varied only "slightly," but I think he spoke in terms of general features for a lay audience: the round, peripteral form and the dimensions in plan are certainly "similar." To examine the more nuanced formal details of the two versions is to discover that they vary substantially; I will discuss specific nuances later in this dissertation. Close examination unveils marked differences in the visual impact of the architecture, ornamentation, and setting. Taking all into account, each design conveyed symbolic, historical, social, and ideological messages differently through their formal aesthetic elements.

By dramatic contrast within its own founding conceptual context as an Ionic, smooth-domed white "City" temple, then, the Sunol Water Temple's final design took a different formal and ideological turn from what Polk had originally envisioned. He created an "Out of Town" style statement (to borrow from PG&E's later design program language, which I will discuss), that is, a picturesque type fitting for a rural, pastoral landscape setting. The final Corinthian design contributed variety in the profile, ornamentation, and materials, in contrast to the smooth, uninterrupted surfaces and lines of the monochromatic Ionic temple with its flat-top oculus on a smooth dome. The final Sunol design appeared more intimate in visual effect than the domed structure. But even more intriguing than the overall architectural design elements—Ionic with white dome and oculus vs. Corinthian with red tile and finial—are specific details of the final temple's features, which began to illustrate decisive and clear-intentioned resolve as soon as Polk turned to the ancient round temple at the Tivoli Cascades as his model.[332]

ANCIENT ROME'S ROUND TEMPLE AT TIVOLI AS MODEL FOR SUNOL

The Sunol Water Temple distinguishes itself among historical revival waterworks architecture for its direct reference to a famous, ancient Roman temple associated with water, the Round Temple at Tivoli. As a specific, well-wrought "copy" of a specific

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[332] Analysis of Rome's ancient round temples appear in John W. Stamper, *The Architecture of Roman Temples: The Republic to the Middle Empire* (Cambridge: Cambridge University Press, 2008), 68-79. Of those visible at the time, they are the Round Temple by the Tiber in the Forum Boarium in Rome; the Round Temple at Tivoli (also referred to as the Temple of Vesta at Tivoli); and the proper Temple of Vesta, in the Forum Romanum.

water temple from antiquity, it is unique as a waterworks building. The Round Temple at Tivoli was well known from antiquity forward, striking for its architecture and for its cliff side perch upon the Tivoli Cascades. **[Figures 67, 79]** Just as the Tower of the Winds and Monument of Lysicrates served a Greek-inspired canon of round and octagonal structures in the 18th and 19th century United States, the Tivoli temple represents a small group of ancient Roman round exemplars. **[Figures 80, 81]** Often called the Temple of Vesta at Tivoli, the ancient water temple is an 18-column round temple perched on the edge of the deep ravine over which the Anio River plunges to create its famous cascades in the foothill town of Tivoli. Known as Tibur in antiquity, the town has been an important riverside city since the Etruscan period (pre-600 BCE).[333] The combination of its high-status water site and its proximity to the city of Rome grounded Tivoli's geographical, political, religious, and commercial prominence throughout history, beginning with (and probably pre-dating) the temple's construction during the Republican period (600 – 44 BCE). The site was an important water location in ancient Roman history, for several

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[333] The name "Temple of Vesta" is based on its likeness to the *bona fide* Temple of Vesta in the Roman Forum, a temple that is not water-related. Any round Roman temple is often called a "Temple of Vesta," whether or not its origins or functions are known to be associated with Vesta, the goddess of the hearth in ancient Rome. The importance of the Temple of Vesta and its distinctive round form permit borrowing of its name for other round temples throughout Roman history, but not all round temples were necessarily dedicated to Vesta. Three existing ancient examples of round temples in the Roman city include the central Temple of Vesta in the Roman Forum, home of the famed Vestal Virgins, the round temple in the Forum Boarium on the banks of the Tiber River. All Rome's ancient round temples, including the round temple at Tivoli, date from the Roman Republic (600-44 BCE) or earlier. The Temple of Vesta in the Roman Forum may pre-date the Republic, as it played a central role in Roman civic worship and almost literally marks the centerpoint of the ancient Forum, or municipal plaza. In it burned the perpetual Vestal fire, tended year-round by an elite group of Vestal Virgins selected from the aristocracy for lifelong, sequestered service. See Amanda Claridge, *Rome: An Oxford Archaeological Guide* (Oxford: Oxford University Press, 1998), 101-04, figs. 1, 34, 37, and 254-56, figs. 120, 121, 55. See also T.J. Cornell, *The Beginnings of Rome: Italy and Rome from the Bronze Age to the Punic Wars (C. 1000-264 BC)* (New York: Routledge, 1995), 240-41. For a pictorial reproduction of the round temple at Tivoli under discussion here, see Chris Morselli, *Guide with Reconstructions of Villa Adriana and Villa D'Este* (Rome: Vision S.R.L., 1995), 56-58. Also recall the Greek monuments discussed in the previous chapter, the Monument of Lysicrates and the Tower of the Winds, which were by Polk's time fully integrated into the neoclassical architectural canon. In the Sunol Temple, the finial, for example, is clearly a remnant of these Greek Revival influences. The Greek features had been interpreted by both American Greek Revival and American Beaux-Arts architects during the 19th century. From American waterworks precedents, Polk most certainly had seen the Beaux-Arts style round waterworks temples incorporated into the water tower at Louisville, among others he certainly knew of Theodore Scowden's San Francisco water supply maps and reports from 1875, long excerpts of which were quoted in issues of *San Francisco Water* in the early 1920s.

reasons, arising from its location along the Anio River, a tributary of the Tiber River running through the city of Rome.

The Anio River is the principal drainage for the Alban Hills, nearby and to the east of Rome, a rivershed that ancient Romans first tapped in 272 BCE as the source for the city's major aqueducts. Between the 4th century BCE and the 3rd century CE, the Romans eventually built eleven aqueducts, and of those eleven, the source for the five largest and longest was the Anio River. These drew water near the marshy valley town of Subiaco, upstream from Tivoli.[334] Ancient intake waterworks at Subiaco funneled the Anio's water supply through a maze of aqueducts as Rome's water needs grew over the centuries. As the primary source for that water supply, the Anio River's water-related cultural value was repeatedly hailed and consistently revived during and after antiquity. The town of Tivoli was renowned for its round temple from the Late Republic, but was known throughout antiquity as a location for patrician and Imperial country villas. Upstream from Tivoli in the first century CE, Emperor Nero had built a cliff side villa overlooking a reservoir he dammed at the Anio River gorge, and a century later, Emperor Hadrian chose the town for his Villa Adriana, or Hadrian's Villa, renowned for its water spectacles and sprawling gardens, and for the waterworks system that supplied them. During the Renaissance, the nearby Villa d'Este rose upon other ancient villa foundations

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334 For more on ancient Roman aqueduct history, begin with the following sources. For translation and study of the only existing ancient Roman aqueduct administrative text, from 97 BCE, see Michael Peachin, *Frontinus and the Curae of the Curator Aquarum* (Stuttgart: Steiner, 2004); and Harry B. Evans, *Water Distribution in Ancient Rome: The Evidence of Frontinus* (Ann Arbor, MI: University of Michigan Press, 1994). For examination of the discovery of ancient Roman aqueduct ruins during and after the Renaissance period, see Harry B. Evans, *Aqueduct Hunting in the Seventeenth Century: Raffaello Fabretti's De Aquis Et Aquaeductibus Veteris Romae* (Ann Arbor, MI: University of Michigan Press, 2002). For history of aqueduct systems based on archaeological evidence, see Lanciani; Esther B. Van Deman, *The Building of the Roman Aqueducts* (Washington, DC: Carnegie Institution of Washington, 1934). For a brief history and guide to existing ruins of ancient waterworks in and around Rome, see Peter J. Aicher's *Guide to the Aqueducts of Ancient Rome* (Wauconda, IL: Bolchazy-Carducci Publishers, 1995). For an overview of ancient waterworks systems engineering throughout the Roman world, see A. Trevor Hodge, *Roman Aqueducts and Water Supply*, 2nd ed. (London: Duckworth, 2002). For a discussion of economic and political factors that may have influenced Appius Claudius Caecus and the Romans to build the city's first aqueduct, the Aqua Appia, in 312 BCE, also see Rina Faletti, "Aqueduct as Hegemonic Architecture: A Case from the Roman Republic," in *Ideas of Water from Ancient Societies to the Modern World,* series 2, vol. 1 of *A History of Water,* eds. Terje Tvedt and Terje Oestigaard (London: IB Tauris, 2010), 147-91. Also consult Rinne, *Aquae Urbis Romae: Waters of the City of Rome.*

on a Tivoli ridge whose steep hillside was terraced into water gardens noted for their theatrical fountains. In the early 19th century, Pope Gregory XVI built the precipitous Villa Gregoriana into the cliffs of the Anio River Cascades on an opposite precipice facing the Round Temple at Tivoli. The Pope's project "cured" the flood-plagued town by redirecting the entire Anio River through a massive double rock tunnel bored through cliffs behind the Villa Gregoriana—where the river naturally slowed, and had backed up into town during floods—before tumbling over the Cascades, which were eventually partially washed away. The Pope's relocated falls are less picturesque than the natural cascades, but still impressive as an engineered flood-control works. . In the 19th and 20th centuries, high-volume water industries such as paper mills and hydraulic power plants were located at Tivoli, some on the extensive terraced foundations of ancient 2nd century CE ruins of the massive Temple of Hercules Victor.[335] In short, from the ancient period forward, Tivoli has been associated with large-scale waterworks made possible by bold and sophisticated water systems engineering.

In Rome, a few round Republican-era temples have survived. One is the round temple on the Tiber River, which in the popular modern imagination, if not in antiquity, was associated with water, positioned as it is in the Forum Boarium above the riverside outlet of the Cloaca Maxima, Rome's main drainage tunnel. The Cloaca was the city of Rome's first major waterworks construction, predating by three centuries any city aqueduct.[336] As Rome's principal internal flood control mechanism, the Cloaca—whose name invokes an ancient water goddess—was key to the topographical unification of the seven hills into a single, well-drained, and therefore buildable, *Urbis*. The area where the Cloaca began was a spot near the Forum Romanum. This city's ancient civic and sacred center was able to be built once the Cloaca diverted surface runoff.

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[335] I thank Sania Shifferd for sharing her unpublished research on the Temple of Hercules Victor at Tivoli.

[336] Republican-era round temples in the city of Rome proved the value of their high cultural and historic importance by surviving in central locations though the entirety of antiquity into the present. These were not connected directly with waterworks. The highest-status round temple in Rome was the Temple of Vesta, the virtual center point of the Roman Forum, a critical center of Roman religion dedicated to full-time worship of the goddess Vesta. See Stamper, *Architecture of Roman Temples,* 68-79.

By modeling the Sunol Temple on the Round Temple at Tivoli (1st century BCE), Polk drew associations with these major historical waterworks systems. Throughout history, water has marked large-scale sites of water diversion, making imposing architectural statements; these tend to increase the status of the patron, the product, and the society associated with them.[337] The round temple type was a well-established European sign long before Willis Polk and the Spring Valley Water Company began grappling with urban waterworks design (even long before Latrobe placed his round waterworks temples in Philadelphia and New Orleans—and domed the Capitol). Various related architectural references were in broad circulation in American architecture, entering with Greek Revival, Gothic Revival, Beaux-Arts, and other forms historical-revival academic eclecticism. O'Day's comment that Polk had studied "all the round temples in the world" poses the question: Which round temples would Polk most likely have considered? Ancient Rome boasts several round temples in addition to the Tivoli example. The proper Temple of Vesta (cult 8th century BCE; last temple renovation 191 CE) in the Roman Forum is a pivotal exemplar, as is the Republican Round Temple on the Tiber (2nd century BCE) at the Forum Boarium, the city's commercial center near the Circus Maxiumus. It may be that Polk also reviewed civic architecture, and if he did, his survey would include the Pantheon (c. 125 CE), of course; others I mentioned earlier in my discussion of the importance of precedents for bank, church, and other civic architecture, and of the octagon. Polk might have considered Emperor Hadrian's villa (2nd century CE), also at Tivoli, which included a famed peripteral rotunda. Domed temple interiors of Rome's Diocletian Baths (c. 306), may have caught his attention, two of which were converted into churches during the Renaissance—Santa Maria degli Angeli, begun in 1563 by Michelangelo, and San Bernardo delle Terme (1598). From Italian Renaissance architects, Bramante's famed round peripteral temple, his Tempietto (1502), often copied, must have been on the list. Many others throughout Europe and the Mediterranean, spanning the Renaissance and Baroque periods, would have come to

[337] For an overview of ways in which these elements played out for the first ancient aqueduct at Rome, consult Faletti, "Aqueduct as Hegemonic Architecture," 147-91, esp. 149-50; and see her sources, for a broader view.

Polk's attention. He would have considered many domes and round temples from the 17th to 19th centuries, as well, such as typical examples set in English country gardens, and others in Palladian, Beaux-Arts, and "White City" architectural styles in the U.S. and abroad.

Polk probably also considered Greek models. From antiquity, the round temple (*tholos*, c. 4th century BCE) at Delphi is a prominent Greek example, in addition to the Athenian Monument of Lysicrates and Tower of the Winds I mentioned previously. In 1913, a report on Spring Valley Water Company structures identifies the Sunol Temple as "a reinforced concrete structure of a Grecian design."[338] Another reference to Greece as primary cultural source comes from San Francisco artist Ralph Stackpole: "The prototype of the Water Temple was built by the Greeks."[339] I assume the writer refers to the round temple at Delphi, but there is no way of knowing. As persistent as references to "Rome" and "Empire" appear throughout popular print impressions of San Francisco at the time, the Greek was as prominent a cultural source.[340] One comment, from 1912, makes reference to San Francisco as "the modern Athens on the … San Francisco Bay."[341]

Temple precedents reflected ideals of Beaux-Arts and of the White City, from Polk's work with Burnham in Chicago. Polk worked against the grain of the more flamboyant design sense of McKim, Mead and White. His acerbic critique of a proposed tower addition for San Francisco City Hall in 1893 typifies his critical voice, but it also confirms foundational concerns about overwrought eclecticism insensitive to architectural history.

> The design threatens to perpetuate a bastard combination of a Spanish clerestory crowned by an English cupola resting on a Franco-Roman base. …It could be

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338 "History and Description of the Constructed Work of the Water Division of the Spring Valley Water Company: Preliminary Draft," [1913], 21, Documents Archives, SFPUC. Alison Moore brought my attention to this document from the archives.

339 Ralph Stackpole, "Dixon's Spring Valley Mural," in *San Francisco Water*, 2:4 (October 1923): 5.

340 The stubborn Roman Imperial characterization of San Francisco persists through the historiography, to the present. See, for example, Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin, with a New Preface* (1999, repr., Berkeley: University of California Press, 2006).

341 "Items of General Interest," *Pacific Gas and Electric Magazine* 4, no. 2 (July 1912): 62, 72.

> removed by complete elimination. It could be partly improved by forcing the mass of detail in its lower middle stage into a more harmonious relation to the dignified Corinthian pilasters which form the rotunda. As the design stands, this part is significantly misproportioned to the main structure. Perhaps the only merit in the entire composition is the effective area of repose which marks its upper middle stage. The top is eminently susceptible of improvement. The whole is hopelessly out of scale to the massive structure it is to adorn.[342]

This commentary exemplifies Polk's attitude toward incoherent eclecticism. He was particularly incensed by a blind, unscholarly, eclectic mix of historical revival elements that yielded visual chaos rather than cohesiveness in overall design.

> …[T]o create a new style, which seems to be the aim of all ambitious American architects, it is not necessary to cast to the winds all previous works of the great classicists and medieval masters. …[H]istoric work, as forming precedents, should be the basis of all artistic study, and…the production of a modern work of art could no more succeed without recognizing ancient and classical standards than could the study of literature and the composition of a grand opera proceed without consulting and following the great compositions and essays of all ages.[343]

Such a survey would not have been new for Polk. He had grappled with round temple concepts since he first arrived in San Francisco in the 1880s. A round temple portico feature distinguished the entry portico of his first major residence, the George W. Gibbs house, an Italianate masonry mansion. In 1908, he designed a round colonnade for the corner entry of his renowned First National Bank building.[344] **[Figure 82]** Even a

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342 Willis Polk, "The New City Hall Tower," in *A Matter of Taste: Willis Polk's Writings on Architecture in* The Wave, by Willis Polk, ed. Richard Longstreth (San Francisco: The Book Club of California [Publication No. 161], 1979), 37-39.

343 Willis Polk, "The Western Addition," in *A Matter of Taste*, 34. In another essay, Polk quips: "The new style will be the East Indian, Egyptian, Moorish, Mission, Assyrian, Aztec, and Conventional." See Willis Polk, "Tendency of San Francisco Architecture," in *A Matter of Taste*, 42.

344 A photograph of the Gibbs porch appears in Frederick Hamilton, "The Work of Willis Polk & Company, "*The Architect and Engineer of California* 24, no. 3 (April 1911): 69. On Polk's "first major independent commission," see Richard W. Longstreth, *On the Edge of the World: Four Architects in San Francisco at the Turn of the Century* (1982, repr. New York: Architectural History Foundation, 1998), 193-95; and James Beach Alexander and James Lee Heig, *San Francisco: Building the Dream City* (San Francisco: Scottwall Associates, 2002), 304-05. The house is at 2622 Jackson Street. "With stone walls and a semi-circular portico, it is beautifully proportioned and was one of Polk's first San Francisco dwellings. It bears no resemblance to the rustic city houses which he would design later. Some people argue that the inspiration for its round porch came from a design by Raphael for the Temple of Vesta. The true inspiration, however, was the work of McKim, Mead and White, and the years Polk spent in New York.

cursory comparison between these porticoes and Polk's round water temple makes clear that, while the Sunol Water Temple was certainly inspired by the Tivoli temple, his round porticoes definitely were not. The 1894 half-round porch on the Gibbs house had a distinctive arrangement of paired Ionic columns with masks in the entablature frieze over each column, and a domed ceiling coffered with rosettes under a tile roof. This portico's clean idealism is an example of an academic round temple of "academic eclecticism," that is, one that seeks to create a cleaner and more understated historical neoclassicism than the florid American Beaux-Arts achieved. In the Gibbs portico, this resulted in an elegant and well-scaled principal feature on an otherwise unornamented neoclassical masonry home, perhaps Polk's first independent commission in California.[345]

Polk's survey of round temple precedents is reflected in the two discrete temple designs he developed, illustrated in the temple series image and in extant drawings. Polk fashioned a white "City" style marker first, one based on a monumental urban models in the Ionic order, and probably with a view to a coherent pairing with the Pleasanton Pumping Station, which he completed in the Ionic order the year before finalizing the Sunol Temple design. The white "City" image was an idea Polk was at the same time developing for the Pacific Gas and Electric Company, the Spring Valley Water Company, and the city of Sacramento. The more generic "City" style is authoritative in the stark

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The house for many years served as headquarters for the San Francisco Institute of Music and Arts." See Alexander and Heig, *San Francisco*, 304-05.

345 The now-suspended website Vernacular Language North (VLN) cited the *San Francisco Examiner*'s description of the Gibbs House as "the first classical residence in San Francisco," apparently an excerpt from Longstreth: "Nevertheless, the Gibbs house generated a flurry of excitement." "Enthusiasm also centered on the fact that this was among the city's earliest houses constructed entirely of stone and that almost no dwelling of comparable size matched the restraint of its exterior. The *Wave* summarized prevailing opinion, remarking that the house's 'unpretentious solidity ... cheapens the much gabled and turreted mansions surrounding it.' In a metropolis of wood, the Gibbs house became an instant symbol of grandeur and permanency. The scheme further set an important local precedent for the collaboration of architect and artist in developing the decorative program. Polk had Douglas Tilden design the Medusa heads for the portico--the sculptor's first commission following his return from Paris earlier that year. Bruce Porter was brought in to create the huge stained-glass window in the stair-hall landing. Lockwood de Forest, who had been a partner in one of the country's first decorative-arts studios, prepared plans for the ornamentation of some of the principal rooms. De Forest's work may not have been executed, and the whole scheme fell far short of the exquisite interiors of McKim, Mead and White's houses, which served as its conceptual model. Still, the work demonstrated to rich San Franciscans that they need not entrust room design strictly to decorators, who often had little concern for architectural cohesiveness." See Longstreth, *On the Edge of the World*, 193-95, 211, 381 n. 10, and img. 150.

monumentality of generalized forms, while the "Out of Town" style modeled on identifiable examples, represented by the red tile variation of the final Sunol Water Temple, places claims on intimacy, variety, and specificity. The white dome booms; the tile roof beckons.

THE PROBLEM OF "SIGHTLY EFFECT": LANDSCAPE ALTERATION FOR VISUAL DRAW

To maximize the visual impact of the Sunol Water Temple, Polk had to solve numerous problems related to the building's site.

> The most interesting problem, artistically, was the search for "scale"—that is, to find a unit of proportion that would look normal in contrast with nature, a stature that would harmonize with environment. The studies devoted to this element in design led through a series of schemes beginning with twenty-four columns sixteen feet in height, resting on a base forty-five feet in diameter, to a final scheme composed of twelve columns thirty-five feet in height, on a base thirty-six feet in diameter.
>
> A determining factor in this final decision was revealed—but only after many visits to the site—by the noble proportions of a huge cottonwood-tree nearby. The dimensions and outline of this tree were measured, and its natural proportions the mass of the Temple.[346]

This cottonwood tree anecdote emphasizes a pastoral effect, beckoning viewers to imagine it as a visual anchor within its larger landscape context. Knowing the site myself—this large cottonwood tree no longer thrives, although the temple has a background of grand sycamore trees along the adjacent Calaveras Creek—I am surprised no mention was made of the dramatic cliff on the opposite creek bank behind the Temple site. The cliffside reminds one of the Tivoli precipice, even if not on scale with that more dramatic site. At Tivoli, whose river cascade is several hundred feet in height, the temple sits overlooking the river gorge, not at the base of the cliff aside the creek bed, as at

[346] O'Day, "Architecture of the Water Temple," 4-5. This cottonwood tree anecdote and the details about the design process convince me that O'Day worked in conjunction with Polk to prepare the article—O'Day was an experienced interviewer and feature writer in arts and culture journalism, and the way in which he writes this piece is on par with other pieces he wrote that depended upon interviews and examination of original documents—so I do not doubt the cottonwood tree narrative.

Sunol. Yet the Sunol cliffs, fronted as they are by large sycamores and cottonwoods growing along the creek create a proportional backdrop for the temple.[347]

The most difficult site problem to solve was that of the elevation of the ground at the temple site. The underground filtration gallery, which led to the "crypt" basins upon which the Water Temple was to stand, was situated in (or its construction had created) a depression in the ground like a large swale. Placed here, the temple base would have stood at a level lower than surrounding ground, and in that low-lying position, it would have been invisible from a distance. The fifth temple drawing in the temple series image shows one way to bring the temple into view: to construct a drum foundation tall enough to even the temple base with the existing ground level. **[Figure 76]** O'Day explained the problem and summarized Polk's ultimate solution:

> A natural obstacle to sightly effect hampered the first studies. It was not perceived immediately, but once recognized and surmounted, progress was more rapid. This obstacle was the natural depression of the ground at the site of the water crypt. It was overcome by raising the foundation of the Temple some fifteen feet and filling the surrounding ground with about fifty thousand cubic yards of fill, in order to bring the base of the Temple up to the ground level of the valley floor.[348]

Polk's final plan indeed raised the temple upon a tall drum foundation, but it was not to build upon a drum foundation, but to add tons of earth infill and alter the landscape completely. The finished site indeed brings the temple up to ground level. **[Figures 75, 83]**

The precise temple location was predetermined by the underground waterworks "crypt" upon which it was centered. In surviving architectural plans, the "existing walls" of the underground "crypt" are labeled and distinguished from new foundation elements with diagonal hatch marks. **[Figures 65, 72, 74, 75, 84]** This confirms the ways Polk's new construction helped the temple to clear "natural obstacle to slightly effect," the deep swale. Polk first inscribed a deep circular wall around the periphery of the "crypt," sunk

[347] In 2011, the SFPUC leased the land adjacent to the Sunol Temple grounds for development as a deep gravel quarry, that is, the Sunol gravel beds are no longer used for water supply. The view of the quarry has been buffered visually by a tall planted berm.

[348] O'Day, "Architecture of the Water Temple," 4-5.

that foundation wall on deep footings, and then raised it "some fifteen feet" on a hollow, cylindrical foundation. This made the temple base a viewing platform, designed to allow visitors standing at a railing between temple columns to peer down into the exposed waterworks as if through an oculus into a sunken cella. Viewers had an experience of mid-air suspension over the cascading water below. In order to create this sublime overhang effect, Polk created a foundation extension. He attached a continuous, circular half barrel arch, like a cap, to the top of the cylindrical foundation, so that the barrel arch sprang from the drum. This created the equivalent of an underground "dome" with a wide "oculus." The top of the "dome" and the edge of the "oculus" became the temple base, with the ring of columns positioned at the edge of the ocular opening, creating the viewing platform. Wrought-iron railing installed between the ring of columns completed the visitor overlook, accessed by low peripheral stairs. The temple now "floated" above the works.

The architect raised and graded the ground level with more than 4,000 cubic yards of earth, erasing the swale beneath the temple proper and burying the cylindrical foundation around the "crypt."[349] Once the earth fill was in place, the steps up the temple "base"—actually hollow beneath—followed the contour of the half barrel arch beneath it, creating access from the new ground level to the elevated viewing platform. **[Figure 75]** This raised the entire temple into view from the surrounding landscape. **[Figure 85]** A 1922 sketch by Polk illustrated the relative effect of the raised and backfilled drum foundation.[350] **[Figure 86]** The drawing places two temples side-by-side in cross-section, illustrating on the one hand the degree to which the temple would have been hidden had it sat in the bottom of the swale, and, on the other the position of the final temple standing at the newly-elevated ground level. Photographs of the temple from the vantage point of the filtration gallery swale show clearly the elevation change the temple's drum foundation created. **[Figure 85]** The ground directly above the filtration gallery was not

349 Fill amount listed as "Structure No. 34" in section titled "Roads: Transbay System," in Metcalf, *Inventory of the Physical Properties,* 136.
350 O'Day, "Architecture of the Water Temple," 4-5.

backfilled, so the swale still exists there; the way in which the backfill was managed is clearly visible to this day. The elevated ground level served another important aesthetic function: it to created a level driveway out to a carrefour entrance Polk designed at the main road. A long, straight avenue brought the temple into full view on approach. The temple now fully activated its spatial placement in the landscape. The garden was complete. With its proportions finalized internally and in relation to the surrounding landscape, the finished Sunol Water Temple stood firmly on its perch: housing a spectacle, and a spectacle in itself. **[Figure 100]**

In 1910, this remote country site was visually compelling. Polk enhanced the cultural power of the temple by formalizing the garden entrance and driveway approach. The long drive (which directly traces the underground path of the Pleasanton pipeline on its approach to the temple) entered the site through an architectural gated entry Polk designed as part of a circular carrefour.[351] **[Figures 87, 88, 89]** This entrance created high visibility for the temple at a major thoroughfare intersection, rural but central, of three regional roads. One ran south to San Jose and Stanford; another west to Oakland, Berkeley, and San Francisco; and a third northeast to California's state capital city of Sacramento, and on to the inland Central Valley and the western slopes of the Sierra Nevada Mountains. Two carrefour drawings survive; Polk supervised the work, with assistance from sculptor Arthur Putnam, under contract to fabricate sea creature figures and ornamental garlands for entry fountains, and a balustrade that marked the filtration gallery's access manhole.[352] **[Figure 85]** The plans show that the three intersecting

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[351] See a photograph of the carrefour, "Carrefour: A Place Where Four Roads Intersect," in the photo essay that accompanies "Water Supply of San Francisco," 7. The caption reads: "The Sunol Carrefour is at the entrance to Spring Valley's Alameda County headquarters. To the left of the avenue that runs to the Water Temple is a walnut orchard; to the right, buildings occupied by the resident superintendent. These grounds are part of the old Sunol Rancho." For a photograph of the headquarters buildings, see "Water Supply of San Francisco," 9.

[352] Correspondence and contracts in the Documents Archives, SFPUC, confirm slender mention elsewhere that sculptor and landscape architect Arthur Putnam was contracted to create the sea creatures (called "dolphins" in contract correspondence) for the carrefour entry gate fountains, as well as for the balustrade surrounding the manhole entrance into the filtration gallery. At the west end of Pilarcitos Dam, Babal reports, stood a fountain by Arthur Putnam (1873-1930) in 1912, but it had been removed before 1987,

highways outside the new temple drive were re-graded and re-centered for the carrefour plan, with each entering through neoclassical gateposts. Drivers, regardless of their destination, would clearly view the temple as they slowed to circle through the carrefour, but how could one fail to stop at this country park? The water company entrance gateposts were fitted with wrought iron gates, and plaques installed on the posts announced the Spring Valley waterworks site was "open to public inspection." **[Figures 78, 87, 88, 89]** Identical wall fountains ornamented with sculptural reliefs of the familiar sea creature, tail winding up around a trident, decorated both gateposts. Carrefour and entry gate beckoned travelers to enter into the architectural formality of these pastoral grounds. The site made for an attractive stop on the long journey, or was a countryside destination in itself. Upon arrival, the full architectural treatment of the carrefour entrance dramatized the visual impact of the temple, and this effect mounted as one turned, passed through the gate, and faced the temple at the end of the long drive.

Polk had resolutely resolved "the problem of sightly effect" with the decision to raise the ground level and place the temple at "the general level of the Sunol valley floor." The formal entrance transformed the temple grounds into a grand landscape

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when Babal reports that "only concrete footings mark the spot" (107). Today remains of a fountain do exist on that spot, adjacent to overgrown remains of the redwood flume that carried the area's ample run-off into the Pilarcitos Reservoir; in evidence is a short offshoot of the flume that fed the fountain and announced its cultural purpose. Just beyond this point the flume empties into the reservoir. Materials for a fountain in this location are listed in the 1914 inventory. See entries under "Pilarcitos" in Metcalf, *Inventory of the Physical Properties.*This Pilarcitos fountain is identical to a balustrade of the same design pictured in a 1922 photograph of the Sunol Temple site in San Francisco Water **[Figure 85]**. After viewing the identical fountain at Pilarcitos, I assumed that the fountain at Sunol had been moved to Pilarcitos. Close examination of the 1922 cover photograph reveals not a fountain within the balustrade, but a manhole cover. This makes clear that the balustrade was not originally a fountain; it was a square balustrade railing with sea creature iconography, meant to mark the point of subterranean access to the Sunol gravel filtration gallery, the source of underground water into waterworks "crypt." The balustrade is no longer at the Sunol site. If a unique object, which I suspect it was, one must guess it was moved from Sunol to the Pilarcitos Dam after 1987. It may have been moved during the initial renovations to the Sunol Temple in the early 1990s, or perhaps during conservation work done on the temple in the early 2000s. The balustrade must have been either converted into a fountain when it was moved to Pilarcitos; or, it was placed atop the ruins of fountain works at Pilarcitos which remained at the site after the original ornamental fountain was removed. It is not currently installed, but rather is in a ruined and piecemeal state on a concrete base. It's not clear whether the fountain plumbing works were still in place in 1987—I suspect they were. Babal's claim to a 1912 Putnam fountain at the Pilarcitos spot remains unverified. Knowing this now, one could make more informed observations at the Pilarcitos site on a subsequent visit garden.[353] This site was a space defined by cultural values whose symbols, of water, architecture, and landscape design, communicated visual tenets of such 19th-century landscape ideas as pastoral and picturesque, beautiful and sublime.[354] The expansive site revealed a landscape that, although no longer "natural," was instilled with the values inherent in social contact with "nature." Roderick Nash might argue this as an altered wilderness, one fabricated, in this case, in conjunction with an engineered waterworks system meant to draw viewers.[355] The nuances the temple brought with it by association—historical, architectural, artistic, social, economic, religious, ideological, technical, corporate—opened and anchored the space, defining and identifying it as unique and new, marked and completed, historic and unchangeable. Its accomplishment is qualitatively similar to the original American precedent, Latrobe's Center Square Water Works, of more than a century earlier.

By comparison with the Sunol Temple's model, the Round Temple at Tivoli, even if born of a discrete historical situation, displays cultural similarity over time. The ancient temple also defined and domesticated a "wild" surrounding landscape space and its waterscape, even if its primary purpose in the broadest cultural sense for ancient Rome, was in the original sense the temple brings: the religious, the sacred. One cannot argue that the water temple in 19th century California brought an authentic religious association with it—the temple did not create a place of worship, as temples in antiquity explicitly did. There is no denying the dynamizing spiritual effect of water flow upon a viewer's

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353 O'Day, "Architecture of the Water Temple," 4, from the caption for the drawing comparing the initial domed-temple design at the lower ground elevation with the final temple upon its higher base and upon the elevated ground level.

354 There is not space to examine the full history of landscape in this dissertation. See my Introduction for background in the idea of landscape in the American West. The standard terms for landscape concepts I list are foundational in art and aesthetics history for the history of landscape, landscape painting, and landscape design, and ground a vast literature. A selected resource list would include Edmund Burke, *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* (London: R. and J. Dodsley, 1757); Immanuel Kant, *Critique of Judgement* (Berlin: Lagarde und Friederich, 1790); essays by William Gilpin and Uvedale Price, for example, from the last quarter of the 18th century. For the United States in the 19th century, one might begin with Andrew Jackson Downing, *A Treatise on the Theory and Practice of Landscape Gardening, Adapted to North America* (New York: Wiley and Putnam, 1841) and writings by Frederick Law Olmsted.

355 Roderick Nash, *Wilderness and the American Mind* (1967, repr., New Haven, CT: Yale University Press, 1976).

experience at the Sunol Temple: for its time, it offered a variety of transcendental experience, a spiritual encounter in nature, perhaps even an overwhelming sense of the divine in the sublime.[356] Yet, like its model at Tivoli, the Sunol Temple provided an exemplary instance of waterworks architecture's ability to activate a space directly due to a dramatic presence of water. The temple form alters not only the engineering works, imbuing the utilitarian with aesthetic tensions, it also alters the perception and apprehension of the surrounding landscape terrain, by association. Cultural perception (and reception) of the landscape heightens, *with aesthetic purpose*. Design and siting permit the temple to dominate and define the landscape, and to include the entire watershed landscape, by activating the architectural form, the space around it, and the flow of water beneath it, with dynamic historic-cultural substance.

The temple's presence was magnified immeasurably by the water experience it showcased. When it was new, the "mingled waters" from the three Alameda County sources entered the subterranean basins in a roar; the rush of water falling up to forty feet from the shallowest to the deepest basins created "a magnificent cascade" on its way into the mouth of the aqueduct pipeline at the base of the "crypt."[357] From above the open ring

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[356] If space for this topic could be opened in this dissertation, I might take more time to examine the pecuniary motivation for a water company's self-representation in the form of an ancient temple. By one mode of thought, the commercial venture counters, even cancels, the ancient model's implicit religious reference. The subversion of original cultural significance might be made more pointed by the inclusion of Biblical verses on the frieze of the temple, which I examine later in this dissertation. At the same time that Biblical verses on a pre-Christian sign of the sacred might be interpreted as a grotesque misappropriation, it is in part the forced association of these discrete cultural belief systems (separated by time and ideologies) that activates the water temple as a symbol in the present. The Sunol Temple's eclectic neoclassicism is a sign for its own day; to describe and examine the formal aspects of that sign is one of the primary purposes of this dissertation. As Michael Charlesworth points out, the Sunol Temple is "a sign of a sign": it signals the water company at the same time it references the Tivoli Temple and Roman water engineering and culture in general. It also makes 19th and 20th century references to broader and more recent historical neoclassicisms such as Palladianism, Greek Revival, Beaux-Arts, et al. At each juncture of current with a historical iconography, the 1910 temple activates different sets of signifiers: it references many things related to water from different times and places, and water as the common ground for its referential eclectic is what defines it as a unique type. The most relevant of its temporal, spatial, and functional context is the one in which the temple was created, as a water temple marking urban works for a major developing modern American metropolis. As Richard Shiff points out, a full examination might approach "the anachronistic place of religious discourse in American cultural society." To examine this point proposes rich material. Author's personal communication with Michael Charlesworth on this point, February 12, 2013; and with Richard Shiff, January 24, 2015.

[357] O'Day, "Architecture of the Water Temple," 4-5.

that exposed the subterranean works, visitors stood on the raised platform, leaned over the iron balustrade connecting the ring of columns, and watched the open works from above, where they could see, hear, and contemplate the perpetual cascade. Design and siting permitted the temple to dominate and define the landscape by bringing the waterworks into clear view, fully activating the space around and under it, and igniting the entire site with a cultural charge. The Sunol Water Temple created a public spectacle from an invisible underground waterworks, and Willis Polk fashioned it, not only for economic success, but also as a meaningful tourist destination.

CHAPTER 5

Water for Power: Hydraulic Substation Design for the San Francisco Bay Area

Willis Polk created striking designs for the water company, but the architect's first water-related, public works architecture was for hydropower. These precede the 1909 Pleasanton Pumping Station and the 1910 Sunol Temple.[358] He had worked extensively on San Francisco's first substation, the 1881 Jessie Street Substation, rebuilding the station twice, first in 1905 after fire damage, again in 1907 after the earthquake. Later, he enlarged the 1907 building.[359] **[Figure 90, 126]** The industrial brick

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[358] All Polk's works buildings between 1905-12 were of major consequence, published in such publications as *Architectural Record, Architect and Engineer*, and *Pacific Gas and Electric Magazine*. Of note, in April 1911, Polk was the focus of a cover story tribute. See Frederick Hamilton, "The Work of Willis Polk & Company," *The Architect and Engineer of California* 24, no. 3 (April 1911): 35-73, and frontispiece, with a color woodprint of the Sunol Temple as the cover illustration. The article features over 40 photographs of Polk's work, before and after he was managing Burnham's San Francisco office as well as for independent commissions. Unfortunately, the illustrations do not date the architecture. Public works buildings illustrated include the exteriors of the Sunol Temple and PG&E Stations C (Jessie Street) and G, and interior views of PG&E Station A, and the in-house power plant rooms for the Pacific Union Club and St. Mary's Hospital. Photographs specifically of Polk's water and power buildings for San Francisco first appeared in the "Portfolio of Current Architecture," *Architectural Record* 32, no. 2 (August 1912): 133-36. In that issue appeared the following buildings: San Francisco Water Company Central Pumping Station (Also known as the Sloat Boulevard Pumping Station, PCAD 8339. The PCAD reports completion in 1908; see also PCAD 15822?); Pacific Gas and Electric Station D (PCAD 8338 lists a 1908 completion date); and the Spring Valley Water Company Sunol Water Temple (PCAD 7175). Articles by water company engineers regarding systems development, facilities, and city beautification projects are located in the O'Shaughnessy (Michael M.) Papers, Bancroft Library, University of California, Berkeley. See especially Carton 35, Folders 9-63 and Oversize Box 3, Folder 21. Of additional interest is Eckart's report as a consultant on Boulder Dam, Carton 48, Folder 8. Willis Polk's correspondence with William Bourn between 1911 and 1921 is held in the President's Files (W.B. Bourn) in Carton 7, Folder 71, The Spring Valley Water Company (SVWC) Collection, Bancroft Library, University of California, Berkeley.

[359] The 1881 Jessie Street Substation, or Stevenson Street Substation, filled a lot between Jessie and Stevenson Street, in the block between Third and Fourth Streets. After the incorporation of PG&E, it was apparently renamed PG&E Station C. It occupied space between the two parallel streets, Stevenson and Jessie, which ran within the block bordered by Market and Mission between 3rd and 4th Streets. The original, continuous and parallel relationship of Stevenson and Jessie Streets has disappeared, given the ways in which the substation block—and the entire south-of-Market area along these two streets—has been interrupted through development since the late 19th century, with plazas and structures eliding the former through-streets. Nonetheless, remnants of the original street grid still exist within a few blocks in the area. Both Jessie and Stevenson Streets survive, for example, between 1st and 2nd Streets (except where

powerhouse was distinctive, its smoke stack rising unmistakably above the skyline, dominant there since its 1881 construction. Judging from period photographs, and from a sketch by Polk, its formidable brick smokestack towered above the city with floating plumes of smoke (all was overtaken in height and the urban image permanently changed when the Call Building went up in 1898).[360] **[Figures 91, 92]** Polk's post-earthquake exterior aesthetic included Italianate windows and sculptural stucco ornamentation, giving the white-on-red stucco-and-brick face an innovative appearance. All the more, given that the building was nearly invisible facing a narrow alley, as period photographs taken from a corner angle illustrate.[361] **[Figure 126]** The building's notable asymmetry on the facade, which the architect developed over three re-building campaigns, is striking.[362] Polk had transformed this first public works experiment in aesthetic design from a common brick industrial building into a remarkable neoclassical works structure, set apart as sophisticated and modern in architectural design.[363]

Stevenson is interrupted by the 1875 Palace Hotel), and between 5th and 6th (except where Jessie Street is truncated by the 1874 Old Mint Building).

360 In Willis Polk's own late-19th-century sketch of the city skyline from Nob Hill, the architect depicts what I conclude to be the smokestack of the Jessie Street Substation, with calligraphic plumes issuing from it, at the center of his composition. It appears as a double-page frontispiece in Willis Polk, *A Matter of Taste: Willis Polk's Writings on Architecture in* The Wave, ed. Richard Longstreth (San Francisco: The Book Club of California [Publication No. 161], 1979).

361 The building is currently clearly visible, as part of the renovation and transformation of the building by Daniel Liebskind into the Contemporary Jewish Museum added a large plaza opening onto Mission Street, facing Yerba Buena Gardens. **[Figure 56]**

362 The Jessie Street Substation building catalogue entry in the Pacific Coast Architecture Database (PCAD) reads: "Architect Willis Polk … remodeled, rebuilt and enlarged PG and E's Jessie Street Sub-station on three occasions: in 1905, 1907 and 1909. He first did a large-scale remodel of an existing power plant erected in 1881. Polk's remodeling effort burned in the Great San Francisco Earthquake and Fire of 04/18-19/1906. He re-erected this important electric facility in the wake of the devastation one year later. It symbolized the modernization and renewed vitality of the city following this withering trauma. The architect also enlarged the building once more in 1909. The building presented an austere but complex and tasteful facade to the city, a sanitized industrial building during the City Beautiful era." See the online catalogue entry for the building, "Pacific Gas and Electric Company (P, G, and E), Jessie Street Substation #2, San Francisco, CA," Pacific Coast Architecture Database, accessed March 1, 2015, https://digital.lib.washington.edu/architect/structures/15728/. After decades of closure, the Jessie Street Substation building re-opened in 2008 as the Contemporary Jewish Museum, after ten years of planning and construction. Architect Daniel Liebeskind preserved Polk's late-Beaux-Arts façade and parts of the original interior, and made significant contemporary additions. See "The Building," Contemporary Jewish Museum, accessed March 1, 2015, http://www.thecjm.org/about/building.

363 I will compare the San Francisco objects I cite and discuss here with Southern California structures in future work. My work in the Southern California Edison Company Archives and at the Los Angeles

A decade later, in a descriptive overview of neoclassical hydropower building designs, Pacific Gas and Electric Company (PG&E) company architect, Ivan Frickstad, commented on the Jessie Street station's still-noteworthy aesthetic aspects. Before describing the building, Frickstad drew attention to the building's location on its "blind alley."

> …[F]ew people realize its existence or have an opportunity of viewing this very fine piece of work in red brick and cream colored terra cotta. It was the first of the company's sub-stations in San Francisco to be designed and built with reference to the exterior appearance. While it does not conform to the "City" type as it was built before the type was developed, it is shown here because it is one of the finest appearing sub-stations to be found anywhere, and is also the largest at the present time of the City sub-stations. The central portion as marked by the large central opening is the sub-station, while the west end is used as a storage battery room and the east end for company's garage.
>
> The detail of the terra cotta is exceedingly fine, the ornament over the small entrance well modeled and at one time (before the fire of 1906) there was a like group over the main entrance, but this unfortunately has been destroyed. The soft cream color of the matt glazed terra cotta, in combination with the slightly rough face of the dull red stock brick and the granite base with rustications in the brick work above, creates an impression of being a substantial, solid structure of refined lines and finish.[364]

At the time, this architecture situated Polk alone in an unprecedented field in California. The Jessie Street station presents a unique precedent, representing new movement in utilitarian architectural aesthetics, with Willis Polk the architect who began that movement.[365]

Department of Water and Power Archives, has been especially rich in archival photographs. I researched multiple collections at the Huntington, most of which are not cited or discussed within this dissertation, while in residence as a Huntington Library Short-Term Fellow in 2008.

364 Ivan C. Frickstad, "Some Sub-Stations of the Pacific Gas & Electric Co.," *The Architect and Engineer* 43, no. 2 (November 1915): 62-64. Note interior and exterior photographs of Station C.

365 For a contemporary history of PG&E substation designs, see Frickstad, "Some Sub-Stations," 54-68. See also Ivan C. Frickstad, "The Development of 'Pacific Service' Architecture as Exemplified in Its Modern Power Houses and Substations," in *Pacific Service* 8, no. 6 (November 1916): frontispiece, 205-16. On the topic of attributing credit to Polk for buildings designed when he was managing Daniel Burnham's San Francisco practice, the year 1910 seems to be a transition year for Burnham's closure of the SF office and Polk claiming designs under his own company name. In "Some Sub-Stations of the Pacific Gas & Electric Co.," Frickstad credits "Willis Polk & Co., Architects" for the Station C building; but in the in-house PG&E publication *Pacific Service* in the following year, he gives credit to D. H. Burnham & Company. Frickstad also credits Burnham's office with the new Station C, which Polk designed. As I have

ARCHITECTS DESIGN "CITY" AND "OUT-OF-TOWN" SUBSTATION STYLES

The Jessie Street architectural experiment initiated a Polk-driven decade of major architect-led neoclassical water and power works buildings commissioned by the Spring Valley Water Company for its water supply, and by the Pacific Gas and Electric Company for hydropower delivery. When PG&E incorporated in early 1906 (before the April earthquake) three gas and electric substations existed in the city.[366] Like the Jessie Street Substation (Station C), Station A and Station B were original to PG&E's predecessor companies, built between the 1880s and 1905.[367] "Electric Station A" was a brick industrial building in the style of a double gymnasium, comprising massive north and south boiler rooms, located at 23rd and Georgia Streets. In a 1911 photograph in the PG&E company magazine, one notes a smaller, two-story, white building, apparently attached to or part of Station A, presumably of earlier construction, which boasts a four-column Greek Revival temple façade of three arch-pedimented bays (a window flanks each side of the central doorway), with the columns supporting an entablature and pediment.[368] **[Figure 90, 118]**

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mentioned, Polk had managed Burnham's San Francisco practice after the 1906 earthquake. Polk collected in his scrapbooks an article announcing the change in office management in San Francisco. See Willis Polk Scrapbooks, vol. 1, 47, California Historical Society (CHS), San Francisco, CA. Polk started his own practice in about 1910.

366 PG&E had been incorporated as a merger of several gas, light, and power companies serving San Francisco. William Bourn (current patron of Polk and future owner of the Spring Valley Water Company) and many other civic and business personalities had been involved the negotiations, and Bourn may have been instrumental in securing Polk's employment as PG&E substation designer. Polk's first project, the remodel of the burned 1881 Jessie Street structure, took place in 1905, presumably during PG&E's final corporate negotiations; the second and third renovations and the final enlargement were post-earthquake, post-incorporation creations.

367 Stations were named by letters of the alphabet to show their chronology: the first two stations built were Station A and Station B; the Jessie Street Station was known as Station C. PG&E continued this practice with new substations.

368 The small Greek Revival structure suggests an earlier substation following a Latrobean tradition, but I have not yet identified it as part of the PG&E predecessor buildings. The question awaits further evidence. See exterior and interior views of Stations A and C, and an exterior view of Station B, in "Electric Distribution System," *Pacific Gas and Electric Magazine* 2, no. 7 (December 1910): 226-29. Station A stood on Georgia Street, which no longer exists in the South Potrero vicinity with its U.S.-state-named streets, but a 1913 city well survey reveals the area intact as originally platted, with the location of Station A at Georgia and 23rd Streets occupying the lower, southeast corner of Potrero Hill, on the industrial waterfront in view of Union Iron Works. Station B was on Townsend Street between 2nd and 3rd Streets, at the southern base of Rincon Hill in the North Potrero vicinity, just north of Channel Street. Consult "Map

Polk had first redesigned the Jessie Street Substation before PG&E's January 1906 incorporation, which preceded the earthquake and fire of the same year by just a few months. After this, the company hired him to begin designing signature styles for its hydropower substations.[369] **[Figures 90, 93]** Smooth walls of those large rectangular "City" structures reveal their purpose as warehouse-style containers for industrial works.[370] **[Figures 90, 101]** Two other architects, Frederick H. Meyer and Ivan Frickstad, followed Polk's lead in designing "City" style substations to standardize the power company's urban image. In total, architecture of aesthetic note among PG&E substations during the post-earthquake decade was designed by these three architects: Willis Polk (Station C, Station G, Station D, River Station in Sacramento); Frederick H. Meyer (Station J, Station S); and Frickstad (Station K, San Mateo Substation, Cordelia Substation, Drum Powerhouse).[371] **[Figures 90, 93, 94, 95, 96, 97, 103, 105, 115, 118]**

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of the City and County of San Francisco Showing Location of Wells to Accompany Report on Underground Water Supply of San Francisco County," prepared by M. J. Bartell, Hydraulic Engineer, under the Direction of M. M. O'Shaughnessey, City Engineer (May 1913), appended to the inside cover of M. J. Bartell, *Report on the Underground Water Supply of San Francisco County: Present Yield, Probable Additional Yield* (San Francisco, 1913). The map can also be found in Box 12, Max J. Bartell Papers, Water Resources Collection and Archives (WRCA), University of California, Riverside. Until 2011, the WRCA was called the Water Resources Center Archives, and was located at the University of California, Berkeley.

369 After Jessie Street, Polk designed Station G and Station D, which replaced an older brick substation in the same location.

370 Hamilton, "Work of Willis Polk," 35-73.

371 For the initial group of architect-designed PG&E substations and the electrical system as complete in San Francisco by 1910, see exterior and interior views of Stations A and C, and exterior views of Stations E, I, G, J, B and D (prior to Polk's Station D replacement), and an electrical service map, in "Electric Distribution System," 226-29. The article lists locations and industrial functions of all PG&E substations in San Francisco, accompanied by a map of the areas of the city served by electricity. Station I still stands on 8th Street just south of Mission Street, and kitty-corner to William Merchant's Industrial Art Deco style substation at 8th and Mission streets. Station I is different from the picture published by PG&E in December 1910 (above); the existing building is in the signature "City" style Polk devised, with walls plain panels patterned with intermittent rosettes at lower center, and a heavy crowning cornice, with the station name in a plain frieze over the door. For a detailed, partially annotated, color street map of San Francisco pertinent to this study for this time frame, see "Map of the City and County of San Francisco Showing Location of Wells to Accompany Report on Underground Water Supply of San Francisco County," prepared by M. J. Bartell, Hydraulic Engineer, under the Direction of M. M. O'Shaughnessey, City Engineer (May 1913), O'Shaughnessy (Michael M.) Papers.

By 1913, PG&E had made Ivan C. Frickstad the company's official architect, and by 1915, Frickstad had articulated and illustrated the power company's architectural goals in an article in *Architect and Engineer*.[372]

> It is only fitting and proper that the buildings comprising such a system, especially so when it is made up of a number or plants which are dependent upon one another for the perfect fulfillment of their specific mechanical functions, would be made to express this relationship by carrying a consistent architectural theme throughout the system which fulfills the mechanical requirements as well as the function of utility.
>
> This has been gradually brought about in the buildings constructed by this company during the last four or five years and the illustrations shown here bear testimony of the progress made and illustrate the most modern of the corporation's buildings.
>
> …The electrical sub-stations have developed along two general types, a "City" type used in the large city centers and an "Out of Town" type used for sub-stations located outside and in the smaller city centers.
>
> …Thus is a system being built up through co-operation where each unit presents a substantial and pleasing appearance, a welcome addition to its neighborhood, and expresses its relationship in the system.[373]

The idea of "City" and "Out of Town" substation design prototypes in a conscious design program became a signature of California PG&E station exteriors. Both historical revival treatments—a civic neoclassical White City style for urban stations, and a Spanish-Renaissance Mission for rural substations—had already made a general entrée into architectural culture by the time of the 1893 Chicago Columbian Exposition. Polk's

372 For a retrospective overview of PG&E's "City" and "Out of Town" substation design development, and images of Stations G, D, J, K, S, and C; Polk's River Station in Sacramento; and Frickstad's Drum Powerhouse, Cordelia Substation and Woodland Substation, see Frickstad, "Some Sub-Stations," 54-68. See also Frickstad, "The Development of 'Pacific Service,'" frontispiece, 205-16.

373 Frickstad, "Some Sub-Stations," 55-68, esp. 55-56, 68. He elaborates further on the "City" type: "The "City" type has developed as a windowless building, as it has been found that a windowless building gives the maximum economy in arrangement, that it provides unbroken wall surfaces which are needed for attaching various parts of the installation and makes possible the insulation against the noise of the station operation disturbing the neighborhood in which it may be located. As all power leads are brought in underground, windows are not required for this purpose. Nor are they needed for light and ventilation since the interior is flooded with light to best advantage from skylights in the ceiling, and ventilation is best accomplished through air ducts with openings in the floor and louvres in the roof. This has given the designer an opportunity to treat wall surfaces with but one opening to consider. This is the main entrance and is treated as such by the concentration of ornament at this point the individuality of each station is expressed architecturally in the detail of its composition and ornaments. Also in such other features of its environment as may be peculiar to it." Frickstad, "Some Sub-Stations," 54-57.

charge was to refine this image into a locally identifiable architecture associated with water and power provision. Business enterprise aimed to identify with those trends, and to stake a claim in California for water and hydropower architectural design.

MONUMENT REMNANTS: "CITY" STYLE FOR WATER AND HYDROPOWER STATIONS

Polk produced the first self-conscious "City" design for a 1910 redesign of an earlier Station G.[374] **[Figure 90, 102]** The monolithic, unfenestrated concrete structure took up half a residential city block. Its solid white exterior was scored with lines of faux masonry courses, ornamented with corner quoins and cornice mouldings, and ornamented with cartouches centered over wood-paneled doors. Entablature and friezes emblazoned the company title and station name.[375] Station G "was in a residential section and plans

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374 See C. F. Adams, "Station 'G,' San Francisco," *Pacific Gas and Electric Magazine* 2, no. 12 (May 1911): 451-54. See also Frickstad, "Some Sub-Stations," 54-57; photographs of Station G appear on 54 (exterior) and 56 (interior). In 1933 the company labels Station G the first of the accepted "City" design type and describes a subsequent expansion's conformity to the style: "Station 'G,' located on the northwest corner of Ellis and Broderick streets, San Francisco, was the first of this type to be constructed. It is finished in white cement. The large door with cartouche centering over same as shown in the illustration was the center of the original building. The third panel was added at later date. Willis Polk & Co. were the architects." The later addition referred to was made in 1932-33: "An addition has been built to the north of the original buildings and the new Broderick Street front has been given the same architectural treatment as the rest of the station, making a uniform structure throughout." See also a photograph and description of reconstructed Station G in Richard B. Kellogg, "Reconstructed Substation Is Typical of Modern Design," *Pacific Service Magazine* 18, no. 11 (January 1933): 335-38.

375 I use the descriptive term "monolithic," meaning "of a single piece of stone," to describe several objects in this study, but I use it variably, relative to the scale of the objects I am describing, to address a degree to which the object appears monolithic within its relative architectural context. A dam, for example, is monolithic in different ways from a 32-by-59-foot suburban substation. Even within the class of dams, as in the class of substations, there are different scales of monolithic structures, and the degree to which a dam appears monolithic depends upon internal, design-based aspects of scale in the structure, and in relation to surrounding structures and landscape elements, and ways in which these aspects bear, explicitly or by implication, upon the scale of the human body. The original Mulholland Dam, for example, a concrete gravity structure highly stylized in a neoclassical art deco, appears less monolithic, and might benefit from certain architectural design elements to bring it into balance with its site and to create an aesthetic product; this dam is nowhere near the scale of a larger concrete dam like the Hoover Dam, but I might use the word monolithic to describe both. Similar reasoning holds for substations, when they are considered in their proper scale. Station G appears monolithic in relation to Station D or the San Mateo Substation, but it is still on a scale with the buildings in the neighborhood in which it sits. It is diminutive in size and scale when compared against high-voltage powerhouses associated with dam sites and aqueduct lines, and it would almost disappear in direct relation with an enormous structure like Hoover Dam, on a different relative scale entirely. Mountain power houses and dams appear in scale when photographed in their landscape settings. Even Hoover Dam becomes visually and conceptually moderate when considered on a scale with the vast desert in which it sits and the extensive stretch of the reservoir it impounds; this, of

were drawn for a station that would not be out of harmony with its surroundings. The station is unique in some respects. It does not contain a single window in its four concrete walls, light, and ventilation being obtained from a long overhead skylight and louvre. A large paneled oak door is the central feature of the front wall. The architectural design is pleasing and is well pictured in the illustrations. The building is constructed of reinforced concrete throughout."[376] Rare photographs evince the custom of illuminating the buildings at night.[377] **[Figure 115]**

In 1912, Polk designed a large City-style powerhouse for PG&E in Sacramento.[378] **[Figure 103]** Local Sacramento press announced the building as "modern and fireproof, of beautiful design by a world-famous architect, Willis Polk."[379] A

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course, at the same time activates the sublime when one considers the fact that nothing less than a desert can provide visual balance for such a structure in its proper scale.

376 See Adams, "Station 'G,'" 451-54.

377 See the cover of *The Architect and Engineer* 43, no. 2 (November 1915), which pictures Ivan Frickstad's Station K night lighting scheme. Frickstad's article, "Some Sub-Stations," appears on 54-68.

378 Polk's Sacramento Powerhouse is pictured in Frickstad, "Some Sub-Stations," 64.

379 This description accompanies a report on construction progress on Polk's Sacramento steam plant, "Fresh Power for Capital City [reprinted from the *Sacramento Union,* January 21, 1912]," *Pacific Gas and Electric Magazine* 3, no. 10 (March 1912): 260-61. Regarding the building's technical modernism, the article continues: "It will be 80 x 130 feet in dimension and immediately after completion some of the most modern machinery in the world will be installed. The dynamos will be the latest designs, the boilers will be fed by oil instead of coal, and the engines will be of turbine type. All machinery and electric fittings will be installed by the company's engineer." The building is also described in "The New Sacramento River Station," *Pacific Gas and Electric Magazine* 4, no. 4 (September 1912): 140: "The handsome building which will stand for all time as a monument to 'Pacific Service' enterprise … is a building with a steel frame with re-inforced concrete walls, and its design is one of the best achievements of that gifted architect, Willis Polk." This article mentions that this station will be connected by underground wires to the city distribution station at 6th and H streets in Sacramento. The new Sacramento River Station was located "north of the railroad depot on the river bank close to the junction of the American and Sacramento Rivers." See also the "The Sacramento River Station [*Sacramento* (Cal.) *Bee,* July 27, 1912]," *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 111, for reference to Polk as the building's designer of "…a great electrical station now building north of the city…" Photos of the Sacramento Substation appear in the frontispiece facing the article "Pacific Gas and Electric Co. Progress in Sacramento," *Pacific Service Magazine* 3, no. 3 (August 1911): 79-81. At this time PG&E undertook an entire overhaul of substation equipment to increase electrical capacity to the city. The city-wide upgrade, undertaken between 1909 and 1911, included creating underground electrical lines, for aesthetic reasons: "the un-ornamental poles through the city's main thoroughfares,[were] dispensed with by placing the conductors underground" (79). Also note a detailed architectural description of Sacramento's new PG&E office high-rise, by architect E. C. Hemmings, after a competition among "four of the leading architects of Sacramento," whose work awaits further research; "The design is of the Italian Renaissance style adapted to modern requirements." See Frederick S. Myrtle, "Our Sacramento Office Building a Credit to the Capital City," *Pacific Service Magazine* 5, no. 10 (March 1914): 327-32, frontispiece.

photograph of the recently completed building, with the site and landscaping still unfinished, contains a caption that reads: “The new station is architecturally beautiful.” The author’s description reveals a building in the same style as Polk’s prototypical monolithic substations for PG&E.

> The exterior finish of the building is at once simple but effective. Plain panels set off by heavy copings and cornices is the scheme of decoration employed. The finish is in plaster of white Santa Cruz Portland Cement, and is a fine example of careful and excellent workmanship.

The main entrance facing the river displays the large-scale architectural elements that a powerhouse this size required: two large double paneled oak doors, with concrete moulded casings, support a large cartouche, the whole backed by a heavily moulded, arched window.[380]

In the main, the “City” design valued mass, solidity, and permanence and represented a vision of urban modernization symbolized by monolithic presence. A few early examples of “City” works buildings displayed these values on a more intimate, detailed scale. The most outstanding example is the second of San Francisco’s “City” substations, Station D, in my view the most aesthetically successful urban substation design.[381] **[Figure 93]** The main structure is in the expected “City” style. Polk was able to improve upon the standard with a wall of windows and a formal garden space permitted by an adjacent lot space that required a creative solution to site, elevation, and plan challenges. The station achieves approachability and intimacy on an individual human scale, a feature lacking in the stations projecting monolithic grandeur alone. In an article

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[380] Paul E. Magerstadt, “Our New Steam-Electric Station at Sacramento,” *Pacific Gas and Electric Magazine* 4, no. 5 (October 1912): 156. The “City” style plant joined a fine neoclassical substation built in 1895 to transmit power from the city’s early, renowned Folsom Powerhouse, one of the world’s first long-distance hydroelectric power transmission systems. For the 1895 Sacramento Substation, see *The Journal of Electricity/Electrical West* 1, no. 5 (November 1895): 123-24, and for photographs of the Sacramento Substation and the penstocks, from the American River Canal directly into the Folsom Powerhouse, to run the turbines. See also *The Journal of Electricity* (September 1895); and *The Electrical Journal* (August 1895): 45, 49-50, for more on the 1895 Folsom Powerhouse.

[381] See photos of Station D within its formally landscaped garden site, in George C. Holberton, “Station ‘D,’ San Francisco,” *Pacific Gas and Electric Magazine* 3, no. 8 (January 1912): 304-05.

inaugurating the building in print, PG&E's Manager-in-Chief Holberton explains multiple aspects of this design and the approaches that led to it.

> We illustrate in this [issue] Station "D", San Francisco, which the writer believes to present the handsomest appearance of any of the electric substations that we have yet constructed and yet does not represent any great expenditure of money over what is usually spent for stations of similar capacity and type of service, and shows how, with a little thought, the stations can be made attractive in appearance without in any way sacrificing their utility.
>
> The principal object in reconstructing the station was to provide for the installation of a storage battery for which purpose we bought the property adjoining the original station.
>
> When it was decided to build this sub-station the writer thought that we should endeavor to carry out at least a similarity in design in our sub-stations, and the sub-station at Ellis and Broderick Streets which has already been described in this magazine had brought forth such favorable comment that it was decided to endeavor to make this station of a similar appearance. By comparing the illustrations herewith with those of Station "G" which appeared in the magazine for May, 1911, you will see that this result was accomplished.
>
> The next step which presented itself was the erection of a building sufficiently large to accommodate the battery without wasting head room and, at the same time, one that would not be a freak in appearance. To appreciate this you must bear in mind that the Bush Street elevation which is shown in the illustration is approximately twelve feet higher than Fern Avenue in the rear of the building, so that if a structure were built sufficiently high to make a presentable appearance on the Bush Street side it would be entirely too high for our purpose on the Fern Avenue end.
>
> The writer, therefore, conceived the idea of keeping the roof as low as possible and converting it into a garden such as shown in the illustration, which, due to the small head room required by the battery, was easily accomplished.
>
> As the main sub-station building shown on the right contained transformers and required water for cooling them, it was deemed advisable to put in the fountain shown in the center of the garden in lieu of the usual unsightly tank upon the roof. It was necessary, of course, to light the battery room, to do which we placed sky-lights in the center of the roof: and as this, perhaps, might look a little unusual in a garden we simply made the skylights waterproof, and converted them into ponds by placing a little concrete coping around them, as shown in the illustration.
>
> The pictures presented herewith show the effect of this garden as well as possible in an ordinary photograph, but to fully appreciate the appearance one

> should see this station so as to get the color effects, as the green bay trees and box hedges harmonize well with the grey of the cement.[382]

A local report describes the building in aesthetic terms, praising the structure for what the writer terms a recently-initiated practice of giving "a touch of classic beauty" to "purely commercial" works structures.[383]

> …It is only within the last few years that the problem has arisen and been seriously considered of giving architectural grace to that class of structures.

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382 Holberton, "Station 'D'," 304-05. In the photograph on 304, the photographer stands across the street from the Bush Street façade of the building. The right-hand, above-ground building is Polk's replacement for the former building on the same lot. The garden on the left was added to accommodate the battery storage room. Holberton's article asks readers to compare Station D in the current article with Station G, published in May 1911. Station G still stands at its original location at Ellis and Broderick Streets, although the surrounding terrain is transformed. On a 1913 well survey, this short segment of Broderick is one of a single string of quarter-blocks running along the eastern border of the Calvary Cemetery, which was one of several cemeteries occupying the region of the city at the northeastern border of Golden Gate Park. Consult "Map of the City and County of San Francisco Showing Location of Wells to Accompany Report on Underground Water Supply of San Francisco County," prepared by M. J. Bartell, Hydraulic Engineer, under the Direction of M. M. O'Shaughnessey, City Engineer (May 1913), O'Shaughnessy (Michael M.) Papers. For a photograph of the Station D building that preceded Polk's replacement, see "Electric Distribution System," 230. In a 1915 issue of *The Architect and Engineer,* PG&E in-house architect to the civil and hydraulic engineering department Ivan C. Frickstad overviews PG&E substation designs, specifically mentioning the unique design solution Polk devised for this building. "Station 'D' was the second of this ['City'] type and is shown by two views, the front, or Bush Street elevation, and the rear, or Fern Avenue elevation. This station presented some unusual problems as Fern Avenue is twelve feel lower than Bush Street and the head room of the portion of the building used for storage batteries was low in comparison with that required I the main portion of the sub-station. The solution resulted in making the roof of the battery room a formal garden to the sub-station with fountain and pools. Through the fountain runs the water from the transformers of the station, which is thus cooled and used again. The bottom of the pools are constructed of sidewalk lights which give plenty of light in the battery room. This station was also designed by Willis Polk & Co." See. Frickstad, "Some Sub-Stations," 57-58; note not only the photograph of the Bush Street entrance, but take special note of the photograph of the rear, Fern Avenue face, which shows clearly the distinct elevations of the two parts of the building; of note, as well is Polk's elaborate treatment of the back, alley entrance. The Station D building still exists, at 1345 Bush, between Polk and Larkin, and backing onto Fern Street, the alley behind it. Since 1982, the building has housed the Alliance Francaise. The ornamentation on the façade of the main building is original except for the addition of "Alliance Francaise" engraved on the upper entablature and "Henri Louis IV," engraved on a lozenge below the original over-door cartouche, naming the French cultural organization that merged with the Alliance Francaise in the 1980s. The adjacent lot, at street level, had a garden plaza that roofed the industrial works beneath it; its reflecting pool doubled as a large skylight for the engine room beneath it. The garden reflecting pool segment of the building is now occupied by the Alliance Francaise library and office/classroom building. This is an adjacent but attached addition to the main structure. The former garden's entrance gate facing Bush Street serves as an public entry plaza, and retains original wrought-iron gates and fencing, carved stone balustrade, and a low central stairway.

383 "Beauty in a Business Building: Station 'D' as Reconstructed Regarded as Furnishing an Object Lesson in San Francisco," *The San Francisco Call*, February 10, 1912.

> Their private and mercantile character necessitates economy of construction, yet even under these conditions the new electrical station has been admirably handled in the present instance.
>
> The requirements were a building of moderate height and inexpensive construction for transformers adjoined by a second building for storage batteries. In meeting the first of these requirements the old building was remodeled into the pleasing front it now presents.
>
> The second building was sunk till it was a few feet above the street level. The roof was treated as a formal garden with fountain, pools and gravel walks, benches and bay trees. The warm water from the transformers is passed through the fountain and into the glass bottom pools, where it cools and is returned to the transformers for re-use. Light is admitted into the storage room through the glass bottom of the pools.
>
> This is a good illustration of how warehouses, substations or factories can be made objects of beauty instead of far too frequent eyesores. Financially, the difference in cost is but slight, while the plan, if followed out generally, will add greatly to the attractiveness of the city.[384]

Polk's Station D design brought a unique and sophisticated new focus to public works design in California.[385] It stands apart as the most elegantly "dignified" urban works structure the company achieved. Part of its success hinges on the garden space, in which water featured prominently. This issued a declared value for waterpower as currency in urban space design; this aspect is commensurate with the Sunol Temple. The standard "City" type urban station design occupies space monumentally, and the solidity of its mass deflects full visual apprehension, in part because stands apart from its surroundings. It acts as civic architecture. By dramatic contrast, Station D conforms to its surroundings, on a neighborhood and on a human scale. Beauty and utility are equal partners.

The low-profile garden element of Station D is its primary achievement. It received mention in the wider industrial community as a model for "designs of station buildings and ornamentation of grounds surrounding stations."[386] If not for the specific

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384 "What the Press Has to Say [from *The San Francisco Call,* February 10, 1912]," *Pacific Gas and Electric Magazine* 3, no. 10 (March 1912): 361.

385 Holberton, "Station 'D,' " 304-05. See also "What the Press Has to Say," 360-61. Two reprinted articles from local Sacramento and San Francisco press regarding Polk's designs for PG&E, as well as the completion of the architect's San Francisco Station D, appear in "Beauty in a Business Building."

386 Frederick S. Myrtle, "Impressions of the National Electric Light Association Convention at Seattle," *Pacific Gas and Electric Magazine* 4, no. 2 (July 1912): 41, 44. The article is a reprint of a report of the

challenges of the low roof and sloping topography that enabled creative design as a formal garden space, Station D might have conformed more directly to the "City" prototype. This basic "City" design is evident in the main building block adjacent to the garden element on the street façade, and it is in clearest evidence from the rear of the building on the Fern Avenue alley, where the garden space is not visible.[387]

Following Station D, all of PG&E's prominent new station designs conformed to the "City" prototype. At the same time, he continued work for the Spring Valley Water Company. His pumping station at the foot of the Upper Crystal Springs Dam, a direct borrowing from his PG&E "City" type, was the only building of this design for the Spring Valley Water Company.[388] **[Figure 192]** He designed a number of prominent

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Committee on Electrical Apparatus delivered at the 35th Annual National Electric Light Association Convention.

387 A photograph published in 1915 of the rear of the building confirms the standard "City" style of the core design. See Frickstad, "Some Sub-Stations," 57-58, where one might take special note of the photograph of the rear entrance, the Fern Avenue face, which shows clearly the distinct elevations of the two parts of the building; of note, as well, is Polk's elaborate treatment even of the back, Fern Avenue, entrance. In 2013 I examined and photographed the exterior of the building; the cartouches over the entrance are gone, but the shadow of their shape remains in the stucco.

388 "Designed by Willis Polk, the Crystal Springs Pump Station pumps water 6.26 miles from the base of Lower Crystal Springs Dam to San Andreas Reservoir." See Marianne Babal, *The Top of the Peninsula: A History of Sweeney Ridge and the San Francisco Watershed Lands, San Mateo County, California* (San Francisco: Golden Gate National Recreation Area, National Park Service, 1990), 106-08. For this statement, Babal cites "Cheminant, *Water and Power* (1935): 67," but I have found no publication by this title and date. Babal was likely referring to L. B. Cheminant and M.M. OShaughnessey, *The Hetch Hetchy Water Supply and Power Project of San Francisco* (San Francisco: San Francisco Public Utilities Commission, 1931). I have the 1931 version, which is essentially the first official report by O'Shaughnessy to the new water and power commission formed after the City took possession of the Spring Valley Water Company system. Babal also cites a source she names as follows: "Willis Polk is Specialist in Public Utility Architecture," *San Francisco Water,* 2:1 (January 1923): 12. Her quoted title is not the title of the article, but rather a sentence excerpt pulled from one paragraph of a longer article, actually titled "Spring Valley's New Building," with the remainder of the citation correct. The article reports on the 1922 groundbreaking and construction plans for the Spring Valley Water Company high-rise office building at 425 Mason Street, by Willis Polk. "Excavation for the new building started on December 16, 1922." See "Spring Valley's New Building," 12. The building opened a year and a half later, as reported in the October 1923 issue of *San Francisco Water.* The January 1923 article names Polk as designer of three buildings for Spring Valley Water Company, including the Crystal Springs Pumping Station, and proclaims his sub-specialty in the water-related works I discuss: "Willis Polk is a specialist in public-utility architecture. For Spring Valley Water Company he has heretofore designed the Central Pumps building on Sloat Boulevard, the Crystal Springs Pumps Building, and the Water Temple at Sunol, which is considered by architects and hydraulic engineers the most beautiful water structure in the country." Babal assigns a date range of 1911-1924 for Crystal Springs Pump Station and the three other buildings, which is accurate, but imprecise: The Mason Street office building opened in 1923; Sunol Temple and the Sloat Boulevard Central Pumps

water company buildings in the same year for the water company, which I will examine later in this dissertation. After Polk's post-earthquake rush of public works buildings for the Spring Valley Water Company and PG&E between 1907 and about 1912, his attention was taken by other activities. In 1912, he was appointed chief of the Architecture Commission for the Panama-Pacific International Exposition, and he had several major commissions in domestic, civic, and commercial architecture ongoing.[389]

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building are from 1910, as I have discussed. I am not yet able to pin down an exact date for Polk's Crystal Springs Pump Station, though it was functioning before the end of 1922, according to an intriguing 1923 visual and historical analysis of a 1902 photograph taken at the foot of the Crystal Springs Dam. The dam's original waterworks structures included the following, as they appeared in the 1902 photograph, "Crystal Springs Booster Station. Portion of Venturi Meter (9/14/1921)," D-312, no. 84300, Photography Archives, SFPUC: "To the left is seen the flume carrying the forty-four-inch Crystal Springs pipe-line over San Mateo Creek. The cottage in the middle background was occupied by the company's pump engineer. The cone-shaped structure next to it was the brick tower of the reservoir outlet housing the regulating-gate. To the right was the keeper's cottage. The engineer's cottage was afterwards moved to the east, and the keeper's cottage and the brick tower were torn down. On the site now stands the beautiful white building housing the Crystal Springs electrically-driven pump that pumps water for Crystal Springs Reservoir to San Andres Reservoir with a capacity of fifteen million gallons daily." The photograph, a picture of a group of "horseless buggies," with the dam as background, was taken to chronicle the participants in and site of "the first automobile meet of California," a collective motor excursion of 50 miles between San Francisco and the Crystal Springs Dam. The description of the dam's waterworks structures and their history on the site appeared in "It Was Twenty Years Ago," in *San Francisco Water* 2, no. 1 (January 1923): 15-16. A photograph of the pumping station at the foot of the dam appears in "The Water Supply of San Francisco," *San Francisco Water* 5, no. 1 (January 1926): 11.

[389] See "Noting Progress on the World's Fair," 170, for a photograph of the Panama-Pacific International Exposition Architectural Commission. Willis Polk stands next to architect Arthur Brown. The caption lists the Commission members. See December editions of San Francisco newspapers, for example, for front-page news regarding the initial appointment of organizers for the fair (See for example, "Panama-Pacific International Exposition Work Undertaken by Men Prominent in Affairs of the City," *San Francisco Call,* December 30, 1909, 1; "Good Ship 'Exposition 1915' Safely Launched on the Sea of Success With a Regiment of Boosters From All the West Ready for Wheel," *The San Francisco Examiner,* December 30, 1909, 1; and "Thirty Men Chosen to Direct the Great World's Exposition: Five-Year Campaign for Panama-Pacific Exposition Inaugurated," *San Francisco Chronicle*, January 7, 1910, 5). These and many other articles and period ephemera were collected in the Willis Polk Scrapbooks, CHS. William Bourn was one of the initial thirty organizers appointed. From 1912 until 1915 Polk designed several major buildings in San Francisco; in addition to several residences for wealthy San Franciscans, Polk's important buildings include expansions to San Francisco's famous 1891 Burnham and Root first skyscraper, the Mills Building, in 1914 and 1918; a 1912 post-earthquake conversion of the Flood Mansion into the Pacific Union Club planned as early as 1908 (See "To Use Ruins of Old Flood House," *The San Francisco Examiner,* August 8, 1908); the 1913 Insurance Exchange Building; the 1914 Hobart Building. Between 1914 and 1916 Polk was working on William Bourn's country estate, Filoli; he had built earlier residences for Bourn at the Empire Mine and in San Francisco. In 1917 Polk built the Hallidie Building, the second high-rise he designed for the University of California Regents, and in 1918 he restored Mission Dolores. For images of Polk's work before 1911, see Hamilton, "Work of Willis Polk & Company," 35-73, and frontispiece, with a color woodprint of the Sunol Temple on the cover. The article features over 40 photographs of Polk's work. Unfortunately, the illustrations do not date specific buildings.

From 1913 into the early 1920s, William Bourn again hired Polk to design and build his private mansion, called Filoli, on a large property he had purchased in the remote Spring Valley Company's Crystal Springs Reservoir watershed.[390] **[Figures 159, 222]** In 1922, Willis Polk returned to public utilities architectural design when the Spring Valley Water Company hired him to design its new Mason Street office high-rise; I will examine this building later in this dissertation.

In Polk's absence from substation design, PG&E hired two San Francisco architects. Ivan R. Frickstad designed several stations; his future role as official company architect included creating a signature architectural style for the company.[391] Frederick H. Meyer, who had designed the company's first high-rise office building in 1908, created two cartouche-style substations, Station S and Station J, on the "City" model Polk had initiated.[392] **[Figures 94, 95, 96]** Station S appeared in the October 1913 PG&E Company magazine:

> Station S is located on the west side of Meacham Place, which is a small street running off Post Street, just west of Hyde. The building is of steel frame and brick construction and was designed by Mr. Frederick Meyer. The front of the building, facing on Meacham Place, is of ornamental design. An open space at the south of the building is devoted to an artistic flower garden. Upon entering the building one steps on to the visitors' gallery, from which a general view of the interior of the station is obtained. …One is struck immediately by the handsome appearance

390 Bourn's mansion and garden are open to the public. His name for the estate, Filoli, was a word he invented by combining the first two letters in each word of his motto, "Fight. Love. Live."

391 Frickstad would soon become PG&E's full-time, in-house architect. By contrast, Meyer's later architectural roles would include supervision, with John Galen Howard and John Reid, of the 1912 competition for San Francisco's new City Hall and Civic Center commission, to open for the city's 1915 Panama Pacific International Exposition (PPIE). See "Competition for San Francisco's City Hall," *The Architect and Engineer of California* 28, no. 3 (April 1912): 48, 49. "The Board of Public Works has appointed, as Consulting Architects, John Galen Howard, Frederick H. Meyer and John Reid, Jr., who will advise as to the design and architectural features of the City Hall and the other buildings to be placed in the Civic Center and will determine the conditions which shall govern the design and construction of the City Hall and other buildings. …The designs submitted are to be judged by a jury of seven as follows: the Mayor of San Francisco, one member of the Board of Public Works selected by the Board of Public Works, one member of the Public Buildings Committee of the Board of Supervisors selected by said Committee, the three Consulting Architects and one architect to be chosen by the competitors, as herein provided." According to the article, 110 San Francisco architects registered for the competition.

392 See "San Francisco Gas and Electric Company, Main Office Building, San Francisco, CA (1908)," Pacific Coast Architecture Database, accessed March 14, 2015, http://pcad.lib.washington.edu/building/18719/.

> of the station, with its ornamental tile floor, white tile walls, and the boiler fronts, partly of white enamel brick and partly of black iron, making a pleasing contrast.[393]

Horizontal scoring on the exterior meant to indicate faux masonry courses. Oversize paneled wood doors, recessed within a moulded frame, feature a denticulated entablature over the architrave crowned by an ovular cartouche entwined with fruit and tendrils in sculptural relief. A large central rosette above the shield reaches to the frieze, engraved with the company name, and theatrical wrought-iron lantern sconces flank the entrance. Fencing and gate work appears most clearly in images of Polk's Station D, whose street-facing public garden entrance required a good deal of wrought-iron fencing and broad ornamental entry gates.[394] **[Figure 93]**

Meyer's remarkable Station J stands in the financial district; as the endpiece of an alley block between Sacramento and Commercial streets, it features three street faces.[395] **[Figure 94]** Large wooden double doors on the main front façade at 536 Sacramento Street boast the usual ovular cartouche over the entrance; the building's rear industrial entrance opens onto Commercial Street, inscribed "Station J" in the overdoor frieze; the third street face onto the alley presents a solid, unfenestrated, double-story wall. The station's second story occupies only one-half the building's breadth in plan, so that on the alley it towers as a continuous second story, while from the front or back street facades that half upper story appears as a tower. This second level is unadorned, except for a simple crowning cornice.

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[393] C. H. Delany, "Station 'S', San Francisco, from which 'Pacific Service' Supplies the Public with Steam-heat," *Pacific Service Magazine* 5, no. 5 (October 1913): 144-47; front façade photo on frontispiece, and interior photo on 146. See also Frickstad, "Some Sub-Stations," 54-68.

[394] A sampling of the company's standard wrought-iron fencing and gate design also appears in a Station S photograph: vertical parallel bars bordered at top and bottom with a line of continuous circles; centered on the gate the company logo appears, a circle within a triangle, inscribed within a larger circle. Its details are easily missed without focused visual inquiry: the outer circle bears the full company name, and the inner circle states simply, "Pacific Service."

[395] Station J is a designated San Francisco Landmark No. 142 at 569 Commercial Street. See "San Francisco Preservation Bulletin No. 9," San Francisco Planning Department, accessed March 2, 2015, http://www.sf-planning.org/Modules/ShowDocument.aspx?documentid=5081. Two designers are listed: Meyer and Henry C. Vensano. Vensano was PG&E's engineer. The building is National Register #86003514**.**

If not for Meyer's surprising treatment of overdoor cartouche iconography, this building would appear to be patently stock. Extended, close examination of the cartouche ornamentation reveals unusual narrative nuance tailored specifically to the building's origins in hydropower, details easily missed without focused visual inquiry. **[Figure 96]** Meyer's inventiveness brings a witty, and welcome, departure from Polk's more standard cartouche embellishments. The large medallion surface in smooth plaster is centered over the main door in the usual way. At a glance, its peripheral ornamentation, fruit and flower garland strands winding up around a leaf-like ovular perimeter, seem traditional enough. Upward-twining tendrils culminate in a pair of flaming torches, one flanking either side of the medallion crown. This does not seem extraordinary, but upon closer viewing, one realizes the torches are actually architectural sconces, secured in brackets as if at a doorway. They sport flame-shaped glass bulbs, not an uncommon decorative sconce style for the day. Following this suggestive imagery, the gaze traces the intertwined tendrils downward, discerning that the sconce bases below their figurative wall brackets are wound not with plant tendrils, but with a tangle of electric wires. In turn, what appear to be traditional sculpted leaves and petals at intervals along the tendrils are actually insulator brackets through which wire "tendrils" interweave. At the base of the cartouche, the usual seedpod rosettes gathered with fruit and flower arrangements are in clever disguise as miniature hydropower turbine wheels. Other elements of hydroelectric hardware hide among the leaves. In place of symmetrical hanging vine blossoms, such as those Meyer used to adorn his Station S cartouche, the Station J hanging blooms are figured as the familiar sea creature with upward-winding tail. On both sides of the cartouche, the creature belches a wave of water, as if to power the turbine-shaped hydraulic hardware. At this close level of observation, one discerns not only remarkable detail, but also deeply sculpted relief—this in a cartouche whose traditional format suggests very low relief, hardly noteworthy. In Meyer's cartouche embellishments, the fact of relief is significant, for in the deep-relief background beneath layers of shadows behind the central oval's leafy surface, hidden hardware, sea creature scales, brackets and rivets, and a foamy current of water all undulate back up behind and around the composition, finally streaming around the central oval. The waving pattern on the scored plaster is reminiscent of a Polk signature, a sheeting water pattern I will examine in my discussion of Polk's Spring Valley Water Company buildings.

Meyer consciously invests creative capital in his cartouche design for his PG&E Station J commission, and in so doing, he distinguishes it as a work of art of his own specific refinement. At the same time, he honors Polk's original "City" design and pays tribute to his fellow innovator's leadership in industrial hydraulic iconography. One imagines the two musing over the results. Meyer in fact improves upon the company's design mandate—which was clearly to replicate Polk's "City" style. Meyer indeed creates the required construction, and he improves the design type by artistically embellishing the single aspect of the building that permits such license.[396] Viewers who do not look closely easily miss the astounding creative detail.

ICONOGRAPHY OF HYDROPOWER: TURBINE, DYNAMO, BOLT

The iconography upon which Meyer's cartouche ornamentation draws is specific to hydraulic power generation. Figural referents are often literal remnants: "Candle power," "horse power," and "acre feet" are figural remnants of measurements once able to be conceived and verified by a single human being. Industrial technology gradually expanded human scales to meet urban requirements to the point where technology could create formerly inconceivable quantities at incomprehensible velocities: gallons per minute, feet per second, and revolutions per minute needed new symbols. In hydraulic power technology, the turbine wheel and the spinning action of its internal dynamo became symbols in themselves, visually and rhetorically.[397] Hydraulic turbine design modeled the Pelton Wheel, an innovation on the traditional waterwheel. **[Figure 123,**

[396] After Meyer, PG&E hired Ivan C. Frickstad as the company's in-house architect, first titled Architectural Assistant. His first design in Polk's "City" style was Station K.

[397] My mention of the symbolism of the dynamo alludes to Henry Adams' essay from 1900, "The Dynamo and the Virgin," in which he compares the relative cultural "energy" or "power" carried by two cultural symbols, one traditional, the Virgin Mother of Christ, and one modern, the dynamo in hydropower transmission. The essay can be found in Henry Adams, *The Education of Henry Adams: An Autobiography*, vol. II (1918, repr., New York: Time Incorporated, 1946), 161-73.

124] A waterwheel was a giant wheel constructed in wood framing fitted with hinged bucket attachments, which lifted water by both gravity and the pressure of water under velocity. As water was drawn into successive bucket attachments from a river or canal, the turning buckets lifted it to an open aqueduct flume at the top of the wheel, where the buckets dumped the water on the downward side of the wheel. The water's weight and the weight and velocity of the source as it fell into each bucket kept the wheel moving. The primary purpose of early hydraulic power wheels was not to transport water but to power other machinery, as energy produced by the falling water propelled a gear system attached to the revolving crankshaft of the wheel. In 19th-century mining technology, Pelton Wheels powered machines for hydraulic mining processes. These metal Pelton Wheel bucket attachments were stationary, not hinged, and the water source powered the wheel differently. Rather than entering the "buckets" from a canal or stream whose water poured into them at a relatively low velocity, water entered the reverse stationary cups at the base of the wheel, where water under extremely high pressure shot into the stationary cups, turning them in rapid succession. The high pressure impact turned the wheel at a high velocity, and the spinning power of its axle powered machines with specific mechanical functions. This machinery was improved and put to maximum use for hydraulically powered electricity, or hydropower. Pelton Wheel technology was adapted for even more rapid energy production for hydropower turbines in the late 19th century.

Waterpower for electricity took on its own scheme of symbols and iconography. An explicit and concise presentation of this iconography, all in one building, appears on architect William Merchant's 1949 Industrial Art Deco PG&E Mission Substation in San Francisco. **[Figure 125]** The regular spacing of panels on the exterior—vertical on the south face and stacked in the horizontal on the east face—suggest the inner mechanisms of hydraulic production powerhouses. The ornamental treatment also includes iconographic bas relief shields—or cartouches, if you will—on the building's entrance façade, by Bay Area sculptor Robert Boardman Howard, son of architect John Galen Howard and husband of sculptor Adeline Kent. Howard's iconography in the two wall sculptures, "Power" and "Light," explicitly refers to hydropower processes, symbols, and machinery. Reminiscent of the sculptural cartouches Polk and Meyer placed over entrances in the earliest "City" substations, Howard's sculptures take a step toward the representational from the earlier overdoor sculptures on PG&E structures. Willis Polk's substation cartouches were adorned with traditional fruit and flower tendrils, with power iconography suggested in the form of a flaming brazier at top center in the Jessie Street overdoor arrangement.[398] **[Figure 126]** Frederick Meyer disguised hydropower and electrical icocnography brilliantly on his Station J within a traditional-looking fruit-and-tendril design.**[Figure 96]** Howard's reference to the machines, processes, and products of hydropower generation is explicit, though the sculptor flattened and closely overlapped the symbols so that they require focused and extended looking to read. In this way, Howard's work resonates iconographically in the spirit of Meyer's cartouche on Station J, if they do not reach Meyer's literary handling of the material. Howard's two Art Deco bas reliefs intertwine water and electrical power generation iconography illustrated in visual, iconographical terms, in which stylized images of the spinning turbine and the electrical bolt figure prominently.[399]

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398 Many iconographic details I discuss in this dissertation were accessible in such books as Franz Sales Meyer's *Handbook of Ornament: A Grammar of Art, Industrial and Architectural Designing in All Its Branches, For Practical As Well As Theoretical Use* (1892, repr., New York: Dover Publications, 1957).

399 By the teens, water and power companies had begun using animated characters to serve as "mascots" who served not only to brand utility services, but to promote certain social behaviors around water and electric power. Animated figures symbolizing utilities—for example, Miss Cubic Foot and Miss Kilo Watt from 1916; Willing Water from the period; and Reddy Kilowatt from 1926. Reddy Kilowatt, a stick man with limbs and torso of yellow lightning bolts, became a universal symbol for private power companies. Willing Water was a large, blue drop of water styled into a cartoon character. These were among the best-known American promotional icons to figure in advertising and to promote electricity and water as "products" through mid-century; their animated behaviors emulated social practices and model cultural values promoted by utility companies and by the government in relation to water and energy use. This topic is a substantial history in itself and not one I have space in this dissertation to explore. See the trademark lawsuit of Reddy Kilowatt, Inc., Appellant v. Mid-Carolina Electric Cooperative, Inc., and National Rural Electric Cooperative Association, Inc., Appellees (AKA: Reddy Kilowatt Inc. V. Mid-Carolina Electric Cooperative Inc.), 240 F.2d 282 (1957). Selected excerpts from the court brief include relevant history. "*Saturday Evening Post* June 10, 1911, Hot Point, Miss Glad Iron and Miss Sad Iron, showing an animated electric iron; *Saturday Evening Post* (1920) French Battery & Carbon Co., showing Mr. Ray-O-Lite in connection with batteries. This character has a badge made up of jagged lines to simulate lightning or electricity. …[A] gas light and an electric light in animated form named, respectively, 'Miss Cubic Foot' and 'Miss Kilo Watt', [was] published in 1916.…[A] group of magazines published by American Waterworks Association show[ed] the use of an animated drop of water. It is humanized and is delivering

Signs for hydroelectric power were very different from those associated with movement and delivery of a water supply. The symbolism of electricity revealed its own brand of cultural values: it visually aligned with structural modernism, distancing it from the historical narrative inherent to historical revival styles. In dramatic contrast to the organic, flowing quality of water and its iconography, and to the ways in which the visual terms of antiquity "dignified" water-related architecture, the symbol of water's transformation into electricity—for example, a lightning bolt oriented on a forceful angle—was qualitatively different from that of the imagery of water itself. Linear, bold, diagonal, geometric, it identified with nature but detached itself from the romantic-pastoral narrative inflection. Its representations were hard-pressed to separate themselves from the mythology of providential awe: electricity's modern lightning bolt, after all, brings a clear if detached allusion to Zeus and the sublime. The commercial personifications of electricity and electrical service, whether in the form of the affable Reddy Kilowatt of the 1930s or the awe-inspiring Bolt, presented nature's harnessed power as rising from its own dynamic matter and taking form through the inventive hand of engineering technology. **[Figure 125]**

Electricity's lightning bolt borrowed from ideas about nature, landscape, and mythology, a bold symbol for the striking and magical power of electric energy, but the *process* of electricity's delivery by high voltage wires was figured in water terms: as *current*. Electrical power created from fast-running water was modern magic. In 1914 Pacific Gas & Electric Company promoted this magical transformation by calling the route of high-voltage power transmission towers the "Electric Road" as it traveled its long-distance path from river source to urban center. From its inception, electricity was water's magical fourth state, and it had the power to transform and to better civilization:

> Nature's naturally replenished sources of power must be used instead of consuming wood, coal, oil, etc., and the most natural source of power is falling water, which nature is annually reproducing….

messages and performing functions of the public water supply service in much the same way that plaintiff's character has been used to personalize electric service. The character is known as 'Willing Water'."

> A glance at the map of California showing the development of electric transmission systems in the last fifteen years, and a knowledge of the undeveloped resources will give an idea of what has been accomplished and what may be the result twenty-five years hence. It follows that every encouragement should be given to develop water power as against steam power, in order to gain the advantages for California of the highest type of civilization—one that will endure to the end of time.
>
> It requires no prophet to predict that within the life of most of us the steam locomotive will largely disappear, and that in its place will be the electric motor, quietly, rapidly and effectively doing the future work of transportation; and it requires no prediction that the electric motor and other electrical devices will be largely responsible for future progress and advancement of civilization generally. In fact, civilization and philosophy will be very much influenced and directed by electricity and its accomplishments. The philosophy of Marcus Aurelius and Confucius, who lived two thousand years ago, is as sound as that of our modern philosophy; yet Rome decayed and China now sleeps. The electric transmission of intelligence and power would have prevented the decay of the former and would arrest the sleep of the latter. It is impossible to judge the future by the past without making full allowance for changed conditions resulting from the modern electrical transmission of information, power, and products.
>
> The transmission and distributing systems are gradually covering the entire state, forming an electrical metallic screen over the country. This is a screen of equal and constant potential under which service, opportunities, rates tend to become equal. By building the transmission systems across and through the valleys of California there is formed a system which makes for the uniform and stable development of the state as a whole. Not only this, but the hydro-electric companies use a waste to reduce a want, and in using this waste energy to lift the burdens of humanity we make a net gain for civilization and do not merely transfer a burden from one set of shoulders to another. That is, electric power tends to make masters of men and to eliminate slavery. This gives us assurance for the future, for an increasing population requires progress, progress requires profits, profits require efficiency—and we may claim in all modesty that modern business could not be carried on efficiently without electric power.[400]

From the first decade of the 10th century, the "City" style substation relied on monumentality for its overall architectural form, in line with traditions of civic building.

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400 F. G. Baum, "The Economic Value of Electric Transmission," *Pacific Service Magazine* 5, no. 9 (February 1914): 298-306; the map of California to which Baum refers (300) is an unlabeled topographical map of the state overlain with a spider's web of lines representing the caption title: "Electric Power Transmission Lines in California."

The unrelieved mass of this approach relied upon a specific iconography to articulate its function and meaning in more intimate terms.

"Out of Town" Substation Design and California's Mission Revival Style

While the Pacific Gas and Electric Company called upon a monolithic neoclassicism to distinguish its "City" substations, designs for the "Out of Town" stations relied upon the warmth, color, and varied lines of Spanish Mission Revival to suggest a more intimate and inclusive narrative style. Architect Ivan Frickstad explains the thinking behind this approach:

> An adaption of Spanish Renaissance style of architecture was developed for the "Out of Town" type because of its adaptability to the many exacting conditions and requirements of each station. The early traditions of the State had much to do with the selection of this style. Especially so, since the Pacific Gas & Electric Company have been pioneers in their field, whose efforts have been such as to have largely to do with the uniform and staple development of the State as a whole.
>
> Somewhat the same conditions exist in these sub-stations as in the City sub-station, except that the power leads come and go through windows which are necessarily placed with a certain overhead clearance and thereby give large, flat, unbroken surfaces beneath them. This agrees well with the fundamental principle of Spanish Renaissance, i.e., the universal concentration of ornament at a few salient points.[401]

Promotional rhetoric aside, Frickstad's description of the "Out of Town" station describes design features that cohere with technical function as they create a conscious aesthetic. The first "Out of Town" substation was built in 1912 for the town of Woodland, a growing rural town of about 4,000 in population just west of Sacramento, well outside the immediate San Francisco Bay Area. **[Figure 104]** The station was billed by PG&E as a Spanish Renaissance, California Mission style design meant to establish a new design idea.

> The Woodland Substation now nearing completion will be without a doubt one of the handsomest structures on the system.

[401] Frickstad, "Some Sub-Stations," 64-67.

This station was designed as an endeavor to originate a type of structure which would be distinctive and which would be adaptable and could be used for all future stations and sub-stations of the Company.

It was designed by Mr. I. Frickstad of the Engineering Department and is a Mission-Spanish Style of Architecture. There is no question that the building is of a type quite distinctive and which if used over the entire system would have a considerable advertising value. Because of its Mission Style it would seem particularly appropriate for use in California by one of the largest of California Corporations.[402]

Over time, Frickstad himself worked to understand and integrate the early architectural and cultural aims of the California Mission Revival style, while making clear that the indigenous style (even if only understood in caricature) belongs to a broader California architectural revival aesthetic.

The early traditions of the State have had much to do with the selection of this style, for the Spaniards have left their influence everywhere. In fact, so well, although so crudely, did they build that the Missions standing today as a monument to their work are the foundation of a new style of architecture peculiar to this section of the country, the crudeness of their building being due only to lack of material, tools and skilled workmen. Such being the case, it is not the crudeness we should use as a motive in the development of this style, but the underlying principles of the compositions, obtaining our refinement of form and detail from either the Spanish Renaissance in Spain or the Spanish Colonial in Mexico.[403]

Frickstad implies clearly that architects should explore and revive aspects of the underlying styles the Missions themselves sought to replicate—with meager resources and materials—as they create a signature Mission Revival Style for California. Frickstad is correct in naming the Spanish Renaissance, and also in specifying it as a Colonial architectural tradition specific to Mexico, when he labels the projected intentions for the development of a new style for California. The 1912 Woodland Substation is one of the

402 “Items of General Interest,” in *Pacific Gas and Electric Magazine* 4, no. 5 (October 1912): 185. See a photograph of the station on the frontispiece, titled “Woodland Substation An Ornamental Feature,” facing the article W.E. Osborn, “Our New Substation at Woodland,” *Pacific Gas and Electric Magazine* 4, no. 10 (March 1913): 339-42.

403 Ivan C. Frickstad, “Cordelia Substation From an Architectural Standpoint,” *Pacific Service Magazine* 5, no. 11 (April 1914): 363-68, cover, and frontispiece. The article includes comparative illustrations of the like designs on 367-68.

earliest attempts to style a specific Mission-Revival substation type in the state. Rather than a full-fledged Mission building, the Woodland Substation appears as an odd Gothic-inspired, post-Victorian eclectic, with Mission-suggested details at the front door entrance. This station does not nearly suggest the studied level of academic eclecticism Frickstad's subsequent designs would soon reflect, but it does represent the beginnings of an idea. The concept was eventually to be ingrained as a 'staple' in California's architectural image, developed by PG&E specifically for water and hydropower works.[404]

The Woodland station, a utilitarian warehouse-like structure, is a rectilinear building with smooth stucco walls whose timbered eaves, large-scale wood entry doors, overdoor scrolled arch moulding, and Mediterranean red tile roof suggest Spanish Mission architecture. Spanish Missionaries built 21 missions along California's coastal spine in the 18th and early 19th centuries. At their most basic, California Mission churches and their compound buildings characteristically feature white-stucco-surfaced adobe brick walls, tile roofs supported by heavy timber beams and trusses, and interiors embellished with hand-painted wood, terracotta, or plaster ornaments. Painted patterns were stenciled directly onto wood and stucco surfaces. Revived in the late 19th century, many of these hand embellishments became trademarks of California's Arts and Crafts bungalow style. During the mission-building era, "Alta California" belonged to Mexico, until annexed by the U.S. in 1848; it was a hinterland inhabited by native indigenous tribes and Russian fur traders. The Spanish Baroque spirit of Mexican Colonial architecture inspired the mission buildings, yet building was limited by local conditions, thus Frickstad's comment about the "crudeness of their building." Eventually, ideas of Mission architecture melded with the early 20th-century California Bungalow style, a wide-ranging and sometimes rambling historical revival eclectic primarily referring to small residences—California's answer to the Eastern "cottage"—that took under its

[404] A powerful contrast illustrates a more advanced development of the Mission Revival style in other areas of architectural work in the state, as published in a 1911 issue of *Architect and Engineer of California*. In this issue, dedicated specifically to the Mission style, architect Arthur Burnett Benton narrates a history of California Mission architecture as a vehicle for his Southern California Mission Inn as a fully-developed example of the style. See Arthur Burnett Benton, "The California Mission and Its Influence Upon Pacific Coast Architecture," *The Architect and Engineer of California* 24, no. 1 (February 1911): 35-75.

purview the Spanish Colonial and Mission Styles, as well as overlapping aspects of Arts and Crafts. I will discuss California's Mission Revival and Bungalow styles in more detail later in this dissertation. In the Woodland Substation, the large central doors featured a Mission-inspired overdoor scrolled moulding. Eave trusses supported deep, red-tiled crowning cornices, directly beneath which a continuous clerestory of six-light windows, seven to a side, coursed around the building. Topping the tiled cornice, an ornamental wrought-iron balustrade, evenly spaced with stout, globe-top posts, ran the full perimeter of the building, giving Victorian Gothic expression to an otherwise modest Mission-Revival prototype attempt for this PG&E "Out of Town" station design.

> The ceiling between the four [central interior support] pillars is surmounted by a sky-light in size about 15 x 8 feet. Ranging around the top of the wall are thirty-eight six-pane windows, thus, with the sky-light, giving ample light and ventilation.
>
> From without the cornice is of Mission type with red and green trimmings, which with the red tilings, contrast strikingly with the cream tinted walls. Along the top of the cornice are thirty-eight pilasters, each surmounted by a round, opal globe containing a 40-Watt Mazda lamp which, at night time particularly, punctuates 'Pacific Service.' Between and joined to each pilaster is an iron balustrade adding to the beauty of the building's crown.[405]

A few months after the Woodland Station opened, a local notice remarked on its landscape design: "The new substation presents a very attractive appearance and when Landscape Gardener Mr. Barker finishes planting the grass and white clover it will be a beauty spot of which all Yolo County will be proud."[406] The station opened in December

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405 Osborn, "Our New Substation," 341.

406 An excerpt from "Woodland's [local PG&E] report for the week ending October 19th: 'The new substation presents a very attractive appearance and when Landscape Gardener Mr. Barker finishes planting the grass and white clover it will be a beauty spot of which all Yolo County will be proud.'" See "Items of General Interest," *Pacific Service Magazine* 4, no. 7 (December 1912): 258. *Pacific Gas and Electric Magazine* changed its name to *Pacific Service Magazine* beginning with the December 1912 issue (vol. 4, no. 7); the company published the magazine from 1909 to 1933. A contemporary pumping plant in Woodland provides an interesting comparison showing that architectural design was reserved for selective types and locations of buildings. The company draws attention to a small, simple, rustic, wooden structure with no claim to architectural spectacle, but purely to utility, yet which is still pictured and thought to be a valuable advance: "We present herewith a picture of a new pumping plant installed near Woodland. It affords a splendid illustration of the possibilities of 'Pacific Service.' The plant is operated by a 20-horsepower motor direct-connected to an 8-inch centrifugal pump which delivers 1800 gallons per minute." The announcement does not elaborate on the "splendid…possibilities" the structure illustrates. I suppose

1912. A few months later, in March 1913, an inaugural notice appearing in the company magazine identified the architectural style as "Spanish Renaissance, verging on the Mission type."[407]

Throughout its newly consolidated and rapidly growing territories, PG&E began enlarging and updating existing substations. In the Sacramento River area, domestic and industrial service needs were rapidly changing as plans developed for constructing the Sacramento and Woodland Railroad, as the "Electric Road" from Sacramento to the Bay Area gained in progress, and as PG&E's plans for developing high-volume, long-distance hydropower in the Sierra Nevada Mountains moved forward. As Frickstad's later articles on substation design will suggest, the "Out of Town" design furthered an interest in creating Renaissance-referenced architecture "native" to California's Spanish and Mexican cultural history. The California standard soon invested, both materially and rhetorically, in visually evocative, historical revival references to Spanish, Colonial, and Mission architectural heritages. The 1912 Woodland Substation and a handful of others in the corridor between Sacramento and the Bay Area became a starting point for this cultural statement.

Between 1914 and 1916, Frickstad explored the architecture of five PG&E stations, all "designed in the same style," as cornerstones for the company's California Mission Revival architecture. Frickstad provided detailed descriptions, illustrations, and comparative examples to show clearly how these initial buildings ground an explicit architectural aesthetic for "Out of Town" water power structures. A clear, consolidated visual idea emerged. On the heels of the Woodland station, Frickstad built PG&E's first

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this intends to call attention to the service of pumping and conveying water, and not to architectural possibilities. Notice with photograph, in "New Pumping Plant Installed Near Woodland," *Pacific Service Magazine* 5, no. 7 (December 1913): 244.

407 Osborn, "Our New Substation," 339-42; exterior view on frontispiece; interior view showing clerestory lighting on 340. Osborn describes the structure as "architecturally handsome and perfect in its up-to-date equipment." The March 1913 issue frontispiece is illustrated with a photograph of the finished Woodland station. The photo caption underscores the value of the architect's attention to aesthetic design: "Our new substation at Woodland, regarded as an ornamental feature reflecting credit on the community." In the article, Osborn calls the substation "…most striking in appearance, being unlike anything to be seen in Yolo County."

large-scale “rural” station, the Cordelia Substation.[408] **[Figure 105]** Frickstad introduced the Cordelia Substation as initiating an overall plan for continuity in mechanical and aesthetic design.

> This is a system being built up which will be complete not only in its mechanical aspects …but also in its architectural themes…. An effort will be made to show that while each [building] has been given an individuality of its own they are architecturally related, the dominating features of each being united and combined in the composition of Cordelia, the central station of the system.
>
> It is fitting and proper that the buildings comprising a system made up of a number of plants which are dependent upon one another for their perfect fulfillment of their specific mechanical functions should be made to express this relationship by carrying a consistent architectural theme throughout the system which fulfills the mechanical requirements as well as the function of utility.
>
> Spanish Renaissance style of architecture has been chosen to accomplish this, because of its adaptability to the many exacting conditions and requirements of each station, the climatic conditions and the environments of the field in which the system operates. …[T]he interior installation is best taken care of when the walls are unperforated, since it is important to protect the highly-charged apparatus….Solid walls, too, are necessary for attaching the switches and other parts of the installation. This point in utility gives us in the exterior treatment large, flat, unbroken surfaces and agrees well with the fundamental principle of Spanish Renaissance, i.e., the universal concentration of ornament at a few salient points. This principle is justified by that most important canon in art of carrying the attention from the general to the particular. When developed carefully in the composition of a building the beholder receives at first a general impression of the character of the building through the large effects of mass, form, outline proportion. Then he becomes aware of the finer structural points which are explanatory, elucidative and illustrative of the function and purpose of the work, the whole imparting a feeling of permanence and repose.[409]

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[408] “Work on the new substation at Cordelia is being prosecuted with energy. The transmission line, also, is under full headway and in capable hands.” See “The Growing Demand for Electric Power,” *Pacific Service Magazine* 5, no. 1 (June 1913): 192, including reports of the Vallejo and Northern Railroad using power for construction and that rail service will begin between Vacaville and Suisun within a few months. Also see a similar report in F.G. Mudgett, “Breaking a World’s Record in Our Lake Spaulding Dam Construction,” *Pacific Service Magazine*, 5:4 (September 1913): 126: “Work on the new sub-station at Cordelia is progressing rapidly and Mr. J. A. Barker, superintendent of construction there, informs us that the building will be ready in October. …Drum plant is expected to be in operation by Thanksgiving….”

[409] Frickstad, “Cordelia Substation,” 363-68, cover, and frontispiece. The article includes comparative illustrations of the like designs on 367-68. Images of the Cordelia Substation also appears in Frickstad, “Some Sub-Stations,” 54-68; and in Frickstad, “The Development of ‘Pacific Service,’” 211-12.

The completed Cordelia substation had also appeared in an electrical journal within a lengthy analysis by PG&E engineer Van Norden of the company's formidable 1912 Spaulding-Drum hydroelectric transmission system in the High Sierra.[410] The Cordelia substation was the distribution liaison between hydropower production at the mountain powerhouses and transmission to urban customers in the San Francisco Bay Area. In 1914, Frickstad described the architectural style in detail, writing very specifically about ways in which technical utilitarian requirements of the building led to aesthetic design solutions.

> The purpose of Cordelia substation, i.e., the stepping down of the electric current from the high voltage necessitated by the great distance of the powerhouses from the field of distribution to a lower voltage, and its distribution to the smaller substations located with reference to various distributing centers, determines the motive of its design.
>
> The entrance of the high voltage lines to the plant is through windows seven feet square. These windows, placed so as to have a certain overhead clearance, are brought immediately under the cornice. This arrangement led to the use of the continuous window course, which accomplishes all that is desirable in the way of light and ventilation while providing an entrance for the wires. The window openings are separated by pilasters, around each of which breaks the sill-course as a base, and the members of the cornice, beneath the corona, as a cap. Spanish tile have been placed on the slope from the crown member of the cornice to the parapet wall, their scalloped edges showing plainly over the crown member, emphasizing the Spanish treatment. The same window and cornice treatment prevails around the entire building, but on the opposite side from which the wires depart the windows through which they must pass are only three feet square, and to meet this difference the two-size windows are brought together at the ends of the buildings by breaking out the portion in which the large opening occurs against which the sill courses stop. An additional break is made enclosing this large opening as a central feature and the smaller window course is carried across, allowing the sill to return around the corner and die against the surface of the first break.

410 Rudolph W. Van Norden, "Lake Spaulding-Drum Power Development," *Journal of Electricity Power and Gas* 31, no. 24 (December 13, 1913): 539; rear of substation photo, 540. Regarding the building's design, Van Norden mentions: "This substation is a reinforced concrete building…. Architecturally it follows the Spanish Mission style of powerhouses, and is very beautifully finished." The article was originally a paper PG&E engineer Van Norden presented to the San Francisco Section of the American Institute of Electrical Engineers. See also "Editorial," *Pacific Service Magazine* 4, no. 12 (May 1913): 436-37. The author gives the building dimensions as 256 ft. long, 82 ft. wide, 43 ft. high.

> The treatment of the large end openings as central features further emphasizes Cordelia's central position in the system. The requirements of the building called for greater height on entrance side than on the outgoing side. This does not show, however, in the skyline, but was accomplished by carrying one floor level lower than the other. This was the most economical method as the building is located on a hill-side and the shelving off had to be made to solid rock.
>
> The fact that the building is designed for the entrance of two high voltage lines, and that the relation of the station in the system is that of a central switching-station, is indicated in the composition by the central feature which projects beyond the face of the two wings and also breaks the skyline. This marks definitely the division of the two lines entering, the location of the switch board controlling the station and is the main entrance to the building. At this salient point is placed the only ornament used on the building.[411]

He clearly articulates ways in which the historical revival form works to accommodate the machinery of high-voltage conversion and transmission—large industrial doorways, clerestories for passage of wiring, unfenestrated wall expanses for installation of equipment. He elaborates on the building's entrance façade:

> This is composed of four Doric columns in between which are three arches springing from imposts. The central one is the [tripartite] entrance and is glazed throughout. The two side arches are niches in which will be placed formal trees in cement vases. The trees selected bear a white flower and produce a small red fruit. Above the cornice has been placed a grill of ornamental iron work such as is used for various purposes on nearly all Spanish or Latin-American buildings. This grill cuts in between cement lamp-posts which center over the columns. While the treatment of this central feature as a whole is quite simple, an ornate appearance is obtained by contrast with the greater simplicity of the balance of the building and with the absolutely plain walls.
>
> These plain walls, however, will have their bareness moderated in time by a growth of shrubs at the base. The plain surfaces of the buildings are finished in white cement, colored a light buff and roughened slightly by a stippling process. The mouldings are smooth finished, giving them an effect of being lighter, and the whole is crowned with varying tones of red tile.[412]

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[411] Frickstad, "Cordelia Substation," 363-68; frontispiece; cover.

[412] Frickstad, "Cordelia Substation," 363-68; frontispiece; cover. The frontispiece illustration presents a photo of the main entrance to the Cordelia Substation, with a caption: "Note the four imposing Doric columns, each surmounted by a cement post supporting a 11-inch globe containing a 230-watt lamp. At night the substation is plainly visible for miles." Front entrance glazing detail is clearest in the photograph on 367. See a photo showing the relationship of the substation, pumphouse, and cooling pond fountain on 364. Note in photos of the front and back of the building on 364 and 366 that the entrance point of the high-

He compares the Cordelia design with Woodland Substation in its approach to the placement of high windows for electrical wire access: "Woodland is treated the same as the distributing side of Cordelia, with a window course under the cornice entirely around the building through which the wires come and go."[413] Frickstad makes explicit the style comparison with the Woodland Substation:

> The same plain wall-treatment prevails and the same kind of tile covers the cornice. The general treatment of the cornice and the roof lighting scheme constitutes Woodland's individuality. The ornamental iron work around the coping is similar to that used in a different way at Cordelia and is strictly in accordance with Spanish tradition. The lights on each post are in keeping with the purpose of the building, proclaiming 'Pacific Service' to those of the night watches for miles around.[414]

The application of a historical revival style to such a utilitarian structure in the examples I cite is a sophisticated, period-true architectural expression. Frickstad accounts art historically for every architectural decision in these buildings, and he illustrates aesthetic decisions that are conscious, explicit, and sound. Leaving nothing out, he describes the building site and its visibility in its landscape setting:

> The building stands on the side of a hill, with hills rising at either side and a higher range in the background. On the slope in front, a number of oak trees grow a little below and to either side and a higher range in the back ground. On the slope in front, a number of oak trees grow a little below and to either side of the entrance. A pond for cooling the transformer water and the pump-house with its tiled roof and buff colored walls, a necessary adjunct to the plant are also adjacent. Utilizing these natural and necessary features as a setting, some very fine landscape effects are possible. For instance, with Boston ivy softening the severity of the walls, red flowering plants at the base, the slope in front dropping away in terraces and planted to natural grass, the graceful oaks standing and alone and clumps of shrubbery here and there to mark out paths and roads, with grasses and willows around the pond and shrubs about the pump-house, with the roads leading to the main highways laid on symmetrical lines and the buildings of permanent quarters for the operators on the grounds designed in keeping with the

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voltage wiring through the clerestory window course is clearly visible. A perspective drawing showing the building's planned enlargement, never undertaken, is on 367.

413 Frickstad, "Cordelia Substation," 366.

414 Frickstad, "Cordelia Substation," 366.

> style of the building, the whole will present an appearance at once striking and harmonious—a symphony in soft greens, tans and reds.[415]

Subsequently, Frickstad published two nearly identical designs for future mountain powerhouses and presented a project for a wing expansion on the Cordelia station.[416] **[Figure 105]**

> Power-houses 4 and 5, as now proposed, are twins, and being generating stations are related to Cordelia's entrance side by means of its seven-foot square windows and plain wall-treatment. The cornice treatment and the retaining wall on the reservoir side differentiate these buildings. These two stations will be further distinguished from one another by the treatment of the entrance and the retaining wall.[417]

Over the next two decades, the PG&E architect refined the "Out of Town" substation style into the recognizable California "Mission Style" standard, with its red tile roof, arched windows, sunset-hued walls, and temple or tower features. The design came confidently into its own in the early 1920s, when federal "interconnection" mandates following World War I required power system renovation.[418] Technology upgrades necessitated building overhauls, and this permitted new architectural design elements. The 1921 Vacaville Substation (also called the Vaca-Dixon Substation), the key feeder station to the Cordelia Substation, is an exemplary "Out of Town" station showing the fully developed style.[419] **[Figure 106]** It first appeared in print as an architectural sketch of the building plan and a description of the elevations:

> The main substation building, designed in an adaptation of the Spanish renaissance, consists of a main front portion…in plan, one story high, with a rear wing…two stories high. …The second floor…is reached by two flights of

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[415] Frickstad, "Cordelia Substation," 363-68; frontispiece; cover.

[416] These are "powerhouses Nos. 4 and 5 of the projected extension of the South Yuba-Bear River development." In Frickstad, "Cordelia Substation" 366. For comparative illustrations and descriptions, see 363-68, cover, and frontispiece.

[417] Frickstad, "Cordelia Substation," 368.

[418] James C. Williams, *Energy and the Making of Modern California* (Akron, Ohio: The University of Akron Press, 1997), 245-47.

[419] Like the Cordelia Substation, the 90-acre Vaca-Dixon site is a major transmission point in the system. It is located a few miles northeast of Cordelia, and marks the point where long-distance high voltage hydraulic power from the Pit River system lands in the Sacramento-Bay Area corridor for step-down voltage transformation and regulation for distribution to cities.

> ornamental iron stairs leading directly to the floor level of the main building. …The building is a steel and reinforced concrete structure with Spanish tile roofing, and an outside finish of light buff plaster. The predominating exterior feature on the front of the building consists of a semi-circular niche with an ornamental cast cement emblem overhead and framed with an ornamental lattice border. Circular cement steps will form the approach to the enclosure from which the public will be able to obtain a good view of the interior of the station. …Large circular head windows will furnish light to the interior and add to the general exterior appearance of the building. Skylights will admit light to the office, store room and operating deck. …An artistic cooling pond with fountain will be located immediately in front of the building giving a very pleasing appearance to the substation setting. It will be the largest and most important substation on the 'Pacific Service' system and one of the largest substations in the world. All of the equipment will be of the most modern design.[420]

This form of the "Out of Town" style became PG&E's visual signature in architecture.[421] The statement is an amalgam of the values of the structural engineer and the architectural designer, all calculated to impress the public.

Not all of the company's architectural developments showed the integrity and continuity of the "Out of Town" substation style. An example of discontinuity so extreme as to strike one as puzzling was the eclectic mix devised for one of the company's remote facilities on the Pit River hydropower system. The Pit River flows in the north-central part of California, at the base of Mt. Shasta, the headwaters of the Sacramento River. A wide variety of structures on the system presents an architectural timeline of hydropower development after 1920, starting with its first hydropower station, the 1921 Pit River No. 1. The entire system eventually funneled the entire rivershed through five powerhouses, selected details of which I will discuss in this section.

For the first powerhouse facility, Frickstad dwells on the architecture and landscape, but he pays little attention to the massive powerhouse. He invests interest in the employee village compound on the powerhouse site, "a setting which could hardly be improved upon." His analysis showcases the village architecture, of which he is clearly

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420 Hector Keesling, "Carrying on 'Pacific Service'—Vaca Substation," *Pacific Service Magazine* 13, no. 4 (September 1921): 108-09.

421 See A. H. Markwart, "The Meaning of Interconnection—Its Relation to 'Pacific Service,'" *Pacific Service Magazine* 18, no. 6 (October 1931): 172-78. Photos of substations on 172, 175, 177.

proud.[422] **[Figures 107, 108, 109, 110]**. Frickstad identifies this village architecture as "the Swiss chalet type which perhaps harmonizes better than any other with the natural surroundings."[423]

> It consists of one large club house in which it is proposed to take care of all single men, guests, and work crews; six cottages for the men with families, four of these having four rooms and two having five rooms, a large garage, and a warehouse in which will be located the post office. …When completed and occupied, this community center at Pit Power House No. 1 will present a very beautiful appearance, situated as it is among the pines and oaks in the heart of these mountains, the cottages themselves being stained in subdued shades and tones of buffs, greens, and reds, so all will be in harmony.[424]

His description of the clubhouse typifies the residential compound architecture:

> The building has been designed to set low and near the ground, and rock gathered from the site will be utilized for all foundations, with rustic material for the exterior covering of the superstructure. Cedar logs will be used for the porch posts and the outside walls will be covered with split cedar shakes. The interior of the living, dining and billiard rooms will be finished entirely in native woods, with an open roof construction showing the exposed roof trusses, and rafters with burlap covering between. The living room … receives its charm and inviting appearance for the large wood-burnign fireplace flanked by roomy window seats and book shelves, as well as from a balcony over the central stairway which forms a most interesting feature overlooking, as it does, both the living room and the billiard room and providing the ideal location for the musicians when special social gatherings are arranged for them … [T]he cottages…have been designed in the same style as the club house, using the native rock for foundations and combinations of rustic exterior coverings, so that each cottage will possess and individuality of its own. The living rooms of these cottages will be finished similar to the living room of the club house, and each will contain an open fireplace. …[R]oads and paths [will be] developed according to the natural circulation and contour, yet on artistic lines.[425]

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422 See Ivan C. Frickstad, "The Proposed Community Center at Pit River No. 1 Development," *Pacific Service Magazine* 13, no. 4 (September 1921): 103-07, as well as illustrations on the frontispiece and cover, and plan and elevation drawings by architect. For more on the physical and technological details of the Pit River hydropower system and its structures, see W. T. Hannum, "'Pacific Service' in Lassen County – Electricity Transmitted to Bieber," *Pacific Service Magazine* 18, no. 7 (January 1932): 195-200.

423 Frickstad, "Proposed Community Center," 104-05.

424 Frickstad, "Proposed Community Center," 103-07.

425 Frickstad, "Proposed Community Center," 105-06.

Perhaps Frickstad neglected discussing the site's powerhouse architecture because it was completely discordant, not only with its landscape setting but with the cohesive village design. The Pit River village building layout forms a broad, linear arc on high ground, with the powerhouse on lower ground between the village arc and the river. The industrial powerhouse is a castle in a Gothic Revival caricature replete with corner turrets, ramparts, and a "matching" bridge spanning the long tailrace "moat," all rendered in glaring painted concrete. This is decidedly out of place in the rugged mountain valley, and is quite unlike the understated "chalet"-style architecture Frickstad designed for the employee village. By contrast with the powerhouse, the village architecture appears to be in fitting with the remote river valley setting. It conformed to a contemporary American tradition for rustic woodland settings, used for temporary construction camps as well as permanent employee villages situated once waterworks were in operation. When the massive powerhouse was under construction, PG&E's magazine reported that "the architecture is in harmony with its setting."[426] This strikes me as an odd remark, given the stark contrast between powerhouse and village architecture, and the way in which the buildings are grouped in the landscape.

Compare the completed village clubhouse, "Reminiscent of Switzerland," with the nearly complete Pit No. 1 Powerhouse, a turreted, concrete Gothic Revival castle.[427] The powerhouse and its broad tailrace canal are within view of the residential compound, but the elements of the development fail—spatially and stylistically—to appear as an integrated whole. In the summer of 1922, a group of 70-90 journalists visited the Pit No. 1 powerhouse construction site. Many of the writers subsequently commented in newspaper reviews, but one stands out for the ambivalence with which he lauds the eclectic mismatch.

> The visitors expected to see monuments of industry rearing their heads aloft in this splendid region, but they saw something, too, that gave an added thrill to the imagination, for in 'rearing magic castles in an Alpine fairyland,' they did not

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[426] O.W. Peterson, "Progress of Our Pit River Construction Work During the Past Winter," *Pacific Service Magazine* 13, no. 12 (May 1922): 375-77.

[427] See "The Giant Power House at Pit River No. 1 Development As It Appeared to the Newspaper Editors Who Visited It Recently," *Pacific Service Magazine* 14, no. 2 (July 1922): frontispiece.

> have their heads to the earth. They saw the beauties of the landscape about them and they made their works to conform with the locality in which they are built. The clubhouse is a veritable Swiss chalet, blending into the high, green, mountains that form its background.[428]

The writer focuses on the way in which the Alpine architecture of the village conforms to a landscape ideal, but he avoids discussion of the "magic castle" mentioned in his figural parenthetical phrase. It is a stretch to imagine this Gothic powerhouse as a Bavarian castle, for example, in order to create a coherent context for these two disparate designs.

In many ways, the Pit #1 employee village is typical of remote utility company residential facilities of the day. Speaking on a relative architectural scale of village styles between rustic and refined, this compound fits in somewhere between the two. Employee compounds developed for San Francisco's Hetch Hetchy Aqueduct system exemplify the polar ends of this relative design scale. Occupying the more rustic end of the scale is Camp Mather, the mill and laborer village for Hetch Hetchy Dam construction, a forest camp fashioned in rough cabin construction similar to the Watershed Keeper's cabin at the completed O'Shaughnessy Dam at the Hetch Hetchy Reservoir. **[Figure 111]** At the more formal end of the design continuum is the employee village at Moccasin Creek Power House, downstream from the Hetch Hetchy Dam, a picturesque neighborhood of Spanish-style bungalows, complete with lawns and sidewalks on a grid of two or three small blocks, centered around a Mission-style Community Center. This village stands adjacent to the large-scale Spanish Renaissance/Mission Revival Moccasin Creek Powerhouse. **[Figures 112, 116]** The village is clearly integrated in style and arrangement with the powerhouse, and this coherence becomes most evident when the compound is viewed from across the afterbay, where the reflection of the whole, doubled in effect, proves the design's integrity. This is quite unlike the stylistic disjuncture of the Pit River No. 1 site structures. **[Figure 109]**

One impetus for historical revival employee villages relates to a social practice among the "other half." Wealthy capitalists built remote retreat lodging compounds

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428 "Some Comments by the Daily Press [from the *Chicago Enterprise*]," *Pacific Service Magazine* 14, no. 3 (July 1922): 44.

illustrative of Thorstein Veblen's concept of *conspicuous waste*. Massive, sprawling, private, remote, and exclusive, residential compounds for the wealthy were combination vacation and business retreats, an American fantasy rendition of aristocratic country houses. The first, and most famous, of these in California were for mining and railroad company owners, whose hydraulic technologies formed the basis for urban water supply systems in California.[429] In the 1890s, Willis Polk had built a residential estate compound for William Bourn at the future waterworks developer's Empire Mine in Grass Valley, in the Sierra Nevada foothills Gold Country.[430] **[Figure 117]** Perhaps the most notorious elite "lodge" estate is the 50,000-acre Wyntoon compound on the McCloud River in northern California's Sacramento River watershed near Mt. Shasta. Polk designed a rambling "lodge"-style mansion for the estate's first owner, and, later, Bernard Maybeck and Julia Morgan built multiple over-stylized residences—a Medieval castle and a Bavarian lodge among them—for the Hearsts, when they acquired the vast property. These compounds were considered "rustic" in landscape and in architecture, even if grandiose in their materials, construction, and amenities. Wyntoon is on the McCloud River—with the Pit River, the McCloud forms one arm of the massive Shasta Dam

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[429] The "Big Four" California capitalists were Charles Crocker, Mark Hopkins, Collis Huntington, and Leland Stanford. William Randolph and Phoebe Apperson Hearst held sway with this group in San Francisco, as well as the Bourns, Spreckels, and other wealthy families involved in commercial and industrial business, in urban planning and building projects, and in waterworks and gas, electric, oil, timber, and coal power development. On waterworks systems for the transcontinental railroad, see Richard Orsi, *The Southern Pacific Railroad and the Development of the American West, 1850-1930* (Berkeley: UC Press, 2007), esp. 169-275**.**

[430] An example that would fit Veblen's description of social customs of individual capitalists, William Bourn, Jr. had been raised on such wealth as the son of the founder of the Empire Mine. As a young adult, when Bourn had returned to San Francisco from abroad after his father's death, and before he had established himself on his own merits, he listed himself in the San Francisco city directory as "Capitalist," and his address as the luxurious landmark, "The Palace Hotel." See Langley, *San Francisco Directory* (1878), 172. Such a commission was prestigious for an architect. In 1903, San Francisco architect Bernard Maybeck built the clubhouse for elite San Francisco men's association The Bohemian Club, whose membership was made up of the wealthiest, most powerful, and most famous men in San Francisco and the nation; to this day American Presidents are welcomed to Bohemian Club gatherings. The Club's retreat encampment, Bohemian Grove, stands amid several thousand acres of old-growth Redwood the Club owns on the coastal Russian River, north of San Francisco.

reservoir, both rivers being upper tributaries of the Sacramento. PG&E developed both rivers for hydropower, the Pit first and most intensively.[431]

Once the Pit River system was complete, a new substation, the 1922 Claremont Substation in the Berkeley hills, managed large-scale power distribution to Bay Area cities. **[Figure 113]** The station rose on a promontory overlooking a small spring-fed pond with an unusual sandy beach, Lake Temescal, nestled in an Oakland-Berkeley Hills hideaway valley. The lake was developed as a local tourist draw with a local railroad that ran to and from the surrounding piedmont towns in the Oakland and Berkeley hills.[432] The substation perched just above the lake, and commanded a canyon view of the entire San Francisco Bay toward the distant Golden Gate (*sans* the 1937 bridge).

> Claremont Substation was first put into commission in October, 1922. It was established to take care of the electric energy coming in from the company's newly constructed power plants on the Pit River by way of Vaca-Dixon, Cordelia and the high voltage power lines strung across the Straits of Carquinez—the waterway carrying the confluence of the Sacramento and San Joaquin Rivers from the Sierra Nevada Mountains the length of California out the Golden Gate. It distributed power over the network of wires servicing Oakland, Alameda, Berkeley, and the surrounding territory. The station has a marvelously picturesque setting. It stands upon an eminence overlooking Lake Temescal in the foothills behind Oakland and Berkeley, with the San Francisco Bay and the Golden Gate in the clear distant view. At the time of construction, this substation was the last word in modern electrical equipment, with bust [?] structures, oil switches and transformers in full view out-of-doors."[433]

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[431] In addition to the private rustic mansion retreats for the rich like those I have mentioned for the Bourns, the Hearsts, and others of the high-status Bohemian Club socialite membership, luxury hotels in rustic locations like the Wawona Hotel in the Yosemite Valley; there was a like tradition of modest bungalow-cabin retreat developments for the traveling middle class, such as Zephyr Cove at Lake Tahoe in Northern California and Mammoth Mountain in Southern California.

[432] *Temescal* is a word from the pre-Columbian indigenous language Nahuatl, spoken by the Mexica (Aztec) culture of Tenochtitlán (Mexico City).. The word has been in use throughout Mesoamerica from the pre-Columbian period into the present, and names a type of building, a low, small, stand-alone sauna structure, used for cultural practices related to ritual bathing and cleansing during life crisis transitions such as childbirth and marriage.

[433] In D.D. Dexter, "Pacific and Great Western Systems Interconnected at Claremont Sub," *Pacific Service Magazine*, 18:5 (July 1931): 147-49, with aerial photograph of the station and its switchyard. See a photograph of the station apparently under construction, within its then-rural hillside setting, in "Giant Power House," *Pacific Service Magazine* 14, no. 4 (September 1922): frontispiece. In 1931, the Claremont Substation's use expanded when PG&E absorbed the Central California Great Western Power Company, one of the corporate mergers PG&E created when it purchased and absorbed smaller or adjunct systems within its growing service areas. This phenomenon was referred to as "interconnection," and it followed

federal regulations regarding monopolies among utility service providers. It is impossible to ignore this issue of mergers and monopolies in the discussion of water and power structural aesthetics. It is an important topic in need of more research and critical analysis, but for lack of space it must receive only this slight mention in this dissertation. The complex historical and economic issues raised by corporate merger and monopoly in the water and power sector continue to the present. In the 1920s and 1930s, the concept of "interconnection" (or physical mergers), arose and was eventually promoted by capitalists and their corporations. On interconnection, see Williams, *Energy and the Making of Modern California*, 245-47**.** In 1931, PG&E's corporate newsletter recounts the issue in its own, uncritical, self-aggrandizing terms, describing the practice of "interconnection" as a win-win situation for providers and consumers: "In general, interconnections render possible the fullest utilization of the facilities of a combined hydro and steam-electric system. …What really was sought in the early history of electric utility mergers was the elimination of competition and the control of markets. While it is true that the early pioneers had a greater profit to themselves in mind, the reductions in cost following the consolidations came to the consumer automatically. With the inception of state regulation, as we know it today, destructive competitive conditions, with the burden of cost which they inevitably put upon the consumer, were removed forever. Today, because of an enlightened and unselfish policy, the incentive grows out of a constructive desire to consolidate markets and to forestall the investment of capital in duplicate distribution systems in a given territory and to obviate the corresponding operation cost in the consumer interest. Past and present, the consumer interest was, and is, benefited by these consolidations, despite the fact that in the past the motivating spirit was selfish." See Markwart, "The Meaning of Interconnection," 172-73. See also PG&E Second Vice President John P. Coghlan, "Public Utilities and the Public" *Pacific Service Magazine* 18, no. 10 (October 1932): 295-300, for the company's defense of controversial and publicly-criticized fiscal practices. Another term for consolidation, or "interconnection" used at the time was "combination."

A few decades earlier, in 1912, the PG&E Magazine quoted William Randolph Hearst on the "advantages of combination…in business enterprise," which, from Hearst's (and PG&E's) corporate promotional point of view sounded something like this: "'The advantages of combination are the advantages of co-operation and superior organization. These advantages find expression in economy of production and simplicity of operation, in compact and capable organization, and in the elimination of enormous and unnecessary expense and waste and wear and tear of competition.' " PG&E editors comment: "As a matter of fact, Mr. Hearst is standing for what the majority of deep-thinking men of enterprise and students of political economy have claimed and are claiming every day, namely, that when Adam Smith made his oft-repeated utterance, 'Competition is the life of trade,' he dealt with a very different situation than obtains today. As the situation stands now, competition comes very nearly being the death rather than the life of trade." Hearst is quoted from a publication called "The World Today," in "Editorial," *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 105.

At that time, critical political humor was directed toward the issue of ways in which industrial capitalists and business monopolies justified or hid profit-making schemes of questionable ethics. An illustrative example is a joke reprinted in PG&E Magazine: "The attorney demanded to know how many secret societies the witness belonged to, whereupon the witness objected and appealed to the court. 'The court sees no harm in the question,' answered the judge. 'You may answer.' 'Well, I belong to three.' 'What are they?' 'the Knights of Pythias, the Odd Fellows, and the gas company.' " See "Just Some Oddities," *Pacific Gas and Electric Magazine* 4, no. 4 (September 1912): 122. The joke directs critique toward the dozen or more "secret societies" to which prominent men publicly belonged at the time—in San Francisco, the societies and membership names and their duties were listed in the annual city directory, under the explicit heading "Secret Societies." But, more to the point under discussion here, it also makes direct reference to the sensational Federal graft investigations and trials in San Francisco between 1905 and 1911. The trials resulted in the 1911 incarceration into San Quentin Penitentiary of labor leader Abe Ruef for bribery, with clear implications of graft among City political officers, businesses, and service companies, to include public works services. Ruef's seems to have been the only sentence upheld, if shortened, even though former Mayor Eugene Schmitz came to trial in 1912 on new charges. Contemporary political humor in combination with anti-competition and other industry rhetoric in this context is rich territory for future

Like the Vaca-Dixon substation from the same period, this Claremont Substation is an exemplar of the fully formed "Out of Town" design, with its red tile roof and pale walls, a "mission" tower, copper gutters and downspouts, and wall-scale glazing, Arts and Crafts style carved ornamentation around the door casings. Behind the attraction of the architecture is that of the expanse of the switching station machinery, in full view of the high-voltage electrical towers in their march down the hillsides carrying transmission wires like garlands.

California Bungalow Style Substations: Historical Revival Redux (ad inf)

An entire class of small substations of "bungalow" type emerged from the "Out of Town" movement. Usually located in residential neighborhoods, these substations looked like small "bungalow" residences, a California architectural style that hailed between about 1910 and 1939. The typical bungalow was a compact, single-story home on a small lot, horizontal in massing with sloped roofs and eaves, faced in stucco or horizontal siding, with a chimney and a small front porch entry accessed by a few stairs. Stylistically, bungalows spanned the array of revival eclecticism, with distinct historical styles alternating from house to house on any given tree-lined downtown street. Initially, bungalow-style substations appeared in Spanish Renaissance or California Mission style, but eventually bungalow substations revived the full range of the architectural history survey, paralleling the California bungalow movement for residential neighborhoods. The bungalow style residence emerged in the first decade of the 20th century, consistent with PG&E's "Out of Town" substation architectural theme. In a brief 1917 article in *Builder and Engineer of California*, an editor attempts, evidently out of sheer frustration, to define the California bungalow style in order to remedy the style's "misinterpretation" outside California:

study. I remind readers that, regarding logical extremes of "interconnection" and monopoly in the utility and energy sector following from this history, a logical historical extreme was reached at the turn of the 21st century in both California and Texas in the PG&E and Enron energy scandals, another historical theme this dissertation cannot address.

> It is both amusing and annoying to pick up an Eastern publication every now and then and find in it a picture of a one and one-half story cottage, and not infrequently a two-story house with this caption beneath it: "A California Bungalow." To educate the East into an intelligent comprehension of the difference between a bungalow and an ordinary cottage seems a most difficult task, strange to say. We've been telling them about bungalows for at least eight years—telling them that a bungalow is a one-story house, first, last, and always, yet they go right on talking about the two-story house that is "modeled after" or a "prototype of" the California bungalow.
>
> Recently the *Building Age* published a photograph of a house—a frame cottage, the architecture of which, according to the text, is supposed to have been influenced by our California bungalow. Here is what Mr. F. A. Shilling of Los Angeles wrote in contradiction:
>
> "In the first place, the roof is too steep. A bungalow roof is about one-sixth or one-eighth pitch. Again, a bungalow never has an upper story. We call such houses 'cottages'—not bungalows. The windows certainly show the Eastern Colonial influence both in design and size. Bungalow windows are not mullioned, and are wide. The pergola shows no bungalow influence—it is Colonial. The dormers surely are not 'bungalonial,' to coin a new word; neither are the boxed eaves…."[434]

The California bungalow as a mini-sampler of historical revivalism carried itself as upon a wave into the 1920s and 30s.

A fine, typical example of a Mission Revival style bungalow substation for PG&E is the 1932 Carmel Substation. **[Figure 113]** An "attractive little substation, almost concealed in the tall trees," the Carmel example featured beige stucco with a red tile roof, arched entry and windows, and a Mission-style silhouette (a bell-shaped false front) on the two side facades. It resembles the bungalow-style residences typical of the nearby village of Carmel By The Sea.[435] A symmetrical entry on an arched landing is balanced by two narrow, high arched windows on the primary facade. The Carmel station provides a clear instance of a substation in intentional architectural disguise as a residence.

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[434] "The 'Real' California Bungalow," *The Architect and Engineer of California* 49, no. 2 (May 1917): 104.

[435] The article includes a photo with caption reading, "Carmel substation, in a setting typical of the region." See M.C. McKay, "The Substation Feature of the Electric Distribution Problem," *Pacific Service Magazine* 18, no. 10 (October 1932), 308-09. The article also describes the various types of substations on the PG&E system, from hydroelectric plants, to steam-electric substations, high-tension distributing substations, and local distribution substations.

PG&E's corporate twin to the south, the Southern California Edison Company, invested even more cultural capital in bungalow-style substations. The company published a style sheet, "Typical Substations of Southern California," that illustrated and labeled six sample substation design prototypes. **[Figure 114]** Two of these are Spanish Renaissance/Mission Revival bungalows; one, the "Ramona" substation, is a caricature of the Mission style ranch home that Helen Hunt Jackson featured in her popular 1884 novel, *Ramona*, set in Southern California. The novel has gained credit in cultural histories of California for encapsulating, and promoting, a certain California cultural image, part of which was transmitted by architectural typification of historical revival styles. The California bungalow was a historical revival survey in microcosm.

CHAPTER 6

Words as Iconography: "Dignity" for Corporate Waterworks

Taken together, the waterworks and hydropower buildings I have discussed pose a set of prominent historical revival styles between the 1890s and 1930s. During this period, the Spring Valley Water Company and the Pacific Gas and Electric Company used architectural material to parade cultural prominence for corporate waterworks. So Far, I have discussed only hydraulic structures—the utilities workhorses. But public works companies invested in corporate image through their architecture for office buildings, as well. The Spring Valley Water Company's office building history serves as an apt case study, given that the company operated continuously from 1860 to 1930.[436] In its high-rise architecture, one can trace a visual rhetoric of "dignity" as part of the company's crafted image. This fits into a larger cultural discourse of the time regarding relationships among wealth, civic duty, and public service. It indicates ways in which aesthetics signaled cultural values pertaining to water and the large-scale infrastructures that moved water.

[436] I have pieced together this history from various fragments of primary evidence, available but never published cohesively, as I offer it here, in a continuous historical narrative. The company was founded in 1860, when it merged with the Spring Valley Water Works. By 1903, it operated under the singular title of the Spring Valley Water Company. Negotiations took place between the company and the San Francisco municipality over the next several decades until the City purchased it, took over the company's assets in 1930, and became the Water Department of the San Francisco Public Utilities Commission (SFPUC), which operates to the present. The SFPUC retained all records, properties, works, buildings, water rights, and easements of the Spring Valley Water Company, making for a continuous history from 1860 to the present. The complicated legal relationship between San Francisco and the Spring Valley Water Company, and the history of the sale, are not within the purview of this dissertation. For a brief precis of the Spring Valley Water Company's point of view at the time Calavaras Dam was under construction, when the two entities were planning to merge under a formal agreement required by the Federal Railroad Commission, see S. P. Eastman, "Keeping Faith," *San Francisco Water* 3, no. 1 (January 1924): 1-4; and George A. Elliott, "Calaveras is Ready," *San Francisco Water* 4, no. 1 (January 1925): 2-12, 16. The SFPUC relates its own abbreviated version of this history in Warren D. Hanson, *San Francisco Water & Power: A History of the Municipal Water Department and Hetch Hetchy System* (San Francisco: City and County of San Francisco, 2005), 14.

In 1922, the company's new water offices on Mason Street were under construction, and in same year, its magazine, *San Francisco Water*, debuted. **[Figure 73]** In one of the first issues, editor Edward F. O'Day's writes loftily about "dignity" in the display of water at the Sunol Water Temple.

> Spring Valley Water Company recognizes the "utility of beauty." This recognition finds distinguished expression in the architectural treatment of important structures, notable the Water Temple at Sunol in Alameda County.
>
> To assume responsibility for the water supply of a metropolis is to acknowledge a solemn obligation, and to be clothed with a special dignity. Whatever expresses that obligation in terms of beauty enhances the dignity of the water company in the minds of all, not only lifting the routine of water supply from the plane of mere business to the higher level of public service, but also enlarging the opportunity for usefulness.
>
> Beauty is the handmaid of dignity, and if dignity be rooted in self-respect it will command the respect of the general public.
>
> Perhaps there is nowhere to be found a more perfect illustration of beauty as an interpretation of public utility service than in the Sunol Water Temple.
>
> Lands and structures given over to water supply are "dedicated to their highest use," and in the case of San Francisco's water supply the Sunol Temple is the most impressive symbol of that dedication.[437]

O'Day reveals an ideological context that places the water temple in line with cultural values that esteem water, its industrial movement, and its cultural management. The gist of O'Day's commentary is rhetorical and literary. His repetition of the word *dignity* intertwines, like acanthus tendrils on a capital, with *responsibility*, *obligation*, *self-respect*, *dedication*, and *public service*. Such phraseology suggests the water company image projects a fulfillment of *noblesse oblige* through its delivery of urban water service. The Sunol Water Temple symbolizes this noble civic gift. It follows from O'Day's figurations below that the Sunol Temple's architectural aesthetic (or Gardner Dailey's later Calaveras Gate House temple) might be conceived as a personification of the wealthy industrial capitalist, himself "clothed with a special dignity" as he serves city and society. Through this tradition of public service, he expresses his "understanding of the dignity of water":

[437] All quotes in this paragraph, Edward F. O'Day, "The Architecture of the Water Temple," *San Francisco Water* 1, no. 3 (July 1922): 3.

> As an old San Francisco institution, Spring Valley Water Company is deeply interested in the progress of this city, not merely along industrial but also along artistic lines. When Willis Polk designed the Water Temple at Sunol, and when Arthur Putnam designed the fountain at Pilarcitos, they were helping this company to express its understanding of the dignity of water. Mr. Dailey was doing the same thing when he gave us the beautiful Gate House at Calaveras Reservoir.[438]

Etymologically in English, the word *dignity* signals dress as a formal, public statement of cultural status. It implies public display as a practice and receipt of public respect and admiration as its motive. Human worth inflects such an object, and, worn or carried, makes worthy the one who dons it. A "dignified" object or person exhibits respect and status though the trappings of adornment. When worn, they signal a dignified person; when displayed, symbolic objects confer dignity upon their owner, and upon his associates.

As Thornstein Veblen made plain in 1899, "habitual" objects and the act of clothing for display is potent figuration. As this applies to the Sunol Water Temple, the preference for the Corinthian order directly—if figuratively—implies dress. The allusion draws from antiquity, specifically from architectural writing by Vitruvius. Architects throughout history have been well aware of the first-century Roman's treatise, *Ten Books on Architecture*, in which Vitruvius discusses Greek column orders, whose origins tradition figured in forms of dress. Vitruvius narrates:

> [The Athenians] wanted to set up columns on the temple but did not have [a system of symmetry] for them. Seeking out principles on which they could be made so they might both bear the weight and have approved beauty in their appearance, they measured the imprint of a man's foot and compared this with his height. On finding that, in a man, the foot was one-sixth of the height they transferred this to the column. They raised the shaft, including the capital, to a height six times the thickness at its base so that the Doric column began to

[438] All quotes in this paragraph, Edward F. O'Day, "Fountains Dispersed Abroad," *San Francisco Water* 6, no. 3 (July 1927): 11. The special aqueduct issue of *San Francisco Water* appeared in January 1927; mention of Dailey's photographs is on page 11. Another issue discussed ancient aqueduct engineering through the eyes of Frontinus' text. See George E. Tonney, "Di Aquis Urbis Romae," *San Francisco Water* 4, no. 4 (October 1925): 12-16. O'Day writes on Vitruvius and ancient Roman water engineering in "Vitruvius Descants on Water," *San Francisco Water* 5:2 (April 1926): 13-15.

> provide buildings with the proportions, strength, and beauty belonging to the body of a man.
>
> Afterward, when they desired to construct a temple to Diana with a new kind of appearance, they translated these footprints into ratios characteristic of the slenderness of women. At first they made a column of which the thickness was one-eight of its height so that it would have a taller appearance. At the foot they substituted the base in place of a shoe and in the capital they placed the volutes, hanging down at the right and left like curling hair. They adorned its front with cymatia and festoons of fruit arranged in place of hair while they brought the flutes down the whole shaft, falling like the folds in the robes worn by matrons. In the invention of the two difference kinds of columns, one was made masculine in appearance, bare and without adornment, and the other was feminine.
>
> …The later derives its name from the fact that the Ionians originated the type. The third type, called Corinthian, is an imitation of maidenly slenderness; for the outlines and limbs of maidens, being more slender on account of their tender years, admit of prettier effects in the way of adornment.[439]

Vitruvius' text also circulates a legend, of Kallimachos, the Athenian architect, who when passing by a young girl's grave was inspired by a basket of memorial offerings, overgrown by acanthus sprouts. He sketched it on the spot, deriving from it the Corinthian capital with its upward-reaching young acanthus leaves as if sprouting from beneath a basket. Some have envisioned the Corinthian capital as a market basket carried on a woman's head. In their most literal form, as caryatids, columns are clothed female figures. The most famous Greek example appears on the Athenian Acropolis, in the Porch of the Maidens of the Erechthieon.[440]

Objects—including buildings—become part of the way in which a patron "dresses"—or dignifies—his business for display. In the Oxford English Dictionary, *dignity* signals a cultural act, making an ornament of something given in offering or greeting. Wrapping a present makes a gift more presentable, more valuable, more

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439 Thomas Gordon Smith, *Vitruvius On Architecture* (New York: Monacelli Press, 2003), 115.

440 See Thomas Gordon Smith, *Vitruvius On Architecture*, 115-19, for images illustrating ways in which artists and architectural structures have interpreted the figural aspect of the Corinthian column order and its origin. On Vitruvius' influence on long-held western cultural beliefs about the magic combination of water and fire, which electricity represents for early public works in the U.S., Vitruvius mentions the Magi in relation to water and fire in Book VIII (Introduction: 1), his section on water. See Vitruvius Pollio, *Vitruvius: The Ten Books on Architecture,* trans. Morris Hicky Morgan (New York: Dover Publications, 1960), 225. "Among the Seven Sages, Thales of Miletus pronounced for water as the primordial element in all things; Heraclitus, for fire; the priests of the Magi, for water and fire."

dignified. Giving such a gift becomes a moral gesture, sacred because it takes on status as an offering, which brings with it ritual overtones. The building becomes the wrapping for the utility, which the tenets of *noblesse oblige* consider a gift to the public. From its founding in 1860, the Spring Valley Water Company and its individual owners, board members, and executives promoted such high-minded civic *noblesse oblig*e. *San Francisco Water* termed this noble duty to the public a "solemn obligation." Andrew Carnegie urged it as general practice for millionaires, referring public philanthropy as "organizing benefactions" in his 1889 essay, "Wealth."[441] In the public eye, these men were more than willing to bow to the duty of providing water and hydraulic power supplies to San Francisco.[442] This they did in the *guise* of meeting societal obligations as members of an economic class able to organize, supervise, and pay for large-scale services during their lifetimes, even as their enterprises were profit-making ventures.[443] Clothed in terms of *noblesse oblige*, the public gift of a waterworks system, and the service it provided, fulfilled a social and moral mission.

"DIGNITY" AND THE EDITOR'S ROLE: PUBLIC SERVICE COMPANY MAGAZINES

Company magazines participated in this mission, by educating employees and the public who gained access to them about processes, innovations, and history, in the context of the company's promotion of its public image. The significance of cultural underpinnings would not be lost on an editor like Edward O'Day, whose aims for the

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[441] Andrew Carnegie, "Wealth," *North American Review* 148, no. 391 (June 1889): 653-65. "Poor and restricted are our opportunities in this life; narrow our horizon; our best work most imperfect; but rich men should be thankful for one inestimable boon. They have it in their power during their lives to busy themselves in organizing benefactions from which the masses of their fellows will derive lasting advantage, and thus dignify their own lives." (661) Carnegie flatly states: "This then, is held to be the duty of the man of Wealth." He insists that the millionaire should interpret "all excess revenues that come to him simply as trust funds" for the public good, and that he must organize these benefactions during his lifetime (661).

[442] Members of the wealthy social strata also used their buildings to fulfill beneficent social and cultural obligations. For example, historian Leonora Wood Armsby reports that in addition to water company offices at the Sutter Street building, William Bourn donated meeting space for the San Francisco Symphony, which Bourn assisted in founding. See Leonora Wood Armsby, "The San Francisco Symphony Orchestra: First Decade," *California Historical Society Quarterly* 25, no. 3 (September 1946): 241.

[443] Carnegie's only audience for his essay on "Wealth" was businessman intent upon establishing profit-making ventures counting in millions of dollars.

Spring Valley Water Company were more far-reaching than simple publicity and promotion. The company launched its magazine, *San Francisco Water*, in 1922, with the announcement of its new office high-rise plan, with a focus on architectural history as O'Day reviewed the importance of the 1910 Sunol Water Temple to its newest building. He juxtaposed the two buildings to establish how company architecture grounded and reinvigorated the new building and its architect, Willis Polk. This emphasized company growth and the architect's prominence as a public works architect. The success of his past creation, the symbolic temple, increased and stabilized the company's image.

Newly-appointed chief editor O'Day was already a reputed editor, writer, interviewer, literary scholar, cultural journalist, and authority on San Francisco literary and urban history.[444] He had served as Editor for Daniel Burnham's 1906 City Beautiful plan for San Francisco.[445] He co-edited and contributed to the San Francisco literary magazine *The Lantern* in the 1910s, and interviewed cultural figures for "Town Talk" of San Francisco.[446] He broadened his editorial influence outside the literary field, notably

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444 O'Day became known locally as historian and speaker on the topic of San Francisco poetry history. In the 20s and 30s, he appeared on the *California Historical Society Quarterly* masthead in several positions, and wrote for the magazine. See *California Historical Society Quarterly* 12, no. 2 (June 1933), 180; *California Historical Society Quarterly* 12, no. 4 (December 1933): 358-363; *Quarterly of the Society of California Pioneers* 10 (1933); and *California Historical Society Quarterly* 13, no. 1 (Mar., 1934): 88-92. He also published the book *San Francisco Past and Present* (San Francisco: Adobe Press, 1935).

445 Daniel Burnham, *Report on a Plan for San Francisco* (San Francisco: City and County of San Francisco, 1905).

446 A sampling of O'Day's journalism suggests his interview style was to collaborate with subjects—interchange is transparent and the display motive mutual. This was clearly the case for interviews with subjects he wrote about. Additionally, he took literary license in articles, fabricating interviews as a way to educate readership. An example of creative ways in which O'Day wove his mastery of multiple disciplines into interview reports is a humorous piece he published in *San Francisco Water*, in which he inventively embellishes an interview with the Spring Valley Water Company's auditor as a way to provide information on a corporate auditing process. The piece does double duty as a playful character sketch of the auditor. After presenting the interview material as an invented conversation between "Auditor" and "Interviewer," O'Day ends with a parody of a stanza from Pope's "An Essay on Man" (Epistle 1:3), in which the "Auditor" replaces the entire stanza "Lo, the poor Indian!" with a stanza of his own invention, "Lo the poor Auditor!" O'Day's embellished "Auditor" performs the imagined Pope "Ode" stanza from memory, to the astonishment of the "Interviewer." See Edward F. O'Day, "Just One Report After Another: An Interview with the Auditor," *San Francisco Water* 1, no. 2 (April 1922): 14. Another representative example of O'Day's incorporation of literary material into the company magazine appeared in the last issue of *San Francisco Water* before the company transferred to the City of San Francisco. O'Day indulges five pages to an invented conversation between two characters, "*Technicus*, a hydraulic engineer, and *Sillicus*, a layman," in which the two discuss the history of hydraulic engineering via conjectural theorizing about

for water and urban planning publications. In addition to his 1922 appointment at *San Francisco Water*, O'Day was inaugural editor of the Western Pipe and Steel Company's magazine. In its first issue, O'Day wrote about water conduit for the Spring Valley Water Company and the Hetch Hetchy water and power system.[447]

Later, in 1927, O'Day would write a real estate prospectus for the developer of the luxury Southern California beachfront community, Bel Air; San Francisco landscape architect Mark Daniels designed the subdivision.[448] Daniels had created garden landscapes for Spring Valley waterworks, and O'Day had published two pieces by the landscaper, one a musing on waterworks and aesthetics and another on planting plans for Willis Polk's Millbrae Meter House.[449] **[Figure 119, 223]** I will discuss both in this dissertation. As part of the Bel Air prospectus, O'Day included poems by San Francisco poet George Sterling, and, in the same year, he organized a tribute to Sterling with a Spring Valley Water Company memorial bench. **[Figure 98]** Surfaced with glazed Mission Revival style terracotta tiles, the bench was installed on the high knoll of the Lombard Street Reservoir, the city's first 19th-century reservoir. Upon the city's highest natural elevation, the site commanded a full view of the bay.[450] The water company's contracted architect Gardner Dailey designed the bench and its park.

Biblical figures as water engineers and ideas in water history from Archimedes and Vitruvius to Da Vinci. See Edward F. O'Day, "Engineers and the Science of Hydraulics: A Dialogue, By the Editor" *San Francisco Water* 8, no. 2 (August 1929): 12-16.

447 See George A. Elliott, "The Use of Steel Pipe in Water Works," *Western Pipe and Steel News* 1, no. 1 (April 1924): 2-5, 8.

448 For O'Day's prospectus on the Santa Monica Bay planned development of Bel Air, see Edward F. O'Day, *Bel-Air Bay: A Country Place by the Sea* (Los Angeles: Alphonzo E. Bell, 1927); it includes poems by California writers George Sterling and Robinson Jeffers, among others.

449 See Mark Daniels, "Beauty and the Utilities," *San Francisco Water* 1, no. 1 (January 1922): 15; and Mark Daniels, "A Public Utility Planning," *San Francisco Water* 1, no. 2 (April 1922): 15-16. Apparently O'Day had known and worked with William Bourn: the Bancroft Library holds a small collection of materials related to Bourn's relationship to O'Day in the Edward F. O'Day Papers, 1847-1928, in which reside material pertaining to an article on the history of Spring Valley and Bourn's Empire Mine community. Further research on O'Day will be a welcome addition to the history of San Francisco arts and culture, and to California public works and urban planning history.

450 Portions of the bench still survive on site, as shown in my photograph. The Lombard Street Reservoir site at the highest elevation atop of Russian Hill's winding Lombard Street is still owned by the city's water division; it is now called George Sterling Memorial Park. Reservoirs are topped by tennis courts, with the steep surrounding reservoir sides lined with stairs and paths, and landscaped as park. O'Day once owned all or part of George Sterling's papers, an archival collection now held at the New York Public Library.

> Mr. Dailey's plan called for a bench uniting beauty with utility, placed at the end of a graveled walk enclosed by trees. The bench was executed by Gladding, McBean & Co. in decorative tile, a medium still new and strange to the general public but widely recognized by artists as a superb vehicle of beauty. Inset is a memorial tablet in bronze. Plane trees that will grow up and interlace their branches were planted on either side of the approach. Behind the bench will rise a screen of noble Monterey pines.[451]

O'Day devoted an issue of *San Francisco Water* to the poet and the memorial park.[452] Photographs of the bench dedication ceremony illustrate the cultural transformation of the formerly utilitarian hilltop reservoir site into a designed landscape with a "dignified" cultural purpose.

O'Day—like PG&E's architect Ivan Frickstad, who penned many articles for the Pacific Gas and Electric Company magazine—was a clear-thinking, history-oriented writer interested not only in design, building, and ornamentation, but also in broader cultural values, whose architectural implications he worked to enunciate. Both Spring Valley Editor O'Day and PG&E Architect Frickstad wrote lucidly for a combined technical, political, and popular audience. Their writing shows that each, within his own context, was mindful not simply of promotional or marketing aims, but also of a proper editorial aim, to educate readers with thoughtfully planned, well written, broadly considered material. These qualities permit one to draw critically from their work, to mine contemporary evidence of aesthetic, social, intellectual, and cultural values regarding the importance of water and its works architecture.

RHETORIC AS ORNAMENT: WATER AND THE WORD OF GOD

For the Spring Valley Water Company, the most common form of rhetorical iconography was the carving of Biblical verses on plaques, friezes, and entablatures.

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451 "To Remember George Sterling," *San Francisco Water* 7, no. 3 (July 1928): 2. Descriptions and photographs of the memorial bench and park appear in Idwal Jones, "Sterling: A Tribute [Reprinted from the *San Francisco Examiner*, November 18, 1926]," *San Francisco Water* 7, no. 3 (July 1928): 4-8. Jones recalls an interesting waterworks-related, literary anecdote about Sterling: "When Jack London built the big dam across his ranch at Glen Ellen, it was Sterling who made the plans and ordered the materials with such shrewdness that when the job was done—and a staunch, handsome dam it was—not a pound of nails or a sack of concrete was left over."

452 The George Sterling memorial issue is *San Francisco Water* 7, no. 3 (July 1928).

Emblazoned with the weight of the Word of God, how could the dignity of these works be questioned?[453] On the 1910 Sunol Temple, a Biblical inscription encircling the entablature frieze led visitors around the temple to work out the phrase: "I will make the wilderness a pool of water and the dry land springs of water the streams whereof shall make glad the city." **[Figure 77, 215]** This combines two verses: Psalms 46:4 of the King James Bible, "There is a river, *the streams whereof shall make glad the city* of God, the holy place of the tabernacle of the most High;" and Isaiah 41:18 of the King James Bible: "I will open rivers in high places, and fountains in the midst of the valleys: *I will make the wilderness a pool of water, and the dry land springs of water.*" Bible verses also appear on the two later Pulgas Temples, which marked the terminus of the Hetch Hetchy Aqueduct on the Crystal Springs Reservoir (the primary storage facility for San Francisco's water supply). The first of these, from 1934, was a temporary temple, a replica of Polk's 1910 Sunol Temple; its Bible phrase was identical with Sunol's.[454]

[453] It is at once self-evident and an oxymoron to talk about *neoclassical Biblical imagery*, especially when the neoclassical forms under discussion directly reference pre-Christian architectural models. The long architectural history of European church forms, first the Roman Catholic Church, derived from ancient Roman basilica and bath architecture; the much later American developments parallel church, bank, and capital building architecture rooted in early-19th-century Latrobean Greek Revival, as I have discussed in this dissertation. In the least rigorous analysis, the Bible poses hermeneutical problems for possible intentions behind iconographical images—we might call these "visual utterances"—that require one to consider ideologies ("motive systems," so to speak) behind images used on corporate or government buildings. To approach the large topic of ideologies humming behind corporate or government water-related utilities, one might discuss a myriad of ways in which combinations of neoclassical and biblical iconographical elements might bolster one another, cancel each other out, or work to cinch or foil arguments for a God- or History-inspired impetus behind economic and cultural achievement in 19th and early 20th century waterworks architecture in California and the American West. For now, I will focus on the case of California in San Francisco, and will avoid a direct discussion of ideology, although my rhetorical analysis of Biblical inscriptions on waterworks buildings for the Spring Valley Water Company will suggest underlying corporate ideological elements. For the purposes of this study, I will state my conclusions and interpretations in terms of "cultural values" and not of "ideology," as my own art historical practice aims simply to identify specific places where visual material indicates or suggests "underlying motive" expressed as an aesthetic term or visual utterance. All of this addresses the attempt to interpret a dangerously imprecise—but highly suggestive—concept, of "corporate cultural practices." This dissertation does not attempt to identify, label, or classify in any exhaustive way the specific nature of those motives, or to discuss the deep fields of the history of philosophy, especially critical theory and poststructuralism that it implies and from which my own approach in part emerges, but it does work to point out and discuss specific places in works of art and architecture where visual material points to motive.

[454] Photographs taken between October and November of 1934 attest to the fact that the temple was wood-framed and plaster-finished in a matter of about two weeks prior to the October 28 publicly-broadcast Completion Celebration. I have found no evidence for the cast Corinthian capitals, the only overt

[Figure 127] Around the 1938 permanent Pulgas Temple entablature (and repeated on a plaque inside the temple's cella barrel) appears the phrase, "I give waters in the wilderness and rivers in the desert, to give drink to my people." **[Figures 129, 130, 131]** This is an excerpt from Isaiah 43:20, American Standard Version (1901): "The beasts of the field shall honor me, the jackals and the ostriches [or "dragons" and "owls;" animal types vary among translations]; because *I give waters in the wilderness, and rivers in the desert, to give drink to my people,* my chosen." Another example, located in the Crystal Springs watershed, is a Biblical inscription around a 1914 Pilarcitos well-head fountain, by Willis Polk: "But the water I shall give him shall be a well of water springing up into eternal life." This is derived from John 4:14 in the 1901 American Standard Version of the King James Bible: "*But* whosoever drinketh of *the water* that *I shall give him* shall never thirst; but the water that I shall give him *shall be*come in him *a well of water springing up into eternal life*." **[Figure 132, 133]**

An unusual combination of façade frieze inscriptions appears on the Spring Valley's Sloat Street Central Pumping Station, another building I will examine in this dissertation. **[Figure 99]** The building features two Biblical inscriptions, inscribed separately on two frieze levels. Centered on the frieze directly above the portal entablature, one excerpt reads, "Let thy fountains be dispersed abroad rivers of waters in the streets," from the King James Bible, Proverbs 5:16. Above the doorway frieze, running nearly the full length of the building's upper frieze, this verse appears: "But the land whither ye go to possess it is a land of hills and valleys and drinketh water of the rain of heaven," from Ecclesiastes 11:11.

In a 1915 issue of *The Pacific Unitarian,* an editorial on religion, civilization, and the soul describes Spring Valley Water Works buildings by Polk, as examples of public monuments fit for "majestic" Biblical verses.

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decoration on the round peripteral grandstand. My conclusion, after analyzing SFPUC photographer George Fanning's artistic series of photographs of the temporary temple in the Photography Archives, SFPUC, all taken the week after the ceremony, on November 4, 1934, that the photo shoot was documentary and memorial in nature, and presages the structure's imminent demolition, presumably before winter rains would begin reducing it to mush.

> The controlling head of our Spring Valley Water Works has shown fine appreciation of Scriptural passages in connection with the edifices devoted to supplying the city with water. On a classical building on Sloat Boulevard housing the pumps that lift the peninsula supply, appear two fine passages: "Let the fountains be dispersed abroad and rivers of waters in the streets," and "But the land whither ye go to possess it is a land of hills and valleys, and drinketh the waters of the rain of heaven."[455]

The article also mentions the 1910 Sunol Temple Biblical inscription.

> At the point where the wonderful subterranean supplies of the Sunol gravel-bed and the Livermore Valley are brought together, a noble water temple has been erected and around its circular entablature is inscribed the words, "I will make the wilderness a pool of water and the dry land *spaces* of water, the *strength* whereof shall make glad the city." Very fitting and beautiful these well-chosen selections.[456]

This is certainly an overblown assessment by critical standards which indicates at best a nod of approval of a part of the religious community that the water company had its eyes on the great provider. Close analysis of the editing of the inscriptions' wording, however, reveals some insight into underlying beliefs and intentions, and suggests that certain elements of architectural style were designed to manage cultural responses to their symbolism. The Sunol Temple inscription is a phrase created by fusing and then editing Isaiah 14:18 and Psalms 46:4. Refer to my italics in the preceding block quote; these highlight selective editing of the quoted Scripture to yield a "Biblical" phrase tailored by and for the water company. The inscription inserts the words "spaces" and "strength" in place of the King James Version's "springs." Without the omissions, the combined Bible verses would read: "I will make the wilderness a pool of water and the dry land *springs* of water … the *springs* whereof shall make glad the city." My italics indicate the edited words, adding an ellipsis mark to show the fusion point of the two verses. When one compares the unedited texts quoted above with the edited inscriptions engraved on the

[455] "Editorial," *The Pacific Unitarian* 24, no. 7 (May 1915): 171. A cover photograph of the Sloat Boulevard Central Pumping Station doorway published in the July 1922 issue of *San Francisco Water* reports that Mrs. Bourn chose the Biblical inscriptions on the building.

[456] My italics. See "Editorial," *The Pacific Unitarian,* 171. See also Richard L. Kagan, *Urban Images of the Hispanic World, 1493-1793* (New Haven, CT: Yale University Press, 2000).

waterworks building, one notes they create cultural inflections. One might call this tampering an example of "Biblical chicanery," to modify and reapply a phrase cited earlier in this dissertation to refer to ideology-inflected cartographic practices in early American history.[457] These water temple inscriptions expose an iconographical practice that seeks to attribute divine "strength" to waterworks "spaces."

A problem arises, as I have intimated elsewhere in this dissertation, when one questions, for example, the disjuncture inherent in a representation that incises a Bible verse into a pre-Christian architectural icon. To examine this question opens plethorae of cultural implications. Historical circumstances of the evolution of Christianity as a countervailing force in western history, the uses of architectural material and space as ways to communicate force within that history, and specific ways in which that history inflects history and urban architecture in the United States, is rich material. Even more specifically, the ways in which developers of urban infrastructures merged visual material into designs whose iconographical messages communicated their aims persuasively to its various audiences is also pertinent, but too large to examine (or even properly introduce) here.

From the point of view of aesthetics, water and hydropower companies employed word-as-iconograph to ornament their buildings, and they hired editors and writers to describe and promote this cultural communication process in their corporate magazines. As much as historical revival forms in water and hydropower buildings invited viewers to imagine they shared in the continuity of time and history, technological modernism forced a rupture in that historical continuity, as Leo Marx's potent image, the machine in the garden, entreats us to consider. An encounter with a new form invites one to imagine an unprecedented future, yet peering ahead toward an unknown form resonates with allusions to past forms. And, when considering an object in time, its current form is both a postscript to a past *and* a prelude to a future configuration. Under the influence of long-held cultural images pertaining primarily to landscape, even new and strange waterworks architecture engages with a familiar and ennobling cultural construct: it stands in dignity.

[457] Kagan, *Urban Images of the Hispanic World,* 107.

Architectural style, landscape design, visual iconography, and literary references together created an image that ascribed human “dignity” to industrial urban waterworks around the turn of the 20^{th} century. And this process of inter-identification applied not only to utilitarian works structures but also to water company headquarters buildings. Water and power companies built these high-rise offices to house and display the corporate work of service, their offering to the civic body.

CHAPTER 7

Spring Valley Water Company's High-Rise History, 1865-1923

Tracing the Spring Valley Water Company's high-rise history is a study in early and continuous high-status corporate waterworks architecture for California. In October 1923, the company announced its new high-rise office building, at 425 Mason Street, a block from Union Square. **[Figure 73]** Celebrating the building's opening, O'Day summarized the company corporate headquarters history:

> [F]or the first time since April, 1906, Spring Valley has a home of its own. During its corporate history of sixty-three years, Spring Valley has but rarely changed its habitation. There has been manifested by this Company a decided tendency to "stay put."
>
> In April, 1860, the first meeting of the Board of Directors was held at the first office of the Company, Number 2, Bolton & Baron's Building, corner of Merchant and Montgomery streets. In August of the same year the office was moved to the southeast corner of Montgomery and Jackson streets. These premises were leased from Pioche & Bayerque, the well-known bankers, at the munificent annual rental of $720.
>
> In 1865 the Company constructed and occupied its own building at 516 California Street, the site afterward occupied by the German Savings Bank.
>
> Thirty-two years later, in December 1897, Spring Valley erected what was known as the City of Paris Building, at Stockton and Geary streets, occupying the sixth floor with an entrance on the Stockton Street side. This had been the site of the famous old Wigwam Theater. The Company remained at 126 Stockton Street until burned out in the catastrophe of 1906. Thereafter the site was disposed of, and the new City of Paris arose there in due time.
>
> From April to August of 1906, Spring Valley occupied temporary offices at Herman and Waller streets, on the old "Market Street Reservoir" lot. Thence it moved to the beautiful old Theodore Payne residence at 1409 Sutter Street, remaining there until May of 1908, when it leased the Driscoll Building at 375 Sutter Street, from which it has just departed to a new home of its own.
>
> The brand-new home of the water company is on Mason Street, at the corner of Derby, between Geary and Post. Across the street is the Native Sons Building, and north of that the First Congregational Church. Spring Valley has very nice neighbors.[458]

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458 "A Home of Our Own," *San Francisco Water* 2, no. 4 (October 1923): 1-2. The article was likely penned by Editor Edward F. O'Day. City directories, period letterhead, *San Francisco Water* magazine mastheads, and company *Minutes* confirm office street addresses. The company was technically known as

I reprint the entire list and description of the company's high-rise history in the block quote above in part to give readers a point of reference as I discuss the water company's architecture. But I also include it because this information is essentially inaccessible; unpublished and uncirculated in history proper. The company's architectural timeline grounds a major revision in San Francisco water history.

THE WATER COMPANY'S BEGINNINGS IN CORPORATE ARCHITECTURE

The company established offices in prestigious buildings from its 1860 founding to its dissolution when the City purchased it in 1930. Prior to the construction of its own first building in 1865, the company rented offices of respected banks and attorneys.[459] The company's first high-rise headquarters, at 516 California Street, on or near the corner of California and Montgomery Streets, stood in the central hub of San Francisco's

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the Spring Valley Water Works until 1903, when the Spring Valley Water Company became the company name for all consolidated structures, system elements, and files. In 1930, the Spring Valley Water Company in turn was purchased by the City of San Francisco and administered via a City Commission, which was soon named by its current title, the San Francisco Public Utilities Commission. Piecing together the architectural history of each of the water company's office buildings is a work in progress. Original Spring Valley Water Works Company (SVWWC) *Minutes* typescripts, volumes A – G (except B) held in the Documents Archives, San Francisco Public Utility Commission (SFPUC), confirm office addresses reviewed in the excerpt in the block quote here. The *Minutes* (Aug. 21, 1860) confirm SVWW leased offices from Pioche & Bayerque and also confirm meetings held at Bolton and Barron's in 1860. The company added stockholders (including F.L.A. Pioche, who also may have been a lawyer for the company) when it increasesd its capital stock from 60,000 to 3 million shares in June 1860, announced in the *San Francisco Daily Times* at least weekly between May 29 and June 6. See *Minutes*, June 23, 1860; and *Minutes*, August 14, 1860. The transcripts of *Minutes* for June 15, 1861 to April 1, 1875 (volume B) are missing from the SFPUC collection; the Bancroft Library at the University of Califronia, Berkeley, lists them as held in the Spring Valley Water Company Collection. The *Index to Minutes of the SVWW, volumes A-G* (volume A: 59) refers to the California St. lot and building under the entry "Office of the Company," sub-headings: "Committee on. B. 194;" "Lot on California St. for. B. 195;" "Committee on. B. 194;" "Insurance of. B. 215." Extensions and changes to the California Street office building are discussed in the *Minutes*, April 1, 1885 (committee appointed "to report on the expediency of building an addition in the road for a Directors room") and Dec. 17, 1885. In 1889, the company seems to have added space and increased its address listing, suggesting it annexed adjacent buildings: "the rooms occupied by the President to-wit – Rooms No. 29 and 30 in the building 508 to 514 California Street be and the same are hereby adopted as and made part of the office of this corporation and that until otherwise ordered, the office of this corporation shall be at No. 508 to 516 (inclusive) California Street." See *Minutes*, May 1, 1889.

[459] The buildings were also associated with men who had associations with the water company. From my general purview of Spring Valley Water Works/Company Minutes, city directories, and local news reports, I surmise that in addition to banking, members of the Pioche family also worked as or with lawyers for Spring Valley Water Company, and these names appear in early water company investor lists.

financial district along California Street, a main axis leading from the original port at Yerba Buena Cove.[460] **[Figures 134, 135, 136, 137]** San Francisco architect John P. Gaynor may have been the building's architect, judging from an elevation and plan

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460 For San Francisco's layout near this time, see "San Francisco & vicinity. United States Coast Survey, 1853," David Rumsey Map Collection, accessed March 14, 2015, http://www.davidrumsey.com/maps1645.html. Compare the Coastal Survey with a composite map from 1850 showing downtown platting overlaid upon the original shoreline of Yerba Buena Cove, "Map of San Francisco Showing Business Section and Waterfront," Ron Henggeler, accessed March 14, 2015, http://www.ronhenggeler.com/History/yerba_buena/1851map.htm. At the time of the Spring Valley Water Company's sale of its first high-rise in 1897, the former headquarters building was located at 503-516 California Street, inclusive. The German Savings Bank to which O'Day refers, was called the German Savings and Loan Society, established in 1868. See Richard Germain, *Dollars Through the Doors: A Pre-1930 History of Bank Marketing in America* (Westport, CT: Greenwood Press, 1996), 102. Photographs in the San Francisco Public Library's Historical Photograph Collection show the German bank society identified with a two-story Gothic Revival building at 526 (or possibly 516) California Street by 1896. Post-1906-earthquake damage photographs seem to identify that building and the much larger adjacent multi-story block-style corner building as also belonging to the German Savings Bank. But this conflicts with a report that in 1899 the Equitable Gas Company made the Spring Valley Water Company's former building its headquarters, apparently continuing its public works occupancy: "The first annual meeting of the stockholders was held yesterday afternoon In the company's new offices, 516 California Street, formerly occupied by the Spring Valley Water Company. …The new gas company occupies the entire building at 516 California Street, the main floor being devoted to the counting room and for the display of gas stoves of every description, meters, and other appliances. The upper floors are used by the officers and directors, while the basement is used for testing meters and as a general supply and store room." See "Equitable Gas Company is in Full Operation," *San Francisco Call* February 22, 1899. Complicating matters is an 1898 entry in the SVWW *Minutes,* Documents Archives, SFPUC, reporting that the water company accepted an offer by the German Savings and Loan Society of $25,000 for the sale of the office building at 516 California Street; photographs suggest that this building was a two-story building adjacent to the company's building(s) at 508-514 California Street. Further research will sort this out. In the *Minutes* in which the sale is reported the lot is described specifically as follows: "Commencing at a point on the northerly side of California Street distant one hundred and thirty seven (137) feet six (6) inches westerly from the Westerly line of Montgomery Street, running thence westerly along the northerly line of California Street twenty-two (22) feet, three (3) inches; thence at right angles northerly one hundred and thirty-seven (137) feet, six (6) inches; thence at right angles easterly twenty-two (22) feet, three (3) inches; thence at right angles southerly one hundred and thirty-seven (137) feet, six (6) inches to the place of beginning. " See SVWWC *Minutes,* Sept. 22, 1898. The property is described slightly differently in the Trustee Meeting *Minutes* of October 27, 1898: "Beginning at a point on the northerly line of California Street distant one hundred and thirty seven (137) feet and six (6) inches; thence at right angles and parallel with Califronia Street, westwardly twenty-two (22) feet and three (3) inches; thence at right angles and parallel with Montgomery Street Southwardly one hundred and thirty-seven (137) feet and six inches to said northerly line of California Street, thence eastwardly along said northerly line of California Street, thence eastwardly along said northerly line of California Street, twenty-two (22) feet and three (3) inches to the place of beginning."

drawing by Gaynor, hand-labeled “Spring Valley Water Company.”[461] **[Figures 138, 139]** It is not clear whether Gaynor’s plan was ever built.

Gaynor’s project shows a two-story corner masonry building, one face with two bays and the long, entry face with nine bays, stylistically an early example of a Victorian-era Gothic-inspired neoclassical eclectic. Of the two tower-like bays, one frames the building entrance, with its keystone arch topped by an abbreviated tympanum centered on an entablature band. The keystone arch springs from imposts of stacked masonry and an adjacent half-column, all on pedestals whose height articulates the basement foundation at street level. One of the two tower-like bays frames the entry’s alcove porch; the second of these tower-like bays frames not a door but large window panes, and is fashioned as the entry’s twin, for symmetry’s sake. Crowning each of the tower-like bays is a half-arch ornamented at the center with an iconographic sculpture of a splaying fountain flanked by urns on pedestals. Pedestaled urns mark each of the building’s corners as well, with a balustrade running between them along the full length of the building’s crowning edge. The moulding below the balustrade and rooftop ornaments is in the form of a plain running frieze supported by eave brackets. The linear band is interrupted only by the half arches and ornamental fountain arrangements that ride atop the two tower-bays. The building’s corners feature stacked stone corner pilasters, which in a quasi-Queen-Anne

[461] Undated hand drawing of a corner building elevation and plan, labeled with Gaynor’s name and the address of his offices held in the Document Archives, SFPUC. Gaynor’s project drawing, which does not correspond to a known building, was designed for a corner lot. The drawing includes Gaynor’s architectural office address at the time, which I have confirmed with city directories. At 315 California Street, Gaynor’s office was two blocks from the Spring Valley building. Gaynor had begun working in San Francisco in the 1850s, after success in New York City. His claim to architectural fame in Manhattan—still a noteworthy building today—was his 1857 Haughwout Building, a Venetian-Renaissance Revival structure whose column orders were derived from the Sansovini Library in Venice. The structure featured the first successful elevator in the world, an Otis Hydraulic Lift, and Gaynor’s designs in wrought iron made him and his fabricator famous. Considered a master of innovative building technology, Gaynor was appointed architectural advisor (with San Francisco architect David Farquharson) on San Francisco’s Joint Committee on Earthquakes, formed in 1868 after a major earthquake. See Stephen Tobriner, *Bracing for Disaster: Earthquake-Resistant Architecture and Engineering in San Francisco, 1838-1933* (Berkeley, CA: Heyday Books, 2006), 52-53. In the 1870s, Gaynor gained in local prestige with his 1875 Palace Hotel; other hotel commissions followed. In 1878, he built the prominent Conservatory of Flowers in Golden Gate Park, originally intended for the private estate of James Lick, whose sudden death cancelled the installation. Gaynor constructed the greenhouse, with prefabricated panels from still-unopened crates, at its existing site in Golden Gate Park.

vernacular resemble corner quoins on a redwood Victorian mansion, but, with their base pedestals and stylized capitals, they are clearly meant to give the impression of columns in antis. One of the two corners in the façade elevation expresses much more depth than the other, with two or three columns edges carved adjacent, creating the illusion of a three-column arcade at the side of the building. The plan drawing reveals that the deeper articulation corresponds to a street corner façade, and is a modest example of a lively San Francisco trend along California Street in the 1860s and 70s, with the most exalted examples of this corner column featuring corner entrances. **[Figure 140]**

Primary evidence is scant regarding Spring Valley's California Street building. The details one can piece together—number of floors, addresses indicating the location and suggesting building extent, records of expansion plans, documentation of the 1897 building sale, post-1906-earthquake documentary photographs—lead one to surmise that Gaynor's surviving drawing was *not* selected as the company's 1865 headquarters.[462] **[Figure 136]** Whether or not Gaynor were the architect for the final building design, his existing project design admits to the company's search for an esteemed contemporary architect who could build in the financial district's prevailing design mode.[463]

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462 For example, photographs of post-earthquake remains of California and Montgomery corner buildings reveal what appears to be an inside wall along Montgomery Street (facing the Kohl Building) of as many bays as the California Street face, a larger, taller, square structure than Gaynor's plan illustrates.

463 Architect John P. Gaynor, who served on the Earthquake Committee after the 1868 temblor, had his architectural offices down the street at 315 California Street; the city directory places Gaynor in the building by 1872, in rooms 13-14. See Henry G. Langley, *San Francisco Directory* (San Francisco: Valentine & Co., 1872), 268; (1878), 348, 369; (1879), 352. By 1878, water businesses within Gaynor's office building included The California Water Company and the Excelsior Water Company. Other waterworks companies listed in the city directory in 1878 are the Virginia and Gold Hill Water Company at 47 Nevada Block, and Goodall Perkins at 10 Market Street. According to the same directory, the Spring Valley Water Works/Company hired Goodall Perkins in 1878 for water witching services. Spring Valley Water Works/Company listing for 1878 places it two blocks from Gaynor's California Street building. This was in the next block up from Bourn, Jr.'s offices, at 516 California Street, with Chas. Webb Howard listed as President. See Langley, *San Francisco Directory* (1878), 384, 802, and 1069 under the heading "Water Works." William Bourn, Sr.'s own offices evidently once were located at 401 California, across the street from the Bank of California building of 1868 (whose architecture I will discuss in this dissertation), the first building of major Greek Revival architecture in the financial district. Bourn's former building lot is now the site of the 1910 Robert Dollar Building by W.S. Schmolle at 311 California Street, expanded in 1919 by Charles McCall. See "311 California Street," The Robert Dollar Building, accessed March 3, 2015, http://www.311californiastreet.com/history.htm.

SPRING VALLEY WATER COMPANY'S UNION SQUARE OFFICE BUILDING: CORNERSTONE FOR A FUTURE EPICENTER OF LUXURY COMMERCE

In 1896, after more than three decades on California Street, the company built its second high-rise office building, on a lot chosen and developed for dignity and prestige. The seven-story building, by prominent San Francisco architect Clinton Day, anchored the southeast corner of Geary and Stockton Streets facing Union Square.[464] Architecturally, it was "one of the earliest examples in San Francisco of a large commercial structure designed in the Beaux-Arts style, using steel framing and masonry wall infill for its basic structure."[465] **[Figures 91, 92]** Before building, the water company had owned the lot for years, leasing it to various establishments, most recently to the culturally-prominent Wigwam Theater, whose building was quite unremarkable

[464] Clinton Day, of San Francisco, was the architect for the original building. James R. Miller, of San Francisco, was the Architect for the 1908 reconstruction, with Bakewell and Brown, Architects, of San Francisco responsible for the design of the interior rotunda and dome. The water company sold the building to the Union Square development company in December 1908. See "City of Paris Dry Goods Company, Geary & Stockton Streets, San Francisco, San Francisco County, CA," Library of Congress, accessed March 3, 2015, http://www.loc.gov/pictures/collection/hh/item/ca0632/. See also *California Architect and Building News* 18 (November 1897).

[465] On December 16, 1897 the *Minutes* of the Spring Valley Water Company report the new office location "at No. 126 Stockton Street." In the Historic American Buildings Survey (HABS), the Spring Valley Water Company building is catalogued as "City of Paris Dry Goods Company." This HABS listing identifies the parcel as Lot 14 in Assessor's Block 313, with the original owner being the Spring Valley Water Company. Clinton Day, of San Francisco, was the architect for the original building. James R. Miller, of San Francisco, was the Architect for the 1908 reconstruction, with Bakewell and Brown, Architects, of San Francisco responsible for the design of the interior rotunda and dome. The water company sold the building to the Union Square development company in December 1908. See "City of Paris Dry Goods Company, Geary & Stockton Streets, San Francisco, San Francisco County, CA." See also *California Architect and Building News* 18 (November 1897). From the 1880s, as the property owner of the corner lot, the Spring Valley company contracted to lease the property several times, for example, to C Devereaux, Esq. from 1886 to 1906 with the option to buy it at the end of the lease period (*Minutes*, May 21, 1886). Discussions of leasing appear several times in the *Minutes* (Sept. 2, 1888; Aug. 21, 1890; June 4, 1891; May 4, 1893), Documents Archives, SFPUC, including mentions of the termination of a lease when a building stood on the property (July 24, 1890). The *Index* to volumes A-G of the company *Minutes* refers to the "Starr King Building" in reference to the Geary-Stockton lot. See *Minutes,* Dec. 17, 1888 and *Index*, 33. In some entries the property is listed as the "Wigwam," as the Wigwam Theater evidently leased it from the water company, and the theater was demolished in order to build the 1897 office building. In a photograph of the surviving shell of the Spring Valley/City of Paris building after the 1906 earthquake and fire, the understated entrance to the water company appears at the southeast corner of the building facing Stockton Street. By contrast, the entrance to the City of Paris retail store was prominently located at the center of the Geary Street elevation, emphasized by a formal, arched, and ornamented entrance portico articulated from base to crown

architecturally. **[Figure 141]** Willis Polk owned a photograph (c. 1890) of the theater on that corner, which historian Richard Longstreth supposed Polk used for "study purposes."[466] When Spring Valley built there in 1896, it demolished the Wigwam.[467] This was the first major building to define Union Square as a modern architectural and commercial centerpiece. Period views of Union Square prove the water company building to be both imposing and stabilizing on its corner. It was taller than anything on the skyline except for the brick smokestack of what I conclude to be the 1888 Jessie Street works building.[468] **[Figures 91, 92]** Formerly, several churches were on the periphery, and a mechanics hall had occupied the square grounds until about 1870. But the Spring Valley Water Company building inaugurated the square's new image of urban distinction. **[Figures 142]** Rapid development around the turn of the century included the square's transformation into a formal garden, and architectural additions like the twelve-story St. Francis Hotel, under construction at the time of the 1906 earthquake, lorded over its peripheral spaces.

In 1898, the city's rival newspapers, the *San Francisco Call* and the *San Francisco Chronicle*, had completed their famous high-rise competition on Market Street, with Spreckels' *Call* building out-rising De Young's *Chronicle*. In common views after

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466 Study for what, exactly, Longstreth does not speculate; that Longstreth singles out this photo is interesting to consider in light of Polk's later architectural work with the water company, but Longstreth does not discuss public utilities architecture is a part of Polk's *oeuvre*. Longstreth cites the source of the photograph only as the CED (College of Environmental Design Archives at UC Berkeley). Documents Collection. One presumes it is held in the Willis Polk Collection, but I have yet to investigate the citation. See Longstreth, *On the Edge of the World: Four Architects in San Francisco at the Turn of the Century* (1983, repr., New York: Architectural History Foundation, 1998), 239.

467 Spring Valley Water Company *Minutes* from the company's founding in 1860 to the construction of the Union Square building in 1896 and the sale of the company's California Street structure in 1897 confirms Spring Valley Water Company's City of Paris building replaced the Wigwam Theater in that location. See SVWWC *Minutes*, Documents Archives, SFPUC.

468 In Willis Polk's own late-19th-century sketch of the city skyline from Nob Hill, the architect depicts the smokestack that appeared in period views of Union Square and the Spring Valley Water Company and the Call Building. In Polk's sketch, calligraphic plumes issue dramatically from the smokestack, which holds the center of his composition. My conjecture, having guessed the stack to belong to the Jessie Street Substation after examining period photographs, is that Polk emphasizes the smokestack to call attention to it as a marker of his initial work on public works architecture in the city. The sketch is reproduced as the double-page frontispiece in Willis Polk, *A Matter of Taste: Willis Polk's Writings on Architecture in* The Wave, ed. Richard Longstreth (San Francisco: The Book Club of California [Publication No. 161], 1979), frontispiece.

1898 taken from Union Square, the 1898 *Call* building dominates the skyline. Union Square's flagpole dates pictures before 1903, when a monumental column took its place. One notes in typical views that, even though the *Call* building towers above the far center ground, the Spring Valley structure solidly establishes the foreground, the only building able to provide a proportional structural mass to balance the *Call*'s architectural proclamation. The Spring Valley Water Company structure anchors the corner of Union Square in the central foreground, with the Square occupying the lower foreground. One must keep in mind that when it was built, and for at least two years after its completion in 1896, the water company building was the tallest structure on the skyline—neither the 1898 *Call* building nor the 1903 Corinthian monument existed. The Spring Valley building, and its luxury retail tenant, the City of Paris Dry Goods Co., were central to defining Union Square's prestigious with advanced architecture.[469]

The City of Paris department store had already been famous in San Francisco for nearly 50 years by the time it occupied the water company building at Geary and Stockton in 1896, and the store made an immediate cultural claim on the space. The building was soon, and permanently, identified as "The City of Paris Building."[470] The

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469 The deed to Union Square was transferred to the City of San Francisco just before the turn of the century, designating it as a public square. This act commemorated San Francisco's role in the Spanish-American War of 1898, during which time the City became an important naval port and the embarkation center for troops sent to the Philippines. After the war, civic sentiment backed a movement to erect a monument to memorialize the destruction on May 1, 1898 of the Spanish Fleet in Manila Bay by Commodore Dewey's squadron. Mayor James D. Phelan (who would later play a key role in City, State, and Senatorial water politics and what one might call waterworks capitalism for personal financial gain), organized a citizens' committee, who selected Union Square as the site for a monumental memorial column. After a redesign of the square, President Theodore Roosevelt dedicated it on May 14, 1903. Readers should note that any historic photograph that includes the Union Square *column* is a post-1903 photograph. Before the column went up, a simple, slender *pole or mast* centered the square. The Historic American Buildings Survey (HABS) shows an undated photo of Union Square after the Call Building is up but before the Union Square monument was dedicated in 1903, which, by calculation, dates the photo between 1898 (the Call Building's construction date), and 1903 (the memorial column's erection date). I take time to explain these changes because period pictures, more plentiful after the Spring Valley Water Company and Call buildings went up between 1896 and 1898, are often undated, or simply dated "c. 1900."

470 The store began in 1850 when Paris merchant Lenier brought a shipload of goods into San Francisco harbor, with immediate and continuing success. It had a variety of different locations through the decades, before anchoring on Union Square. The Pacific Coast Architecture Database reports on the City of Paris location before moving into (erroneously reported as "replaced by") the Spring Valley Water Company structure in 1896: "In 1880, [an] ornate, Second Empire Style building, its facade an undulating wave of bay windows, served as the City of Paris Department Store until about 1896. It was replaced by a Clinton

store entrance was the building's central, full-height, tripartite portico on the Geary Street façade. All along the first-story frieze above the awnings, "City of Paris Dry Goods Co." appeared in repeated sequence, like a Wall Street ticker tape. **[Figures 143, 144, 145]** Except for the water company's initials and the building's date carved on a stone crest centered on the roof's crowning cornice far above the central entrance, the water company's presence was nowhere to be seen. The small side entry to its offices were located at the building's back corner on the Stockton Street side, invisible from the prominent Geary Street store entrance portico. On the building's otherwise elegantly designed exterior, the water company's entrance is an anomaly. It was not simply understated, but architecturally inferior. Compressed into its back corner, the entrance door was flanked by two narrow Ionic columns squeezed into a cramped porch space. Its ill-proportioned ornamentation is incoherent with the otherwise elegant design of the building as a whole. Apparently, the water company's success—creating Union Square's luxury distinction by planting the City of Paris on that corner—was so complete as to obliterate the company itself from the architectural record of its own building. The Historic American Building Survey identifies the structure as the City of Paris building, with the Spring Valley Water Company listed parenthetically.[471]

After the 1906 earthquake and fire had gutted it, William Bourn purchased the company and sold the building to the Union Square Development Company, who rebuilt

Day building…." See "City of Paris Dry Goods Company, Department Store #3, San Francisco, CA," Pacific Coast Architecture Database, accessed March 4, 2015, https://digital.lib.washington.edu/architect/structures/6052/.

[471] In the Historic American Buildings Survey of the Library of Congress, the 1896 building's entry title is "City of Paris Dry Goods Company" with "Spring Valley Water Company" as a subtitle (HABS CA-2019; HABS CAL, 38-SANFRA, 135). According to this HABS entry, "after 1909 the City of Paris Dry Goods Co. was the principal (later the sole) tenant," and Bourn opened the Spring Valley Water Company in leased 375 Sutter Street, the Driscoll Building, a block off Union Square. The City of Paris remained in the Geary-Stockton Union Square building until the 1970s, when the Liberty House department store moved in. In the 1980s retailer Nieman-Marcus purchased the site, and against a wave of public protest demolished the City of Paris building, agreeing to preserve its famed central atrium and stained glass dome. The Texas retailer shifted the atrium of a piece out of the building's center, incorporating it as the new building's prominent corner entrance, the configuration of the building to the present. This continues the building's legacy as high-status architectural anchor for the corner of Geary and Stockton Street corner of Union Square.

the salvageable exterior shell for the exclusive tenancy of the City of Paris.[472] Led by architect James R. Miller, post-quake reconstruction occupied two years. The store's most notable feature was designed by Bakewell and Brown, prominent among San Francisco's new guard of architects trained at the University of California in Berkeley.[473] They designed the store's signature feature, a full height open central atrium, balconied and colonnaded, topped by a stained-glass dome.

After the earthquake, the water company moved temporarily into Theodore Payne's prominent corner Victorian residence on California Street, away from the financial district—all businesses moved into temporary quarters while the destroyed downtown regions were under reconstruction. **[Figure 146]** A major such business district formed along Van Ness Avenue, which had been the dynamite line preventing the 1906 fire's spread.[474] During this time, William Bourn purchased the Spring Valley

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[472] The water company sold the building to the Union Square development company in December 1908. See "City of Paris Dry Goods Company, Geary & Stockton Streets, San Francisco, San Francisco County, CA." See also *California Architect and Building News* 18 (November 1897). James R. Miller, of San Francisco, was the Architect for the 1908 reconstruction, with Bakewell and Brown, Architects, of San Francisco responsible for the design of the interior rotunda and dome. The water company sold the building to the Union Square development company in December 1908. The exterior of the reconstructed building was the original from 1896. During post-earthquake reconstruction, the City of Paris set up shop temporarily in a renovated Victorian mansion on Van Ness Avenue, until the Union Square building reopened in1909.

[473] The architects also represented the force of Daniel Burnham's White City and New York Beaux-Arts leaders McKim, Mead and White, with whom A. Page Brown had worked. Brown had been a Willis Polk mentor, as well.

[474] A photo of the Payne house in the 1880s appears online at "Artistic Homes of California: Residence of Mr. Theodore F. Payne, 1409 Sutter Street, S.F.," Historical Photograph Collection, accessed March 4, 1915, http://sflib1.sfpl.org:82/record=b1020971. In 1908 Bourn purchased the Spring Valley Water Company. Gray Brechin contends, without citing sources,that Bourn purchased the Spring Valley Water Company with profits from his sale of his gas and electric utility holdings as he and others arranged for the 1905 final merger leading to the incorporation of the Pacific Gas and Electric Company. He also cites evidence that "shortly before the formation of [PG&E, Bourn] incorporated the Northern Water and Power Company with the intention of bringing power and water to the Bay Area from the Yuba River." PG&E designed a massive hydropower system on the Yuba River watershed by 1912, as I discuss in this dissertation. See Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin, with a New Preface* (1999, repr., Berkeley: University of California Press, 2006), 264, 349-50 n. 23. Ferol Egan does not make this explicit claim for Bourn, but presents a timeline of events in a detailed and clearly cited discussion of the PG&E company formation, from the specific viewpoint of Bourn's role in it. Bourn's accession of the Spring Valley Water Company just after the PG&E merger and the earthquake and fire a few months later, which gutted the Spring Valley Water Company office building, was probably due to a combination of factors, perhaps a matter of utility sale profits, post-earthquake timing, and the collective shares of company stock Bourn had amassed over time, along with other factors, that urged and enabled Bourn to

Water Company, then moved it into the Driscoll Building, at 375 Sutter Street, a block north of Union Square near the corner of Sutter and Stockton Streets.[475] Next door, the Pacific Gas and Electric Company's first high-rise was under construction.[476] Both buildings survive. The water company and newly-incorporated gas and electric works were neighbors for 20 years. In 1923, the water company moved into its Polk-designed headquarters on Mason Street.[477] **[Figure 73]**

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buy the Spring Valley Water Company at this time. There is not space in this dissertation to examine this issue fully.

475 In 1878, William Bourn [II], future owner of the Spring Valley Water Company and son of William Bourn [I], the Empire Mine magnate, had recently to San Francisco after two years preparing for entrance into Cambridge University. His mother called him home when the family fortune and businesses, particularly the Empire Mine, needed direct supervision after his father's death. Bourn had left for Cambridge two years after W. B. Bourn [I] had died, from a self-inflicted but probably accidental gunshot wound. The family businesses faltered after Bourn [I]'s death and in Bourn [II]'s absence, so Bourn returned to San Francisco to the full-time management of the family businesses from its San Francisco office building at 401 California Street. See Ferol Egan, *Last Bonanza Kings: The Bourns of San Francisco* (Reno: University of Nevada Press, 1998), 160. Upon his return from England, Bourn moved into the Palace Hotel; he lists himself in the 1878 *San Francisco Directory* as "W. B. Bourn, Capitalist, Palace Hotel." See Langley, *San Francisco Directory* (1878), 172. The same directory also lists "David L. Parkhurst, Agent, Estate of Wm. B. Bourn[e], 401 California, Rm. 3." See Langley, *San Francisco Directory* (1878), 683. William Bourn I had owned the office building at 401 California Street since before 1873, presumably as an office for the administration of his own businesses; more research is needed to confirm details. See Egan, *Last Bonanza Kings.* Currently the property at 401 California Street is the site of a Chase Bank office, and is directly across the street from the Bank of California site, famed since 1867 as one of the most prestigious architectural addresses in San Francisco's California Street financial district. The pre-earthquake building was an 1868 Second Empire style building known for its structural engineering and a focus of the Joint Committee on Earthquakes; the post-earthquake, extant structure is a Beaux-Arts-inspired bank temple modeled iconographically on the 1st century AD Imperial reconstruction of the Republican-era Temple of Castor and Pollux in the ancient Roman Forum. Later in this dissertation, I discuss the 1908 Bank of California as a possible referent for Michelson and Day's 1938 Pulgas Water Temple.

476 The Pacific Gas and Electric Company's first high-rise office building, designed in 1908 by Frederick H. Meyer, at 445 Sutter Street, corner of Stockton and Sutter, a block northeast of Union Square. The building's completion coincided with the inauguration of the company's monthly *Pacific Gas and Electric Magazine*; the publication later changed its name to *Pacific Service Magazine.* See a photograph of the new office building, still under construction, in "General Offices," *Pacific Gas and Electric Company Magazine* 1, no. 1 (June 1909): Frontispiece. For the online Pacific Coast Architecture Database (PCAD) entry listing Meyer as the building's architect and referring readers to Meyer's drawings at the UC Berkeley Environmental Design Archives, see "Frederick Herman Meyer," accessed March 14, 2015, http://pcad.lib.washington.edu/person/762/.

477 Willis Polk's 1922 Spring Valley Water Company building still stands at 425 Mason Street, two blocks west of Union Square, south of the corner of Mason and Post. Later, in 1947, architect Lewis P. Hobart drew plans for additions to Polk's 1922 office building but as yet I have not confirmed whether these were undertaken (Author's examination of an uncatalogued blueprint of a Hobart design, held in the Engineering Archives, San Francisco Public Utilities Commission, Millbrae offices). Hobart was another prominent San Francisco architect involved in waterworks-related architectural and landscape planning. In 1923 when

the Mason Street building opened, Hobart was the Advisory Architect of San Francisco's elite Olympic Club, which in 1923 finalized a purchase of land from the Spring Valley Water Company to build the Lake Merced golf course. Hobart oversaw the architectural design competition for the golf course clubhouse, the winner of which was announced in February 1923. See "Great Golf Future [Reprinted from *The Olympian*, February 1923],"*San Francisco Water* 2, no. 2 (April 1923): 11. The entire April 1923 issue of *San Francisco Water* is devoted to discussion of history and development plans for the Lake Merced golf course and its architecture. Gardner Dailey laid out the Spring Valley Water Company's Lake Merced equestrian trails. See "Lake Merced Trails," *San Francisco Water* 3, no. 4 (October 1924): 1-2.

CHAPTER 8

Water Iconography as Keystone:
Willis Polk's Spring Valley Water Company Office Building (1923)

From the roof of the 1922 Spring Valley Water Company office building at 425 Mason Street, one has a bird's eye view of two celebrated Beaux-Arts buildings in the same two blocks. Directly across Mason Street, the 1912 high-rise headquarters of the Native Sons of the Golden West fraternal organization stands. Next door to the Native Sons building is the 1914 First Congregational Church, designed as a "White City" building in the Corinthian Order, by the prominent firm, Reid Brothers, Architects.[478] **[Figure 147, 148]** The three buildings still exist, an urban timeline in post-quake architecture. Upon the 1923 opening of the new water company headquarters, the Spring Valley magazine *San Francisco Water* described these neighboring structures as placing the water building "in good company."[479]

By comparison with the more elaborate Beaux-Arts types across the street, "the plans for the new building show a structure in which the note of simplicity is strongly emphasized."[480] **[Figure 73, 149]** The three-part Renaissance Revival columnar composition was typical of understated high-rise styles: the seven-story building divides

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478 Reid Brothers, Architects (also known as Reid & Reid), the prominent firm who designed the 1914 church (San Francisco Landmark No. 177), also designed the Millwright's Cottages for the Dutch Revival windmills that provided the water supply for Golden Gate Park's development; I discuss the windmills elsewhere in this dissertation. See "Designating the Murphy Windmill and Millwright's Cottage, at the West End of Golden Gate Park, as Landmark No. 210 pursuant to Article 10 of the Planning Code," Ordinance No. 122-00 (2000), City and County of San Francisco, Board of Supervisors, accessed March 4, 2015, http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances00/o0122-00.pdf . The firm had also built the nearby Cliff House building to replace the original one, in 1908. See photograph "Cliff House, San Francisco, Reid Bros., Architects," *The Architect and Engineer of California* 28, no. 3 (April 1912): 61. In Golden Gate Park in 1899-1900, the firm built the centrally-located cultural icon, the Spreckels Temple of Music in the Music Concourse in Golden Gate Park. Other prominent San Francisco designs include the 1894 Mills Building; the Call Building in 1898; the first phase of the Fairmont Hotel (gutted in the 1906 earthquake and rebuilt by California architect Julia Morgan after newly-consigned architect Sanford White, of McKim, Mead and White, was murdered). The firm also built several landmark Bay Area and West Coast theaters.

479 "Spring Valley's New Building," *San Francisco Water* 2, no. 1 (January 1923): 12.

480 "Spring Valley's New Building," 12.

vertically into a classical order, with base, shaft and capital. The capital section of this building, created by the penthouse floor, is in the form of an entablature set off by a modest classical cornice above and architrave below the frieze of windows. The shaft segment, that is, the office block, exhibits simple stone-framed windows on each floor. The base-level entry façade distinguishes the building. Double-story in height, the stone frontispiece wraps around the corners of the facade. Four stylized Tuscan pilasters articulate and anchor the building's corners, and a pair of pilasters stand astride the center entrance. Double-story paned windows are set between entrance and corner pilasters, one window on each side of the entrance. Over the arched entry, a masonry keystone connects the capitals of the doorway pilasters. The water company's name appears over the entrance, carved into the entablature at the building's lower third. Structurally, the building is "reinforced concrete, with foundation, walls, and columns capable of carrying two stories more" if an addition beyond the original seven stories were needed.[481]

SPRING VALLEY'S INTERIOR WATER ICONOGRAPHY PROGRAM

Willis Polk was the Mason Street architect and builder, and also was a member of an interior and garden design team: "the scheme of interior decoration was the work of an art committee consisting of Henry Atkins, Willis Polk, Bruce Porter, and Gardner Dailey."[482] Interiors were typical of a standard office lobby of good design and materials,

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481 The building remained at the original seven stories. "Spring Valley's New Building," 12.

482 "Spring Valley's New Building," 12, and Edward F. O'Day, "A Home of Our Own," *San Francisco Water* 2, no. 4 (October 1923): 1-3. Dailey was a prominent California landscape architect (he designed the Mason Street office building's roof garden, and would replace Polk as architect for the Spring Valley Company after Polk's 1924 death); Porter was an artist and designer who partnered with Polk on many building projects over the decades; and Atkins was partner in an important San Francisco art gallery, Vickery, Atkins and Torrey.A sampling of these men's influence on art and culture in the San Francisco Bay Area includes such activities as the following. Polk and Porter founded arts and literary groups in San Francisco, and worked together on many residential projects, most prominent for this study being William Bourn's Filoli estate. Atkins, Porter, and Putnam were instrumental in the success (and subsequent fame) of a pottery studio instituted as part of health treatments at the Arequipa Sanatorium, a residential tuberculosis health facility designed by architect John Bakewell in 1911, established when cases of the disease increased dramatically among women laborers after the San Francisco earthquake. See Suzanne Baizerman, Lynn Downey and John Toki, *Fired By Ideals: Arequipa Pottery and the Arts and Crafts Movement* (San Francisco: Pomergranate Press, 2000), especially the essay by Downey, "The Arequipa Sanitorium and Its Pottery," 17-25.

judging from a photograph the company published shortly after the building opened. **[Figure 149]** Inside the central street entrance foyer, the main floor service area was defined by teller screens of glazed wood paneling.[483] An open waiting area in front of the elevators was furnished as a lobby, in oak; tall side tables on either side of a long bench displayed sculpted stone fruit arrangements; and near the bench stood a waist-high Parson's-style bank table. A description of the room appeared in the October 1923 issue of *San Francisco Water* celebrating the building's opening:

> The first floor, given over to the water sales department, consists of a single, large, well-lighted room handsomely finished. The walls and ceiling are warmly tinted; the wainscoting is of travernel marble; the floor is of Napoleon gray marble with a border of black Belgian; the furniture is of oak. …This large room is lighted by windows on the south and east, and by a skylight over a small mezzanine at the northwest corner.[484]

The interiors of the remaining six floors held offices for the water company's various departments, with the fifth floor dedicated to the executives. All office interiors boasted "handsome," high-quality materials: "the wainscotings and baseboards of halls and reception-rooms are of Alabama marble. The oak finish throughout is beautiful, the wood being an eastern oak finely grained and flaked."[485] Description of office and furnishings were meant to instill confidence in the work of the engineering department.[486] **[Figure 150]**

> The seventh floor is the engineering department, with the offices of the Chief Engineer, the City Superintendent, the operation and maintenance department, and the drafting department, the last being particularly commodious and well lighted, so that conditions for the intensive work of this department may be described as ideal.

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483 A main floor lobby interior photo appears in *San Francisco Water* 5, no. 1 (January 1926): 25.

484 O'Day, "Home of Our Own," 2. A reproduction of the company seal appeared in the January 1926 issue of *San Francisco Water*, apparently on the back cover.

485 All quotations in this paragraph are from O'Day, "Home of Our Own," 3.

486 In Spring 2013, I examined and photographed an uncatalogued blueprint plan of the Mason Street office building seventh floor, numbered R-165 and dated December 1922, discovered in a box of uncatalogued plans and drawings, Engineering Archives, SFPUC, Millbrae, CA.

The material technology of modern waterworks engineering was honored, its spaces lauded.

A 1926 picture caption described the design intent of the ground floor, "to enlist the resources of dignified simplicity in art and architecture to interpret the aims of public utility service."[487] This theme of "dignified simplicity" was central to the company's material production, from print materials to art and architecture. Its urban service function, as expressed in company literature, was to mediate between water and the citizenry, a role that fit into the broader sweep of nature, history, and culture.[488]A specific iconographical water program inside the building lobby detailed the ways in which art and architecture carried that purpose through. Water-related imagery was displayed prominently in a large wall mural, a sculpted clock, and a representation of the company seal, all displayed on lobby walls.[489] **[Figures 149, 151, 152]** Over the elevators on the north side was a mural painting by well-known local artist Maynard Dixon, and a large clock sculpted by Lucille Schoenfeld. On the wall appeared the company's seal, an Indian kneeling to gather water flowing from a spring, accompanied by the motto "Thirst no more."[490] Schoenfeld's sculptural "clock-case" was centered within a landscape frieze at the mural's base: two works integrated into a single display. *San Francisco Water*

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487 See photographs of the Mason Street building exterior, roof garden, and main floor lobby in *San Francisco Water* 5, no. 1 (January 1926): 24-25. Office building exterior photo caption: "The Directors' rooms, the executive offices, the engineering, water sales, agricultural, real estate, and other departments of Spring Valley are housed in this reinforced concrete structure designed for the Company by the late Willis Polk. It stands on the west side of Mason Street between Clay and Post. Occupancy dates from October of 1923." Main floor lobby interior photo caption reads: "In this spacious room on the ground floor where water consumers form their initial impression of the Spring Valley personnel, the effort has been to enlist the resources of dignified simplicity in art and architecture to interpret the aims of public utility service, wherein foresight and efficiency strive to go hand and hand with courtesy." Also see "Spring Valley's New Building," 12.

488 In addition to cultural influences I have discussed, one might examine in more detail the currency of neo-Vitruvian emphasis on the "dignity" of Roman art over Greek in the Corinthian order, for example, one among many ideas that fed Vitruvian vs. Palladian preferences in 19th-century neoclassicism. Other approaches would examine the structural, or architectonic, over the historical revival in the history of architecture. An essential source for sorting this out is Kenneth Frampton, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge: MIT Press, 2001).

489 A reproduction of the company seal appeared in the January 1926 issue of *San Francisco Water*, apparently on the back cover.

490 O'Day, "Home of Our Own," 2. A reproduction of the company seal appeared in the January 1926 issue of *San Francisco Water*, apparently on the back cover, from what I can ascertain in a photocopy.

featured the paired works, in color, on its cover when the building opened.[491] **[Figures 151, 152, 154]** San Francisco artist and sculptor Ralph Stackpole the cultural importance of the art and its artists in relation to a romantic take on a public works aesthetic: "industrial buildings find they may be as beautiful as temple and palace."[492]

THE SUNOL WATER TEMPLE AND ITS WATERSHED REPRESENTED: WATER, ARCHITECTURE, AND LANDSCAPE IN MAYNARD DIXON'S WALL MURAL

Stackpole focused on Maynard Dixon's mural, a large painting of the Sunol Water Temple centered in a landscape context. **[Figures 149 and 151-155, inclusive]**

> The mural painted by Maynard Dixon for the new building of the Spring Valley Water Company shows the Water Temple at Sunol set in a characteristic watershed landscape, a synthetic landscape that embodies the features found in Alameda and San Mateo counties, whence Spring Valley obtains most of its water supply. The Water Temple makes an accent of light among the gracefully rolling and barren brown California hills. These hills become golden as the sun sinks lower into the west.[493]

The temple appears in the middle ground, small in comparison with the watershed surrounding it. **[Figures 151, 152]** Bold slanting sunrays stream from a cloud-filled sky,

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[491] A photograph of the mural and clock-case appears on the cover *San Francisco Water* 2, no. 4 (October 1923): cover. A larger photograph of the clock-case can be found in O'Day, "Home of Our Own," 2. The caption beneath the clock-case photo reads "Clock-case for Spring Valley's new building, designed by Miss Lucille Schoenfeld, a talented young sculptor of San Francisco. Miss Schoenfeld studied with Leo Lentelli, and collaborated with him on his distinguished work for the Panama-Pacific International Exposition, also on the charming patio for the residence of Andrew Welch."

[492] Ralph Stackpole, "Dixon's Spring Valley Mural," *San Francisco Water* 2, no. 4 (October 1923): 5.

[493] Stackpole, "Dixon's Spring Valley Mural," 5. Stackpole's comment on mural painting in this piece is of interest, particularly given his emphasis not only on the Renaissance in general, but specifically on the origins of the Parisian Beaux-Arts, in his reference to Puvis de Chevannes' "revival" of mural painting; Chevannes was an early president and a founding member of the Société Nationale des Beaux-Arts in 1890. Stackpole was educated in part at the Ecole des Beaux-Arts, and became a champion of mural painting; he was instrumental in bringing Diego Rivera to San Francisco to create the Pacific Stock Exchange murals. Stackpole writes: "Mural decoration is an art world-old. It was practically lost after the Italian Renaissance, and was revived again by Chevannes in the last part of the last century. Although still in the infancy of this revival, it again promises to become a big vital art." The caption on the same page, below photographs of Dixon, Schoenfeld, and Polk, states that "Mr. Polk [architect] enlisted the aid of Mr. Dixon and Miss Schoenfeld to enhance the beauty of the new Spring Valley building." I have not yet gained entry into the empty Mason Street office building but can confirm that the mural and clock-case are in their original locations over the elevator bay on the ground floor: it is possible to see them if one peers through the south edge of the building's central glass door at night when a light is on inside and the blinds are not drawn.

framing and highlighting the temple, which is nestled in a shallow valley. Rolling hills and valleys alternate between two varied and characteristic landscapes of Northern California. One, in the upper ground, depicts dark-green and purple hillsides of the watershed's source; the other, in the lower ground, shows the dry, golden brown foothills wanting water. The stylized Sunol Temple, tiny in comparison with the large surrounding landscape context, sits centered between the two, at the edge of a body of water.

This detail calls notice. The Sunol Water Temple does not actually sit on a reservoir or lake, so it is tempting to interpret the body of water in the mural as symbolic or aesthetic invention. But Dixon's representation may, in fact, transcribe the landscape as it sometimes appeared during that time. The low Sunol Dam downstream from the temple on the Alameda Creek did not impound water, as a proper dam does; rather, it slowed and backed up surface water flow in order for it to pool over the deep Sunol Gravel Beds. There it percolated down into the filtration galleries and funneled into the "crypt" below the temple as it rushed into the Sunol Aqueduct pipeline beneath it. **[Figures 72, 85, 156, 157]** I recall seeing one rare photograph of surface water backup over the gravel beds upstream from Sunol, at the Pleasanton Well Fields, and this situation may have been common in the Sunol Valley, too.[494] If so, stream backup over saturated Sunol gravel beds flooded the valley, and from a distance this might have looked like a lake or a reservoir, as it appears in Dixon's mural. Verdant hillsides behind the temple in the mural represent 600 square miles of Spring Valley Water Company watershed reaches in Alameda County, and, by inference, this landscape also suggests the San Mateo County watershed across the bay near the coast. This watershed landscape

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494 Several maps exist in the Spring Valley Water Company Collection of the geological make-up of the Alameda Division area; much of it sits on broad and deep gravel beds. Gravel quarries have worked the area throughout the 20th century, to the present. In recent years, the City of San Francisco permitted the opening of a large gravel quarry directly upon the Sunol gravel beds, which originally fed long filter galleries for the Sunol Water Temple. As at Pleasanton, this ground water source was depleted decades ago. In Pleasanton, the former well field land began to be converted to residential and retail development, which has been ongoing since a major freeway was built through the Alameda Division watershed lands in the 1960s. At Sunol, the temple still stands in the center of its own primary landscape. The Hetch Hetchy Aqueduct pipelines run under the valley, as well. The Sunol Valley historically has been open land except for a golf course, nursery and garden supply businesses, the quarry works, and a freeway easement.

is lush, dark, and cool.[495] By contrast, California's golden hills in the foreground, dry and bare, suggest the common periodic drought condition created by California's short and intermittent rainy season. The dramatic contrast is both real and deeply symbolic. The densely forested watershed represents a natural, "untouched" landscape—a reality created by continuous and historic proprietary protection of the watershed terrain since the 1850s. The bare, golden, rolling hills not only symbolize the land of little rain, the arid lands beyond the 100th meridian, but also graphically illustrate the real results of 19th-century deforestation, water diversion, mining, cattle grazing, and broadcast planting of non-native flora, on a massive scale.[496]

The temple was the literal center point in the Spring Valley Water Company's holdings in Alameda County. In 1923, the Alameda Division was one of the company's two watershed headquarters. The other, the San Mateo Division, is located directly west across the Bay from Alameda, on the Peninsula due south of San Francisco. **[Figure 156]** The Hetch Hetchy Division was originally established as the watershed and right-of-way of the Hetch Hetchy Aqueduct built by the San Francisco municipality. The city's project was discrete, separate from the Spring Valley Water Company. The Hetch Hetchy system became the third Division of the whole in 1930, when the San Francisco Public Utilities Commission formed after the City's purchase of the Spring Valley Water Company. To this day, the Hetchy Hetchy Division inscribes the Sierra Nevada Mountain watershed of the Tuolumne River, partly located in Yosemite National Park, its watershed origins more than 200 miles east of San Francisco. **[Figure 116, 158]**

With the Sunol Water Temple at its center, the surrounding Alameda Division protects a watershed of more than 600 square miles. All of this land and associated water rights and easements were owned by the Spring Valley company continuously from before the end of the 19th century. Like its companion Crystal Springs-San Andreas

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495 "History and Description of the Constructed Work of the Water Division of the Spring Valley Water Company: Preliminary Draft" (1913), 21, Documents Archives, SFPUC.

496 On this topic, see such works (and their sources) as James C. Williams, *Energy and the Making of Modern California* (Akron, Ohio: The University of Akron Press, 1997), esp. 22-52, 90-198; Richard A. Walker, *The Conquest of Bread: 150 Years of Agribusiness in California* (New York: New Press, 2004), esp. 19-75, 108-136, 256-278; and Brechin, *Imperial San Francisco*, esp. 1-120, 245-79.

watershed in San Mateo County south of San Francisco, the Alameda Division watershed has been developed selectively, restrictively, and in isolated segments throughout its history.[497] The Pleasanton Wells site, for example, whose artesian springs were over-pumped from the late 19th century, were finally depleted in the 1940s. The lands were sold in pieces beginning in the 1960s, but were not developed until recent decades.[498] The Sunol and Calaveras portions of the Alameda Division watershed, like the entire San Mateo County Pilarcitos-San Andreas-Crystal Springs watershed, remain closed to public access except for limited areas of restricted open space. These lands have remained remarkably undeveloped historically, in a greater San Francisco Bay Area metropolis whose urban growth is renowned.[499] In addition to its Bay Area watersheds, the SFPUC has managed the Hetch Hetchy Division watershed as a closed water system since it was consolidated with the purchase of the Spring Valley Company in 1930. From Hetch Hetchy Valley in Yosemite, where the O'Shaughnessy Dam creates the reservoir, all along the Tuolumne River and its controlled and dammed tributaries to the Bay Area, water access is strictly regulated, in many places prohibited. In Yosemite, walking on developed trails and roads is permitted, as one stipulation of the 1913 Raker Act by U.S. Congress, which granted San Francisco water and construction easements within the National Park rivers heds.[500] Closed access is upheld within San Mateo County's

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[497] "History and Description of the Constructed Work of the Water Division of the Spring Valley Water Company: Preliminary Draft" (1913), 21, Documents Archives, SFPUC.

[498] Joshua D. Milstein, Deputy City Attorney and expert in legal and historical issues regarding the SFPUC, conversation with the author, November 26, 2013. Thank you to Alison Moore, SFPUC, Consulting Archivist, for arranging this meeting.

[499] San Francisco Bay Area growth does not compare in scale or extent to that of the major metropolitan areas in Southern California, topographically and climatically distinct from the San Francisco Bay Area. Metropolitan Southern California's much lower annual precipitation, its dependency on water imported from farther distances, and its diminished historical protection of undeveloped open space expanses (as for large-scale watersheds) has permitted more extensive development throughout the region. See Williams, *Energy and the Making of Modern California*, 248-67.

[500] The Raker Bill, eventually the Raker Act, refers to H. R. 7207: United States Congress, House of Representatives, *An Act Granting To The City And County Of San Francisco Certain Rights Of Way In, Over, And Through Certain Public Lands, The Yosemite National Park, And Stanislaus National Forest, And Certain Lands In The Yosemite National Park, The Stanislaus National Forest, And The Public Lands In The State Of California, and For Other Purposes* (Washington, D.C.: Government Printing Office, 1913), as well as to prior (1908) and related (1913) hearings. See all primary texts and transcripts, with an explanatory note, online at the Virtual Museum of the City of San Francisco, accessed March 14, 2015,

watershed peninsula south of San Francisco, as well. In the rare instance of company-chaperoned access, the experience of going “back in time” to a “virgin” forest in the Bay Area is surprising and instructive.[501] Many areas of California were once as heavily timbered as the San Mateo Division watershed, even inland near the Sunol water temple, as Dixon’s mural suggests. Inexhaustible demand for firewood, building material, agriculture, and grazing exhausted the Bay Area’s natural woodshed before the end of the 19th century.[502] Yosemite Valley was developed commercially in the 19th century, with environmental consequences. Despite more than a century of controversy over the Hetch Hetchy Valley’s flooding by the City of San Francisco, one of the results of its federally-protected municipalization as a water utility was that the areas surrounding the reservoir are required to remain undeveloped open space accessible to the public.[503] The “pristine” water within the reservoir, however, cannot be touched.

Maynard Dixon’s landscape mural dramatically, if quietly, announces these dichotomies, placing the waterworks like an interlocutor between naturally wooded and technologically bared terrains. **[Figure 152]** In Dixon’s painted sky, Art Deco volutes of cloud frame and embrace the landscape composition within diagonal rays of obscured sun. All is backed by a grey sky suggesting a coming storm: the sky promises, but still holds, the rain. Bordering the mural’s lower edge below the landscape scene runs a frieze painted with a California version of a turn-of-the-century suburban landscape, where red-roofed Spanish Revival structures intersperse with trees. **[Figure 153]** Dixon’s

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http://www.sfmuseum.org/hetch/hetchy.html. For a brief historical summary of the circumstances surrounding the Raker Bill and the Raker Act, see Williams, *Energy and the Making of Modern California*, 250-53.

501 Thank you to Alison Moore, SFPUC Consulting Archivist, for helping to arrange chaperoned access into the Crystal Springs-San Andreas watershed through SFPUC Natural Resources and Land Management Division Watershed Manager, Joseph P. Naras; Watershed Keeper Supervisor, James Avant; and Watershed Keeper, Kevin Kasenchak, who led the tours on May 28, 2013 and July 23, 2013.

502 See Williams, *Energy and the Making of Modern California*, esp. 22-52, 90-198.

503 Discourse surrounding the Hetch Hetchy controversy is vast, and ongoing. From the first proposals to dam the Hetch Hetchy Valley in Yosemite National Park to the present, it has incited political, social, economic, and environmental conflict. For a brief precis, see Williams, *Energy and the Making of Modern California*, 248-53. For a book-length overview, consult Robert W. Righter, *The Battle Over Hetch Hetchy: America’s Most Controversial Dam and the Birth of Modern Environmentalism* (New York: Oxford University Press, 2005).

architecture speaks in a California vernacular, the Spanish Renaissance Mission Revival style, with red tile roofs and whitewashed adobe walls embellished with curved Baroque façades and Colonial arches. The same visual language informs Polk's designs on many of the Spring Valley Water Company buildings, and on Ivan Frickstad's "Out of Town" substation designs for PG&E.

Dixon explicitly included a Mission church building in the mural frieze. The town of Sunol is located just over a rise from Mission San Jose, six miles as the crow flies.[504] Knowing this, one assumes the Sunol Temple might align geographically, architecturally, and historically with California Spanish Colonial Mission architecture. **[Figure 160]** The base frieze on Dixon's mural certainly states this assumption in visual terms. Yet, a look at the architectural history of the San Jose Mission denies any consideration of Mission Revival inspiration for the Sunol Temple. **[Figure 161]** The San Jose Mission was founded in 1797, with a church in the customary style completed in 1809. When a historic 1868 earthquake left Mission and grounds in ruin (along with much architecture in San Francisco and the Bay Area), "a wood frame Normandy style parish church" rose upon the foundations of the original Mission church and remained in place for more than a century.[505] The white wood building had long been in place when the Sunol Water Temple was built in 1910, and it was still in place in 1923, when Polk's office building opened, with Dixon's mural as its artistic showpiece. The San Jose Mission, then, can lay

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504 The road over the Sunol Grade past the Sunol Temple and beyond, the intersection of which I described earlier in this dissertation, is the historical thoroughfare from the south to the northeast toward the Sacramento-San Joaquin River Delta and the inland valleys of Central California to the Sierra Mountains.

505 See the Historical American Building Survey (HABS) entry, "Mission San Jose de Guadalupe, Mission & Washington Boulevards, Fremont, Alameda, CA," Library of Congress, accessed March 4, 2015, http://www.loc.gov/pictures/item/ca0006/. Photograph no. 8 depicts it in 1936. Wikepedia's entry for "Mission San Jose (California)," accessed March 4, 2015, https://en.wikipedia.org/wiki/Mission_San_Jos%C3%A9_(California), entry includes a photograph of the Normandy-style church verified as c. 1910. Between 1982 and 1985, the post-1868 structures were moved, renovated, or reconstructed to make way for a replica of the 1809 church, completed and rededicated in 1985. For the updated information beyond the 1960 HABS entry, see the 2012 Historic American Landscape Survey entry "Mission San Jose de Guadalupe, 43300 Mission Boulevard, Fremont, Alameda County, CA," Library of Congress, accessed March 4, 2015, http://www.loc.gov/pictures/item/ca3929/" The Normandy Gothic style church was moved from the Mission grounds across the Bay to San Mateo to operate to the present as Christ Church Parish; the church's website identifies the architecture as "Carpenter's Gothic." See "Saint Joseph Parish," accessed March 4, 2015, http://www.christchurchparishacc.com/.

no claim as a model for the Mission-inspired buildings in Dixon's mural frieze, nor for the typical local Mission Style, for that matter. A more likely candidate would be Mission Francisco de Assis (1871), known locally in San Francisco as Mission Dolores. **[Figure 162]** Except for its distinctive neoclassical columns, which do not conform with the Mission style stereotype, the San Francisco example has a more typical Mission appearance, certainly, than the Mission San Jose near the Temple. Although the Mission Dolores building was undamaged in the 1906 earthquake, Willis Polk undertook a major structural renovation in 1917, inserting steel support beams throughout without altering the building design. Adjacent buildings on the site underwent several series of renovations, demolitions, and reconstructions.[506] The Mission façade Dixon reproduced in the mural—a bell-curved front face flanked by asymmetrical bell towers—looks most like Mission San Luis Rey, the most commonly reproduced Mission type.[507] **[Figure 160]** The Spanish Renaissance Mission style as an identifying California vernacular took hold first during the 1893 Chicago World's Columbian Exposition and was carried through in the next year at its modest California accompaniment, the San Francisco Mid-Winter Fair. The style was in its heyday by the time Dixon painted his Mason Street mural in the early 1920s.[508]

In addition to a Mission building, another recognizable building feature in Dixon's lower frieze is a capitol dome, suggesting either San Francisco's 1915 City Hall or California's State Capitol in Sacramento. **[Figure 163]** Other buildings in the frieze fill in a suburban view with residential buildings, some large enough to suggest, for example, Hacienda del Pozo, the mansion Phoebe Apperton Hearst built on her thousand-acre

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506 I include a timeline of images of Mission Dolores as an indication of the myriad ways in which Mission buildings were altered in the course of California history. This Mission is noteworthy for the fact that the original building was never destroyed.

507 See representative photographs of historic mission buildings at "The Cardinell-Vincent Postcards of the California Missions, Selected Asistencia and the Royal Presidio Chapel of Monterey," California Missions Resource Center, accessed March 4, 2015, http://www.missionscalifornia.com/content/cardinell-vincent-postcards-california-missions.html.

508 For a period history of the Mission Revival style from a contemporary professional architecture point of view at the turn of the 20th century, see Arthur Burnett Benton, "The California Mission and Its Influence Upon Pacific Coast Architecture," *The Architect and Engineer of California* 24, no. 1 (February 1911): 35-75.

swatch of the Alameda Creek watershed between Pleasanton and Sunol near the Temple. Had Hearst not owned the land, Spring Valley would certainly have acquired it as part of the Alameda Division. These Hearst lands lie adjacent to the Spring Valley Water Company holdings to this day, poised between the two ends of the upper Alameda Creek canyon, within a few minutes' journey, even by 1910 standards, from the Sunol Water Temple. **[Figures 156, 157]**

SCULPTURAL RELIEF: STRUGGLE BETWEEN WATER GODDESS AND SEA CREATURE IN LUCILLE SCHOENFELD'S CLOCK

Centered upon the base frieze of Maynard Dixon's Water Temple mural, Lucille Schoenfeld's clock is in plain view. **[Figures 149, 151, 152]** In addition to the photograph for the cover of *San Francisco Water*, which depicts the mural and clock as they appear together, a larger photograph of the clock alone heads the second page of Stackpole's article. **[Figures 154, 155]** Stackpole emphasizes the mural and neglects the clock, one guesses due to the muralist's relative prominence. However, Stackpole's temple-or-palace assessment regarding aesthetics for public works buildings concludes with veiled reference to gender: "Industrial buildings find they may be as beautiful as temple and palace, and, strangely enough, beauty follows strength and power."[509] This suggests his editorial stance might reflect a common cultural characterization of women as beautiful but weak, and powerless if not in association with men.

Questions of gender bias aside, Stackpole acknowledged sculptor Lucille Schoenfeld as an emerging San Francisco artist. She had sculpted a popular figure for the Panama-Pacific International Exposition's Palace of Fine Arts, which Stackpole lauded in an introductory comment. In Schoenfeld's Mason Street clock (or "clock-case"), two draped water goddess figures flank a round clock face. Sculpted in stone, apparently marble, the inscription "Anno Domini MCMXXIII" identifies the year, 1923. In Art-Deco-style neoclassical toga drapery, the water goddess stands facing away from her mirror image, one figure at each the side of the round clock. Contemplating this

[509] Stackpole, "Dixon's Spring Valley Mural," 5.

arrangement, one might divine it to represent Time as a round pool whose smooth surface reflects the goddess' image. Her arms cradle an emptied amphora she stabilizes at her hip, steadying its weight against the clock's curve. She turns her head away, adjusting her own weight onto her solid standing leg as the other pushes against the lower clock edge, as if to balance an uneven load. A closer look at the foot pushing against the clock reveals that it also presses downward, with some force, upon the head of the familiar sea creature, or dolphin, in its mouth-down-tail-up stance.[510] The water goddess pushes down on the creature's head hard enough that it winds its tail up along the lower curve of the clock to counterbalance the oppressive force. Its open mouth and thrashing tail indicate a struggle to escape the goddess's effort to suppress it. Toga drapery drawn tight articulates muscle and movement. The creature's effort to writhe itself free stirs water and air currents upward, filling the goddess's cape so that it billows up behind and above her. In traditional literary terms, Schoenfeld presents a fine representation of the theme of human conflict with time and with nature, figured in water terms. In a figural narrative theme

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510 This sea creature ornaments several other Spring Valley Water Company structures: at Sunol the figure appears on the Sunol Water Temple finial, on the corners of the balustrade access to the underground gravel bed filtration gallery, on carrefour gate post fountains, and presumably on an inaccessible fountain that appears to be identical to one in the Pilarcitos watershed. At Pilarcitos, the figure is part of the fountain ruins at the former picnic ground between Pilarcitos and Stone Dams, and on the balustrade at the former fountain on the Pilarcitos Dam (which I assume was installed at Sunol as it is identical to the missing filter gallery balustrade marker). In San Francisco, the sea creature is built into the building corner fountains at the Sloat Boulevard Central Pumping Station, in an identical pose to that on the carrefour entrance at Sunol, both of which Arthur Putnam fabricated. In an apparently unbuilt Willis Polk fountain and garden project for the Millbrae Meter House, the creature adorns the central garden fountain on corner pedestals in Polk's drawings. This "sea creature" was inspired by a common image from antiquity and the Renaissance, and is commonly called a "dolphin" in art historical terminology, but it hardly looks like one in the figural poses commonly adapted for the Spring Valley Water Company's program of water iconography. The term "dolphin" is used in some company records pertaining to ornamental aspects of both the Sunol Temple and the Central Pumping Station in San Francisco. Records regarding Authur Putnam's contract to craft the concrete ornaments include "dolphins" for the Sunol Temple and the Central Pumps on Sloat Boulevard; the records are located in several files in Box MB-059, Documents Archives, SFPUC. The Water Temple roof finial including the four sea creature figures, originally designed to be made in copper, was changed to terracotta, with fabrication work contracted to the prominent Bay Area tile and terracotta manufacturer, Gladding, McBean and Company. "Furnish and install tile roof and terra cotta fineal for Water Temple for Spring Valley Water Co., at Sunol, Cal., as per drawings prepared by us…. Fineal to be of glazed terra cotta of a bronze green color and to be securely fastened in place with bronze anchors." See related change orders stipulating terracotta in place of copper, contracts, and letters, dated March 1910, among D.H. Burnham & Co., Spring Valley Water Company Collection, and various fabrication and building contractors, in Box MB-059, Documents Archives, SFPUC.

similar to the William Rush's sculptures of the Schuylkill River and the waterworks at the Fairmount Water Works, water and time flow perpetually, moving in endless and unexpected ways—human ingenuity strives to control, collect, and direct them. **[Figs. 36, 37, 38]** Schoenfeld suggests a dynamic force operates between natural and managed water. The goddess is the water company and its engineering technology, multiplied by her double. She is vertical and erect in the periphery of the composition, a picture of stability, and yet she is curved inward with the struggle required to maintain her equilibrium against the unharnessed elements of water and time in the figure of the sea creature.[511]

One puzzling detail is the empty—or emptied—amphora: no water flows from this mouth-down vessel. Visually, the column of drapery below the open vessel mouth conceivably doubles as water flow from the vessel, giving the impression of a stream of flowing from the downturned clay pot, but this linear column is not directly in line with the urn's mouth. The drapery's clever likeness to falling water suggests a physical identification of the goddess with falling water, a reference to force, direction, and velocity of flow. Associated with the amphora, this implies quantity or supply. The discrepancy is odd when compared with the way water goddess figures empty a vessel on other Spring Valley Water Company structures ornamental representations. On Polk's Sloat Boulevard pumping station, for example (which I will discuss at more length), streams of water pour directly from vessel mouths into waiting basins. **[Figures 164, 165]** This action imitates and mirrors the company logo—an indigenous Californian filling a pot while kneeling at a running stream, inscribed with the slogan, "Thirst No More." **[Figure 151]** Both images include the requisite water vessel, but in these images the pot is either emptying or overflowing in a symbol of perpetual water flow. The puzzle of Schoenfeld's *emptied* vessel suggests the *process* of capturing and managing the water supply, and not the *product* of endless bounty that permits continuous emptying and constant overflow. In Schoenfeld's clock, the real work is to fill the vessel, not to empty

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511 See Henry Adams, "The Dynamo and the Virgin," in *The Education of Henry Adams: An Autobiography*, vol. II (1918, repr., New York: Time Incorporated, 1946), 161-73.

it. This suggests a change in thinking related to the idea of plenitude. Emptied vessels and physical strain figuratively suggest that collecting and deploying an urban water supply is arduous, especially where drought is frequently nature's exception to man's rule of plenty. On this point, water engineering discourse at any stage of development in history addresses the difficulties of designing and building a water *collection* system (dams and reservoirs, and the pipelines, canals, and pumping mechanisms that fill them), as prerequisites for a water *conveyance* system, which moves and distributes collected water. The clock's physical position above the elevators, centered low upon Dixon's mural, underscores the painter's interpretation of the company's work as an intermediary between society's needs and nature's order. This includes time, since rainfall in California is seasonal and historically intermittent, with long periods of cyclical insufficiency. And, it is common knowledge that increases in per capita water use in California respond directly to availability of supply delivery. Every time we turn on the tap, water comes out. Perhaps the artwork reflects a consciousness of scarcity in figuring the waterworks as a tiny temple dwarfed by a vast landscape under skies promising rain. The Water Temple is designed, like Schoenfeld's water goddess, to suppress, harness, and direct, like Rush's early 19th century Schyllkill River gods. Water systems "civilize" nature, permanently and perpetually. This reflects a rhetorical belief of the day, that nature's liquid bounty would "waste to the Pacific, without modern technology's intervention."[512]

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512 In January 1926, *San Francisco Water* published a photo essay of Spring Valley Water Company property developments to accompany an overview of the water system. One photograph in the series shows the small reservoir behind the Stone Dam in the Pilarcitos/San Mateo Creek watershed feeding the Crystal Springs and San Andreas reservoirs. Its caption reads: "Two miles below Pilarcitos [Dam], near the dividing-line between the Oceanside and the interior watershed of the San Mateo hills, the Stone Dam was built to intercept the productive flow of streams that would otherwise waste to the Pacific. This is perhaps the most charming spot to be found on all the Spring Valley properties." See "The Water Supply of San Francisco," *San Francisco Water* 5, no. 1 (January 1926): 15. This rhetoric was commonly used to describe as "waste" any untapped natural waterways that ran their full course without human diversion.

GARDNER DAILEY'S ROOFTOP "GARDEN ROOM" FOR WOMEN

In addition to the mural and clock-case arrangement in the lobby, the interior design committee planned other artistic elements for the Mason Street office building. The most elaborate of these was a landscape design, a roof garden for women. "An unusual feature for an office building," the "sunny and airy" ladies-only roof garden and indoor "rest room…with a kitchenette and other conveniences" was designed by California landscape architect Gardner Dailey. Before the building opened, Dailey published drawings and a description of the outdoor space.[513] **[Figure 166]** His comment on the garden's larger social purpose, that "Spring Valley Water Company is keeping well in step with the stride of modern business toward a more attractive working environment for women…[by providing] a place of quiet and seclusion into which the women can withdraw from the clatter of traffic and the dust of the street."[514]

Dailey's plan drawing shows the interior "garden room" taking up about half the footprint of the roof. The three legs of the horseshoe-shaped garden embrace the garden room, whose entrance from the lower floors was directly beneath the water tower.[515] When the building opened, the water tower was an imposing roof protrusion; eventually Polk added a red tile roof and stout finial, which helped integrate the tower block into the architectural design.[516] **[Figures 73, 149]** From the garden room's interior, casement windows opened onto garden walkways lined with lawn, benches, and planted beds, where a low lattice surrounded the entire rooftop periphery, creating a sense of bounded intimacy while revealing fabulous cityscapes. Double doors led from the garden room to

513 "Spring Valley's New Building" 12; "Home of Our Own," 3. Photographs of the roof garden appear in *San Francisco Water* 5, no. 1 (January 1926): 24-25.

514 Gardner Dailey, "The Rest-Room and Roof-Garden," *San Francisco Water* 2, no. 4 (October 1923): 3. In this dissertation I can do no more than hint, through this brief mention of the "unusual" importance of a ladies-only workplace refuge, at the social and economic implications of working conditions for women in the corporate public works sector.

515 Dailey, "Rest-Room and Roof-Garden," 3-4. See also a photo of the building from the south, in which the water tower and plantings in the roof garden below it are visible, and see a photograph taken of the south side of the roof garden, in the photo essay accompanying "Water Supply of San Francisco," 24-25.

516 The tile-roof cap must have been added later; it appears in the 1926 photograph mentioned above, but not in a 1923 inaugural photograph of the newly-completed building. Compare the photograph in "Home of Our Own," 1, showing the bald water tower housing on the roof, with the picture in "Water Supply of San Francisco," 24, where the aesthetic advantage of the water tower's new tile roof is clear.

the paths.[517] **[Figures 149, 166]** One path ended at the building's streetfront edge, affording an unobstructed view of the financial district and Market Street to the east. Each of four decorative park benches had an arbor train arching above it, covered with "climbing roses and jasmine."[518] The north garden leg, with a view up Nob Hill, featured an open lawn. On the west-facing leg of the garden, Gardner had planned a round pool, perhaps originally meant to pair with planned lobby fountain, but it appears no fountain sculpture was built.[519] Dailey's idea was to keep the garden simple:

> The rest-room on the roof is surrounded by a pleasant garden. The room itself has been fitted up in a cheerful manner, and its windows on three sides look into the garden that surrounds it. The garden has been designed in the utmost simplicity and is free from the usual architectural embellishments that often overburden and oppress the plantings. Instead of heavy stone and cement features, as much green foliage and as many flowers will be displayed as the space will permit. In other words, everything will be done to complete the illusion of naturalness through the use of plants, trees, and shrubs "of the common garden variety."[520]

With or without fountain architecture, and despite the garden's placement in the shadow of the water tower, Dailey planned pool to complete the building's interior water iconography program, with the actual presence of water in the open-air landscape.

POLK'S CASCADE ICONOGRAPHY ON THE MASON STREET OFFICE BUILDING EXTERIOR: ART HISTORICAL CONTEXTS

On the Mason Street building exterior, water iconography is explicit, if nuanced. **[Figures 167-170, inclusive]** At the base of the building's façade composition, surrounding the entrance and defining the first floor, an organic water pattern in low, irregular relief in cast stone evokes sheets of falling water. The pattern extends to the

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517 Dailey, "Rest-Room and Roof-Garden," 3.
518 Dailey, "Rest-Room and Roof-Garden," 4.
519 Regarding Putnam's "missing" lobby fountain: an early-1923 status report on the office building declared that "the distinctive feature of the main floor will be a fountain designed by the distinguished sculptor, Arthur Putnam," but in a 1926 interior photograph, three years after the building opened, the lobby includes no fountain. See "Spring Valley's New Building," 12. **[Figure 149]** For Gardner Dailey's roof garden plan, which depicts a round pool, see "The Rest-Room and Roof-Garden," 3-4. For photographs of the completed main floor interior, *sans* fountain, and the south leg of the completed roof garden, see "Water Supply of San Francisco," 25.
520 Dailey, "Rest-Room and Roof-Garden," 3-4.

broad pilasters, spandrels, haunches, and entry keystone. This cascading water motif articulates the entire façade, providing a figurative support for the entire structure. Water is a stabilizing factor.

In 1910, when Polk was completing the Sunol Temple and the Jessie Street Substation, he was also working on the large Central Pumping Station for the Spring Valley Company, on Sloat Boulevard near Lake Merced. More than a decade after the Sloat Central Pumps would pass before the Mason Street office building landed on Polk's docket, but the architect had already devised an initial form of the cascading water motif. It appears on the overdoor frieze of Central Pumping Station.[521] **[Figures 164, 171, 172, 174]** On the building's portico, Polk introduced the cascading water pattern in an abbreviated, rectilinear frieze centered over the door. This centering is important, as the entry frieze is dwarfed in size by more prominent figures on the building. At this doorway, water iconography ornaments the entablature of a compressed porch of Tuscan columns flanking the entry. In slight overlap behind these two front pillars stand two engaged columns, suggesting a deeper, colonnaded porch, a common Renaissance Revival doorway embellishment. At the roofline, a crowning cartouche centers on a pair water goddess sculptures standing back to back in mirror image. They carry armloads of cattails, a marshland plant. **[Figures 172, 173]** Arranged and interwoven around figures and cartouche are distinctive images suggestive of frieze ornamentation on the Round Temple at Tivoli: ram's head, plant garlands, and rosettes. Polk was evidently fully engaged with imagery from the Tivoli Temple, as he was designing the Sunol Water Temple during the same period as the Central Pumps. The Sunol temple replicated the

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[521] The caption of a Sloat station interior picture states that "the station was constructed in 1911," in "Water Supply of San Francisco," 21. The Sloat Boulevard Central Pumping Station (PCAD 15822; also PCAD 8338) was also published in an article on the use of gunite, cement applied with a gun, on the exterior. See O. P. Shelley, "The Cement Gun," *Western Architect and Engineer* 28, no. 3 (April 1912): 39, 46. In addition to a photograph of the Spring Valley Water Company Sloat Boulevard Central Pumping Station and mention of Polk's work on it, the article includes detailed descriptions and images of the gunite process and machinery, as well as an account of its use to line the Panama Canal. Further renovation work on the Sloat Boulevard Pump House and the adjacent Merced Manor Reservoir was supervised in 1936 by Nelson A. Eckart, Chief Assistant Engineer of the San Francisco Water Department from 1925-1932 and General Manager and Chief Engineer from 1932-48 (**?**); formal, neoclassical public stairways from the street level up the reservoir berm to the roof carry the 1936 date. The facility received a recent renovation in 2006-2007.

column order of the ancient Roman water temple, as I have discussed, but the specific iconography on the garland frieze at Tivoli—rams' heads hung on garlands—is conspicuously absent at Sunol. It appears that Polk may have borrowed from this ancient source for the Central Pumping Station, as well, in the similar garland ornaments. The buildings were, after all, paired technologically on the system: the Sunol Temple stood at the water source in the rural watershed, while the Sloat Boulevard Central Pumping Station marked the water system's in-town terminus.

In addition to the water goddess and her bunch of water reeds, the symmetrical cartouche features pairs of eagles, festoons, volutes, and scrolls. Two head ornaments occupy the arrangement's center: ram's head at the cartouche base, and godhead at top center. The god is presumably meant to suggest Triton, to judge from size, placement, and repetition of the trident, which appears on four tall embedded fountains wrapping the corners of the building's long front face. **[Figures 164, 165]** These identical vertical fountains present polychrome water-pouring scenes that reach from base nearly to cornice. At the highest point, an amphora empties a streaming cascade, the whole embedded in a river scene undulating with water plants and swimming fish. The waterfall suspends above the sea creature, whose tail twists up around the sea god's trident. Close viewing reveals the sea creature winding through vertical cattails, the same marsh reeds the water goddesses carry at the cornice. This creature's mouth today appears to have once been the mouth of the original fountain works—if so, ornamental spray would have fanned out above the fountain bowl below it. This fountain arrangement is replicated on all four front corner faces, multiplying its effect with a theatrical flourish. This creates a vertical substitute for engaged corner pilasters, and visually balances and contains the disproportional relationship of the long horizontal façade with the relatively stouter building height. Sculpture and inscriptions ground the building mass, balancing length with literary interest in the Biblical inscriptions, and softening large expanses of wall space with curving figures, vibrant color, and the presence of real water.

Photographs of the building's industrial interior reveal that it also featured ornamental detailing. Large flat wall panels were framed by mouldings and painted in a varied color scheme. **[Figures 175, 176]** The wall panels stood between simple floor-to-ceiling pilasters whose geometric capitals ran in line with an upper moulding, suggesting an entablature. Interior lighting for this pumping station (which, like the "City"-style PG&E substations, had no windows) was distinctive, clean, and modern. Large globe chandeliers suspended from iron ceiling rods, and pilasters featured an iron sconce with small globes. The caption on a photograph of the building's interior reads: "Simplicity of architectural design gives this utilitarian structure unusual beauty."[522]

Color and theatricality made design for the Central Pumping Station warmer and more lyrical than Polk's first Pacific Gas & Electric Company "City" style substation, also from 1910. Dimensions and plain facings were similar, but in a suburban park-like setting with broad lawns and grand gateposts with wrought iron fencing, the Sloat station succeeded as an intermediary between the monumental "City" style and the colorful variation of the "Out of Town" vernacular. In October 1922, a few months before the water company announced plans for the new Mason Street office building by Polk, a photograph of the Sloat Boulevard Central Pumping Station doorway appeared on the front cover of *San Francisco Water*, a reminder of and update for the architect's prior work for the company.[523] **[Figure 174]**

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[522] See interior and exterior photos of the Central Pumping Station in "Water Supply of San Francisco," 21. Three pumping stations that await further discussion are noteworthy to mention in this discussion of waterworks aesthetics, for their self-conscious inclusion of neoclassical, white-framed, arched windows in a corrugated metal structure. All are pictured in "Water Supply of San Francisco," 16, 22, 23. The photograph of the Lake Merced (or "City") pumping station, whose pumps were installed in 1891, shows most clearly the corrugated emtal walls refined by the installation of arched windows. The photo of the Belmont Pumps, through which the water from the Alameda Division's Sunol Water Temple works and on through the transbay pipeline, also shows an industrial style warehouse fitted with the neoclassical style windows; in addition, the site was planted incongruously, but typically, with large palms. The urban Clarendon Heights pumping station was a proper brick industrial station that boasts a typical but very cleanly style of industrial neoclassical design integrity. For comparison, above it is pictured a more modestly designed pumphouse, the Ocean View pumping station.

[523] On the last page of every issue, a quotation appeared alone on the page in large, decorative typography. The two issues preceding the Central Pumping Station cover issue (October 1922) reproduced the Biblical quotations appearing on the front façade of the Sloat Boulevard Central Pumping Station. Both issues identify Mrs. Bourn as the person who chose the Biblical inscriptions on the building, identifying one of the passages as Prov. 5;16, and the other as Deut. 11:11. See *San Francisco Water* 1, no. 2 (April 1922): 11; and *San Francisco Water* 1, no. 3 (July 1922): 11.

Polk's development of the cascading water motif, from the small overdoor frieze on the 1910 Sloat station into the first-floor exterior façade of the 1922 Spring Valley Water Company headquarters, is in line with developments in modern design for the period. By 1922, subtle Art Nouveau embellishments—dramatic verticality in the cascade pattern and the clock-case drapery, broad pilaster facings, the large mural with its late Arts and Crafts/Art Nouveau sensibility, the high-rise format aesthetically-adjusted away from Beaux-Arts, and even the large, sheet-glass mullioned windows—offer visual cues as to the development of an assertive American modernism that upholds a classical ideal, yet departs from the stricter trends of a studied academic eclecticism, and suggests some theatrical flourish. Relative to more overt Art Nouveau and developing Art Deco treatments, these are subtle details. Yet, this building's stylistic movement away from earlier trends is clearly in evidence just across the street. The Native Sons of the Golden West building, from 1912, was similar in social status to Bourn's water building, although their work-vs-social functions were discrete. **[Figures 147, 148]** Comparison reveals Polk's design to be more restrained in its classical ornamentation. This is especially notable on the smooth wall surfaces on the office block, and the comparatively understated mouldings and entablature at the "capital" level. By contrast, the Native Sons building defines the capital level with an elaborate two-story loggia with five arched bays divided by paired columns, and a deep, articulated cornice capping the eaves. The adjacent 1915 First Congregational Church building, by the Meis Brothers, displays a White City exemplar, of a piece with San Francisco's 1915 urban image as it opened its new City Hall and the Panama-Pacific International Exposition. **[Figures 147, 163]** Longstreth points out that although Polk had endorsed the Beaux-Arts at the time of the Chicago Fair, he derided it by the turn of the century.

> Polk considered the École's direct influence to be inappropriate for the West Coast and fundamentally detrimental to the creative process. He was not challenging the school's emphasis on logical ordering of form and space, its partiality to the classical tradition or its academic approach to understanding and working with the past, but he felt that the École's method of instruction was by rigid, formularizing precedent and produced only "mediocrity." A few years earlier, he had praised the institution. Now, having explored the classical language

> and formal modes of expression more fully, he joined the growing numbers of American architects who questioned the École's infallibility. Indeed, his accusations are among the most scathing made at that time."[524]

Nearly a decade separates the construction of the Spring Valley Water Company (1923) from the Native Sons (1912), and First Congregational Church (1915) buildings. I note the above details to point out Polk's departure from strict Beaux-Arts standards, to underscore his literate eclecticism, and to emphasize his insistence on both modernization and regionalism in design.

Polk's 1923 building also shows an openness toward structural modernism. The double-story sheet glass windows, divided by narrow mullions into six large panes per window, flank each side of the entry portal at the building's base and create, in effect, a glass front. Plate glazing is a departure from the standard neoclassical office building idiom, which featured heavy use of masonry at the street level. The Native Sons building across the street evinces this. Sheet glass was indeed a common feature of retail building street fronts meant for display, but not widely used for office structures in San Francisco at this time.[525] The specific feature of prominent display of sheet glass had nonetheless appeared quite dramatically within the context of Polk's own oeuvre. The pointed example from Polk's work is his art-historically lauded Hallidie Building of 1917, built

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524 Richard Longstreth, *On the Edge of the World: Four Architects in San Francisco at the Turn of the Century* (1983, repr., Berkeley: University of California Press, 1998), 256.

525 A notable exception to the unusual use of sheet glass is the post-earthquake automobile showroom, and mercantile shop windows immediately after the earthquake, located almost exclusively along Van Ness Avenue, where the broad boulevard of large lots, cleared after the earthquake, became San Francisco's temporary commercial-mercantile quarter while downtown underwent reconstruction. After merchants left Van Ness for new buildings downtown, the avenue flourished as "Auto Row." Showrooms, designed by prominent architects, to include McKim, Mead and White, for example, featured sheet glass street fronts within what we might call an ornamental structural aesthetic. Reinforced concrete and some steel beam utilitarian warehouse plans featured high open spaces and large shop window fronts. Architectural styles fashioned the new automobile market with high-status appeal, especially after 1910: "Architecturally, the larger auto showrooms were recognizable as a building type even though they varied considerably in their aesthetic. Several were relatively plain, and in these buildings expression of the skeletal concrete construction was emphasized over ornament…Most auto showrooms were more elaborately decorated with Classical Revival ornament." See William Kostura, *Van Ness Auto Row Support Structures: A Survey of Automobile-Related Buildings along the Van Ness Avenue Corridor* (Palo Alto, CA: San Francisco Planning Department, 2010), esp. 18-34. In conversation, Kostura warns against over-interpreting large sheet glazing on the ground floor of office and retail buildings as a "sign of modernism." William Kostura, personal communication with author, May 28, 2013.

five years before the Mason Street building. The Hallidie Building is assessed critically in architectural history as an important early arbiter of structural modernism. **[Figure 177]** Built for the University of California Regents, it was singled out by Kenneth Frampton, leading historian of 20th-century modern architecture, as "the first application of a pure curtain wall to any building in America."[526] This early modernist gesture was a seven-story curtain glass face divided by mullions into an even grid of large panes. This building-size "sheet" of glazing was then mounted on a cantilevered concrete support system, an armature structure that holds the glass wall more than three feet away from the main building face. The whole gives the impression that the front facade is a single sheet of glass. An ornamental cornice parapet, subdued, almost calligraphic, caps the curtain wall with a Gothic Revival fringe in cast iron, making the entire façade a clever play on the Arts and Crafts ideal of truth to materials. It honors a Gothic Revival aesthetic, while also creating a direct and transparent statement of developing 20th-century structural modernism. With this building, observed Frampton, Polk achieved "a structure of…extraordinary precision and lightness. Such a work was hardly eclectic practice prior to 1915."[527]

In the post-quake period, Willis Polk's waterworks and hydropower commissions were varied, plentiful, and challenging. His strong visual statements for waterworks and hydropower buildings were confident innovations upon established historical-revival styles. His designs ensured that industrial buildings would cohere aesthetically with the local urban image. The best among the designs did more than simply coordinate, blend in, or stand out: they set innovative precedents built on solid cultural and historical foundations for architectural design.

526 Kenneth Frampton and Yukio Futagawa, *Modern Architecture, 1851-1945* (New York: Rizzoli, 1983), 194.
527 Frampton and Futagawa, *Modern Architecture*, 194. The Hallidie Building is typically cited for this early innovation in modernist architectural history; Framption, who penned the text of this book, is among the most articulate on the point.

CHAPTER 9

Private Shrine, Public Temple: Architectural Traces and Transitions from Private Water Company to Municipal Water Department

UNDER COURT ORDER: A DECADE OF SPRING VALLEY COMPANY ARCHITECTURAL UPGRADE BEFORE ITS TURNOVER TO THE CITY OF SAN FRANCISCO

While Polk was finalizing the Spring Valley Water Company's headquarters for its 1923 Mason Street building opening, the water company was also beginning construction on a major new structure in the Alameda Division, the Calaveras Dam. [**Figure 178]** The Calaveras Reservoir impounds Calaveras Creek and lies a few miles upstream from the Sunol Temple. That creek is an Alameda Creek feeder, one of the surface supply branches entering the Sunol Temple works for diversion into the Sunol Aqueduct and on to the transbay tunnel to Crystal Springs storage reserovoirs in the San Mateo Division. **[Figures 156, 157]** The 1925 Calaveras Dam replaced an earthen dam which had collapsed in 1918 before it was finished. This was a dismal and shocking failure, given the fact that the company had hired William Mulholland, the famed engineer of the 1913 Los Angeles Aqueduct, directly on the heels of his completion of that renowned waterworks marvel. Michael O'Shaughnessy, San Francisco City Engineer, took over dam redesign and reconstruction, and the new earth and rock Calaveras Dam opened in 1925. Of special interest is a letter O'Shaughnessy wrote to prominent dam engineer John R. Freeman in 1913 when Mulholland had begun work on the Calaveras Dam. O'Shaughnessy writes a scathing critique of the design, workmanship and materials, describing them as "sloppy," "reckless," and "a sad mess."[528] The engineer's remarks indicate some of the complicated intricacies of water relations between the City of San Francisco and the Spring Valley Water Company and

528 Michael M. O'Shaughnessy, San Francisco City Engineer, to John R. Freeman, October 14, 1913, Box (L) MB-068, Documents Archives, SFPUC. The typed closing reads "Very Sincerely Yours, (Signed) M. M. O'Shaughnessy, City Engineer." This copy carries no original signature.

their engineers. Freeman, too, consulted with both the City of San Francisco and with the Spring Valley company regarding water systems developments. In the previous year, Freeman had submitted his plan, commissioned by the City of San Francisco, for the Hetch Hetchy water system.[529]

At this point, one puzzles over a few details of history. Why is the Chief Engineer for the City of San Francisco taking over a major dam building project for its long-time private competitor? Why is the private Spring Valley Water Company hiring the municipal engineer to do this work? The Spring Valley Water Company had bought the Calaveras watershed and dam site in the 1880s after the prominent waterworks consultant from Louisville, Theodore Scowden, recommended the City purchase it.[530] Further, one wonders, why is O'Shaughnessy supervising this Spring Valley dam at the same time the

529 To illustrate this, I quote at length from the letter here: "I have read with a great deal of interest your thoughts and views on the present Calaveras Dam project now being constructed by the Spring Valley Water Company under the jurisdiction of Mr. William Mulholland of Los Angeles. For unknown reasons the Company has prosecuted a policy of great secretiveness with regard to this project and only took me into their confidence about six weeks ago to the extent of inviting me to see the progress…I think Mr. Eastman, the Vice President, is amenable to suggestion and desirous of doing things right, but I am afraid Mulholland and Hermann are so intensely conceited that they imagine all they might do should be immune from criticism. As the City has no official knowledge of the progress of this work, its official can assume no responsibility for the outcome of that undertaking. The project is of such great importance, however, that its successful completion and operation is of vital interest to the survival of this community for the next seven or eight years, or until the Hetchy Hetchy project is completed that I took it upon myself to criticize severely the sloppy way in which this outlet work is being undertaken. …There is great hesitation on the part of our Engineering Profession to hurt the feelings of our brother members by adverse criticisms on their methods, but I did not refrain in this instance from almost overstepping the limits of politeness by emphasizing my objections to the reckless manner in which the construction of this outlet culvert was contemplated. …Both Mulholland and Lippincott have made a sad mess of much of their construction work on the Los Angeles Aqueduct and I warned Eastman that the reputation of the Company would be damaged except that same high standard of construction were followed in the present works as the previous high standards followed by Mr. Schussler. The latter's nose, by the way, is out of joint and will have nothing to do with and will not even look at the proposed structure in Calaveras Valley, as his plans and advice were ignored in the project.…Considering the extent of values of life or property over $10,000,000. Between this dam site and San Francisco Bay, it would seem to have been prudence [STET] to have put another million dollars into this structure and allay public fears as to any catastrophe which might follow from disaster following a failure. The action of the San Andreas dam under earthquake conditions, which straddled a fault line, impresses me strongly with the merits of this type of dam in an earthquake country…. Unofficially I am going to keep a watchful eye on this proposition so that the City will not inherit a 'gold brick' if it should take this property over."

530 The Spring Valley Water Works Company reported completion of negotiations for its purchase of the Calaveras lands for the future reservoir in the SVWW *Minutes,* June 23, 1887, Documents Archives, SFPUC.

City, led by O'Shaughnessy, is beginning construction on the centerpiece dam on its massive Hetch Hetchy Aqueduct system? To understand more about the historical relationship between the two companies is a step toward understanding building and design decisions made during this period.

At the same time the Spring Valley's replacement Calaveras Dam was going up, and Polk was completing the 1923 Spring Valley Company office building, the City of San Francisco, led by O'Shaughnessey, was in the initial development phases on the Hetch Hetchy Aqueduct construction project. **[Figure 179]** The project had solidified its form when the City submitted a gargantuan aqueduct plan in 1912, designed and penned by prominent dam engineer John R. Freeman, as Consulting Engineer for the City and County of San Francisco.[531] The Hetchy Hetchy Aqueduct project was able to move forward legally only with passage of the long-contested 1913 Federal Raker Act, granting the City of San Francisco easements and access within Yosemite National Park.[532] The first development on the system was the 1919 Lake Eleanor Dam, built to produce

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531 John Ripley Freeman, *On the Proposed Use of a Portion of the Hetch Hetchy, Eleanor and Cherry Valleys Within and Near to the boundaries of the Stanislaus U.S. National Forest Reserve and the Yosemite National Park as Reservoirs for Impounding Tuolumne River Flood Waters and Appurtenant Works for the Water Supply of San Francisco, California, and Neighboring Cities,"* (San Francisco: San Francisco Board of Supervisors, 1912). In addition to proposing the Hetch Hetchy Valley as the preferred reservoir site, the report presents preliminary studies done on nine other watersheds, being those of the Stanislaus, Mokelumne, American, Cosumnes, Ell, McCloud, Feather, Yuba and Sacramento Rivers. Previous to these were T. R. Scowden, *Proceedings had in Board of Supervisors: And Reports of engineer in the matter of furnishing water supplies for the City and County of San Francisco* (San Francisco: City and County of San Francisco, 1875), published as an appendix to municipal report, 1974-75. The study also mentions an 1877 plan to use Lake Tahoe as the City's water supply, included in a report by George H. Mendell, *Report on the Various Projects for the Water Supply of San Francisco, California, Made to the Mayor, the Auditor and the District Attorney, Constituting the Board of Water Commissioners* (San Francisco: Spaulding and Barto, 1877). Mendell's report includes consideration of water supplies of Clear Lake, Lake Tahoe, El Dorado watershed, Mekolumne River watershed, Rubicon and American Rivershed, San Joaquin River, Feather River, Eel River, and other plans stemming from the Bay Area region watershed. An incomplete copy is held in Box HPC-005, Documents Archives, SFPUC.

532 On the Raker Act, or HR 7207, see Warren D. Hanson, *San Francisco Water & Power: A History of the Municipal Water Department and Hetch Hetchy System* (San Francisco: City and County of San Francisco, 2005), 22. The full text of the Raker Act may be found online at Virtual Museum of the City of San Francisco, accessed March 14, 2015, http://www.sfmuseum.org/hetch/hetchy.html. For a print version, see United States Congress, House of Representatives, *An Act Granting To The City And County Of San Francisco Certain Rights Of Way In, Over, And Through Certain Public Lands, The Yosemite National Park, And Stanislaus National Forest, And Certain Lands In The Yosemite National Park, The Stanislaus National Forest, And The Public Lands In The State Of California, and For Other Purposes* (Washington, D.C.: Government Printing Office, 1913).

hydropower only. Water traveled several miles down steep penstock pipelines to generate power at the Early Intake Power House on the Tuolumne River, a few miles downstream from the Hetch Hetchy dam site. At the Early Intake, water entered the aqueduct, a series of pipelines, canals, and tunnels. **[Figures 180, 181]** At this point in the timeline, the aqueduct extended only as far as the foothills of the Sierra Nevada. The water supply the Hetch Hetchy Aqueduct promised was still a decade away from the Bay Area, even if its pieces were under construction all along the 150-mile route.

The second major phase was the large-scale 1924 O'Shaughnessy Dam, the controversial centerpiece of the system, which would create a reservoir from the former Hetch Hetchy Valley by impounding the formidable Tuolumne River. **[Figures 181-183, inclusive]** This first phase of the dam, complete in 1924, fed Hetch Hetchy's hydroelectric system in conjunction with the Eleanor Dam, and these together powered the 1924 Moccasin Creek Power House at the base of the Sierra foothills, where the penstocks could take full advantage of the elevation drops the gravity system used to produce hydropower. **[Figure 184]** By 1926, a year after Spring Valley's Calaveras Dam opened, Hetch Hetchy reservoirs and powerhouses had been producing waterpower to power its own water project for several years. Hetch Hetchy Aqueduct construction crews were making headlines for record-speed tunnel boring on the long-term goal to complete the water supply aqueduct and high-voltage power to the Bay Area.[533]

By 1934, the Hetch Hetchy water supply reached the Crystal Springs Reservoir terminus, and the City organized a nationally-broadcast Completion Ceremony at the site of the aqueduct terminus, at that time called the Pulgas Outfall Tunnel (P.O.T.). For the occasion, the city hastily constructed a temporary copy of Willis Polk's Sunol Water Temple, changed the name of the P.O.T. site to the Pulgas Outfall Temple, and from the

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533 "Not only did a spirit of competition grow between the City's work forces and those of contractors working on adjacent sections, but direct comparisons of costs for similar work became possible. Completely outworking the private contractors, Hetch Hetchy's City forces set a new record for one month's tunneling excavation [on the Foothill Tunnel] in March 1926—781 feet at Hetch Hetchy Junction east heading. Six months later City forces broke their own record at the same work face—803 feet in September—setting a new national record for this type work. Foothill Tunnel was completed in 1929, at a total cost of $8 million. Chief O'Shaughnessy later reported that tunneling costs for City work came to $35.53 per foot—contractor cost was $40.49." See Hanson, *San Francisco Water & Power,* 36.

temple's peripteral platform stage, CBS Radio broadcast the first delivery of Hetch Hetchy water to the Bay Area, closing a decades-long controversy with broad national interest. **[Figure 185]** In 1938, the second phase of the O'Shaughnessy Dam was complete: new construction which in essence attached a second concrete dam directly upon the first phase dam, expanding its storage capacity to create San Francisco's full water supply. **[Figure 249]** In in the same year, a new Pulgas Water Temple had replaced the promotional temporary structure at the Pulgas Outfall, creating a permanent aqueduct terminus and public garden. **[Figures 186, 187]** I will examine both Hetch Hetchy Aqueduct terminus temples later in this section.

All of this took place in the context of a decades-long, contentious history of start-and-stop negotiations between the City of San Francisco and William Bourn's Spring Valley Water Company, to finalize a purchase price. A parallel, and complicating, context involved regulatory requirements regarding water and power sharing between the City and Spring Valley. The Hetch Hetchy system had been approved and initially funded by 1913, and by 1922 the City's purchase of the Spring Valley Water Company had become a *fait accompli*, based on an agreement in that year between the two entities.[534]

> Under the terms of [a] 1911 State Railroad Commission order, the water arbiter at the time, and the 1922 agreement between Spring Valley and San Francisco, the city acquired an option to buy the Spring Valley Water Company and its assets to integrate with the Hetch Hetchy system once completed.[535]

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534 For a brief retrospective overview of the relationship between Spring Valley and the City, and for a detailed timeline, see Hanson, *San Francisco Water & Power*, 14-15, 20-42, 49-54.

535 Hanson, *San Francisco Water & Power,* 40. After 1924, when San Francisco had run out of money for the Hetch Hetchy project, the Spring Valley Water Company advanced $1 million to the City. Hanson quotes excerpts from period press (an *Oakland Tribune* editorial on December 12, 1924) commenting on the historically antagonistic relationship between Spring Valley and the City of San Francisco, and on the incongruity of Spring Valley's loan, seen as a magnanimous gesture: "In referring to 'controversies which have hindered and threatened to halt the work...,' the *Tribune* opined, 'In the light of history, it seems a little incongruous that at the most critical period in the Hetch Hetchy war, and when the money was not available, the much-maligned Spring Valley Water Company came to the front to furnish the funds to complete the job.' In the light of history, it seems a little incongruous that at the most critical period in the Hetchy Hetchy work, and when the money was not available, the much-maligned Spring Valley Water Company came to the front to furnish the funds to complete the job." See Hanson, 40. A complete history of the complicated relationship between Spring Valley Water Company and the City/County of San Francisco has been widely explored, and is not within the purview of this dissertation.

Even at this time, while the City was well into construction of its massive Hetch Hetchy infrastructure, it did not own a municipal water system for storage, power generation, or distribution. The Spring Valley Company owned San Francisco's entire water system and its watersheds, water rights, and easements. Enforced agreements materialized, which required the upkeep and development of both water systems—Hetch Hetchy and Spring Valley.[536] The City finally took over the Spring Valley Water Company's system and holdings in a 1930 purchase.

Over the long period of time when that purchase was anticipated but not yet finalized, the private Spring Valley Water Company's system expanded, and architectural additions kept pace. During the thrust of Hetch Hetchy construction, most notable were the construction of Calaveras Dam and the heightening and upgrading of dams, storage, and conveyance in the San Mateo Division, which I will discuss later in this section. Improvements also substantiated the private company's existing ownership and authority over its long-held urban water storage and distribution system, with architecture continuing to ground that claim. The company had relied upon aesthetics all along, as I have discussed, producing high-quality, "dignified" neoclassical architecture for its waterworks and office structures. High standards of aesthetics in architectural design were upheld during the company's 1920s system modernization, when the eventual sale of the company to the City was in motion. Of interest to this study are actions each entity made during those years regarding its waterworks architecture. The December 1928 expansion of the San Andreas Dam, for example, which included a new Outlet Temple and works, underscored Spring Valley Water Company's expansion, even though it dovetailed with voter passage in May 1928 of bond authorization for the City of San

[536] See Hanson, *San Francisco Water & Power,* 22. The Spring Valley Water Company withdrew its opposition to the long-fought Raker Act "when a special clause was included in the Act providing that all of the water from sources near San Francisco be used before water from the Tuolumne could be diverted. This clause protected Spring Valley in its investment in all properties and rights up to the full amount of their water producing capacity." See Hanson, 26.

Francisco's purchase of the private water company.[537] The eventual purchase assured municipal consolidation of the entire existing—and expanding—Spring Valley water system with the City's new Hetch Hetchy system. It guaranteed a vast water supply not only for San Francisco, but also for the surrounding cities it anchored, which had sprawled into a new urban movement advocating for a "Greater San Francisco" metropolitan region, today termed the Greater Bay Area.[538] The interrelationships between the city water project and the private water company become more comprehensible with the above details in mind, so we can return to the question of architectural design for Spring Valley's improvements in the 1920s.

UPSTREAM FACE: MEMORIALIZING WILLIS POLK AND REBUILDING THE FAILED CALAVERAS DAM

Willis Polk died in 1924, a year after he completed the Mason Street office building and a year before the Calaveras Dam opened. A number of tributes honored his life's work. At the Sunol Temple, a memorial plaque bearing a quotation from Keats—"A thing of beauty is a joy forever: its loveliness increases; it can never pass into nothingness"—was designed, carved in marble, and set in the temple base by Gardner Dailey, the landscape architect who had designed the rooftop garden for the Mason Street offices. **[Figure 188]** In the next year, a memorial ceremony at the Sunol Temple honored Polk, with a large letterpress broadside pamphlet printed and bound—in an edition of only 35—for the occasion. This pamphlet, "To Remember Willis Polk," carried a representation of the memorial plaque on the front cover and a rich photograph of the temple on the frontispiece.[539] Two brief memorial essays, one by Bruce Porter and another by Edward F. O'Day, memorialized the architect. Porter's was a general tribute in eulogy; he also published a eulogy in *San Francisco Water*.[540] O'Day's focused

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537 "By October 1934, San Francisco voters had authorized seven bond issues to finance the Hetch Hetchy work; $600,000 in 1910, $45 million in 1910, $10 million in 1924, $24 million in 1928, $6.5 million in 1933, for a total of $101,695 million." See Hanson, *San Francisco Water & Power,* 42.

538 See Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin, with a New Preface* (1999, repr., Berkeley: University of California Press, 2006), 100, 115, 269-70.

539 "Spring Valley, An Historical Review," *San Francisco Water* 5, no. 1 (January 1926): 32.

540 Bruce Porter, "Willis Polk: By Bruce Porter," *San Francisco Water* 3, no. 4 (October 1924): 12.

explicitly on the importance of the Sunol Temple to local water architecture, the importance of the temple to Polk, and the larger cultural idea of a water shrine.[541]

> Willis Polk regarded the Water Temple at Sunol in Alameda County as one of his most distinguished achievements in architecture, so it was very fitting to remember him there in marble.
>
> The spot where the Water Temple stands in all its Corinthian nobility has a very special importance in the great system of properties that Spring Valley Water Company has dedicated to the water supply of San Francisco. Then all the waters of the Alameda Division mingle their streams for the journey across San Francisco Bay to the Metropolis.
>
> Originally a rude shed covered this "meeting of the waters," but Mr. William B. Bourn, president of the Spring Valley Water Company, appreciated the desirability of a dignified treatment, and the idea of a temple took form in his mind. So Willis Polk was asked to design a water temple, and after a year of thought and study, in the course of which a number of projects were developed and rejected, he produced this beautiful shrine, inspired by the Temple of Vesta at Tivoli.
>
> The Water Temple was completed in the year Nineteen Hundred & Ten. Willis Polk died in Nineteen Hundred & Twenty-four, and in the following year a marble slab bearing the words "To Remember Willis Polk," with a quotation from the *Endymion* of Keats, was set in the floor above the crypt. The inscription was carved by Mr. Gardner A. Dailey.
>
> …That there is a happy fitness in thus honoring Willis Polk at the Water Temple we know from an eminent authority on the history of architecture who gives us classical precedent for what has been done at Sunol. Sir Banister Fletcher, writing of that "ancient Roman regard for running waters, which almost amounted to adoration," has said: "Water, ever fresh and ever changing, was used to memorialize great men and noble deeds. Water shrines … honoured the dead and served the living."[542]

The potential for discussing the question of a shrine to water, and ways in which the idea of water worship engages the history of religion as it examines American attitudes and

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[541] In places, O'Day's text is identical in wording to introductory comments he made in "On the Architecture of the Water Temple," *San Francisco Water* 1, no. 3 (July 1922): 3-5.

[542] Edward F. O'Day, in *To Remember Willis Polk, Architect: With a Reproduction of His Water Temple at Sunol, Alameda County, California*, (San Francisco: John Henry Nash, 1926). The Colophon reads: "Of this memorial to Willis Polk, the cover bearing a facsimile in miniature of the marble tablet at theWater Temple, Sunol, California, thirty-five copies have been printed for Spring Valley Water company by John Henry Nash of San Francisco, 1926." O'Day refers to Sir Banister Fletcher's *A History of Architecture*, probably the 1921 edition; Fletcher and his father first published the renowned book in the 1890s. The excerpt from Fletcher that O'Day quotes in his memorial piece above also ornamented the back cover of the April 1926 issue of *San Francisco Water*.

beliefs toward nature, wilderness, landscape, environment, natural resources, and urban development, is an open one.

Another memorial gesture toward Polk appeared in the year following his death, one in architecture. Gardner Dailey designed a round Outlet Temple for the 1925 Calaveras Dam's pipeline tower, a conscious formal reference to Polk's Sunol Temple, and an explicit "reminiscence" on the part of the Spring Valley Water Company.[543] **[Figures 188, 190]** The Outlet Temple, encircled by an arcade of six attached smooth Doric columns, topped with a polyhedral tiled roof, also features a visually compelling entry of decorative wrought iron and an overdoor frieze inscribed, "Lympha Optima." **[Figure 191]** Loosely translated, the phrase means "optimal water" but the Latin *lympha* implies clear spring or river water and *optima* directly refers to the artistocracy. The temple's high perch poised it above the reservoir, with access across by an arcaded bridge with a formal gateway leading from a parking circle at the dam crest, which commanded a view of reservoir, tower, and surrounding hills.[544]

Photographs of the upstream side of the Calaveras Dam reveal another unique aesthetic feature of the upstream dam face, finished with a "rock-facing…laid in a series of arches."[545] **[Figures 178, 188]** Structurally, the arcaded upstream face of O'Shaughnessy's new 1925 Calaveras Dam, lined with the laid-rock masonry, was

543 On Gardner Dailey's Outlet Temple (or "Gate House") as expressing "the dignity of water," see Edward F. O'Day, "Fountains Dispersed Abroad," *San Francisco Water* 6, no. 3 (July 1927): 11. For photographs of Calaveras Dam and the Outlet Tower (or "Gate House", or "adit tower") see *San Francisco Water* 5, no. 2 (April 1926): 8. The full "reminiscence" caption reads: "The outlet tower surmounting the shaft that houses the control gates. The causeway leads from a circle of formal architectural treatment. The tower was styled in reminiscence of the Sunol Water Temple." See also "Water Supply of San Francisco," 5. The photographs accompanying "Water Supply of San Francisco" are credited to George Fanning, Spring Valley Water Company's longtime photographer, and to Gabriel Moulin, the prominent photographer of San Francisco architecture and engineering projects. See "The Water Supply of San Francisco," 29.

544 "Calaveras Dam is one of the big earth-fill dams of the world. It closes the outlet of the long narrow valley that has been converted into Calaveras Reservoir. The white tower houses the gate-valves that control the release of water through a tunnel to the creek channel below the dam. …Calaveras Reservoir dominates the trans-Bay (or Alameda) Division of Spring Valley's catchment system. It is replenished by the streams of a very productive watershed in the Mt. Hamilton spur of the Coast Range. Water is released into Alameda Creek, percolates through the Sunol gravels, and enters the Sunol Aqueduct" beneath the Sunol Water Temple. See "The Water Supply of San Francisco," 5.

545 See photographs and their captions in *San Francisco Water* 5, no. 2 (April 1926): 8; and "Water Supply of San Francisco," 5.

"designed to prevent sloughing of the earth," which had caused Mulholland's 1918 dam failure.[546] This *bas relief* arcade, from a distance, lends a lovely artistic touch to the upstream side of the dam. The series of low-relief masonry arches along the full breadth of the upstream face resembles a profile view of a giant masonry aqueduct arcade, with the dam crest riding atop it like an aqueduct channel. The overstated scale of this feature works proportionately with the mass of the dam, yet its style, materials, and artistic effect are understated, with its low profile against the angled dam face, hues of the natural rock surface, and anticipation that upstream it would be submerged by rising reservoir water. Taken together as a grouping, the Calaveras Outlet Tower's arcaded access bridge, the temple's small peripteral arcade, and the low relief masonry arcade serve to unify and add visual variety to the whole, and they make a subtle allusion to aqueduct arcade history.[547]

I suggest that the upstream arcade facing may have borrowed from—or simply recalled—a related design idea submitted more than ten years earlier by leading American dam engineer John R. Freeman. **[Figure 189]** In 1911, Freeman submitted a concrete gravity dam design for the first Calaveras Dam. The design featured giant pilasters running the full height of the downstream face.[548] In the next year, Freeman published his 1912 plan proposal for the Hetch Hetchy Aqueduct, and in that document, Freeman's drawing for the downstream face of his proposed Hetch Hetchy Dam was

546 Quoted from the caption of the upper photograph of the Calaveras Dam's upstream face in *San Francisco Water*, 5, no. 2 (April 1926), 8.

547 In 2014, Gardner Dailey's 1925 Outlet Tower still stood, albeit in a partially demolished condition, adjacent to a larger-scale replica of Gardner Dailey's Outlet Tower, under construction as part of the Calaveras Dam rebuilding project, current, ongoing at the time of this dissertation's writing. The project has seen several major delays due to discoveries of geological irregularities in the abutments for the new dam beneath the former "Observation Hill." Confirmed upon personal site observations by author during 2014. I am indebted to Tim Koopman, SFPUC, Alameda Division, Sunol Temple administrative offices; and John Rocca, SFPUC Engineer, Calaveras Dam project, for interviews and a site visit during March 2014.

548 Original blueprint drawings submitted by John R. Freeman, Consulting Engineer, Providence, RI, and signed off by Spring Valley Water Company Chief Engineer Herman Schussler, April 13, 1911. See Freeeman drawings E-131 to E-143, Engineering Archives, SFPUC, Millbrae, CA. especially the perspective drawing of the downstream face, E-135, where the engineer labels the full-height column details as "pilasters**."** Engineer Schussler, who retired from the company in 1909, also consulted with the company after his retirement, and maintained a private practice until his death in 1919. See Hanson, *San Francisco Water & Power,* 8.

similar to his Calaveras Dam proposal.[549] **[Figure 189]** Spring Valley did not select Freeman to build the initial Calaveras Dam, but rather William Mulholland, and the dam style chosen was earthen and not concrete. Mulholland was later defamed by the 1928 failure of his St. Francis Dam in Southern California, which I will discuss in a later chapter, in conjunction with a discussion of Freeman.

The history of Calaveras Dam engineering design is interesting for the number of leading engineers who gave it their attention over the decades. In 1875, Theodore R. Scowden, the celebrated engineer of the 1860 Louisville Water Works, recommended that the City of San Francisco purchase the Calaveras watershed lands, in a commissioned report on the city's future water supply. The City did not purchase the property immediately, but the Spring Valley Water Company did, in 1887.[550] John R. Freeman submitted his Calaveras Dam plan in 1911, and in the next year, Freeman completed a report for Spring Valley on the Alameda watershed and its future development. Hermann Schussler had also submitted a similar report on the Livermore Valley Pleasanton Wells portion of the Alameda watershed.[551] In 1913, William Mulholland was hired to build the Calaveras Dam, bringing with him his Los Angeles waterworks engineer, J.P. Lippincott.[552] When Mulholland's dam failed in 1918, Michael O'Shaughnessy, San Francisco's City Engineer, took over the Calaveras Dam's reconstruction. Spring Valley Water Company Chief Engineer Hermann Schussler had retired a decade earlier, and continued to do consulting work for the company, but O'Shaughnessy's letter to Freeman mentions that Schussler, his "nose out of joint" for some reason, was uninterested in the Calaveras project.[553] Freeman was nationally known

549 See Freeman, *On the Proposed Use of a Portion of the Hetch Hetchy*, 118.

550 See SVWW *Minutes,* June 23, 1887, Spring Valley Water Company Collection, Document Archives, SFPUC.

551 A copy of Schussler's report can be found in the Document Archives, SFPUC.

552 O'Shaughnessy to Freeman, October 14, 1913, Document Archives, SFPUC

553 O'Shaughnessy to Freeman, October 14, 1913, Document Archives, SFPUC. Schussler had retired as Chief Engineer in 1909, and his successor, Fred C. Herrmann, took the position in 1911. Freeman listed himself on the Calaveras Dam plan he submitted in 1911 as "Consulting Engineer," and Schussler continued to consult with the company after his retirement; he died in 1919 at 77 years old. In 1929, a memorial plaque to Schussler, designed by Gardner Dailey, was placed along the crest road at Crystal Springs Dam. See "A Memorial to Hermann Schussler," *San Francisco Water* 8, no. 2 (August 1929): 1.

and served in a consulting role in just about every area of California's waterworks landscape, and his dam engineering expertise was highly sought after. Work on the Calaveras Dam attests to the small, tight, and elite nature of the world of water engineering at the time, and the fact that the dam received the attention of leaders in the field confirms its historical importance.

The Spring Valley Water Company was renowned in American waterworks engineering, specifically at the forefront of dam construction. The company's Chief Engineer from the 1870s until his 1909 retirement, Hermann Schussler had set that reputation in stone, most emphatically with his Lower Crystal Springs Dam of 1888. This dam was the most significant early development in concrete gravity dam building in California, and it put San Francisco on the waterworks map. Schlussler's innovative structure dammed the San Mateo Creek watershed south of San Francisco. **[Figure 192]** The Lower Crystal Springs Dam created a U.S. precedent as the first massive concrete gravity dam, a type which became standard practice for American dam building. Concrete gravity dams are in what has been called "the massive tradition," which I will discuss later in this dissertation. Schussler's Lower Crystal Springs dam earned landmark status for several reasons.

> The problems of constructing a concrete dam in California, at a time when masonry dams were the state of the art, were immense. In the first place, the region had only begun to be settled 40 years previously, with the influx of the gold miners. In addition, transcontinental railroad service was in its infancy, since

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Generally speaking, the Freeman Plan determined the actual Hetch Hetchy route. See Hanson, *San Francisco Water & Power,* 22, 38, and "Chronology," a timeline printed on the inside covers of the booklet. Freeman's 1911 Calaveras Dam project drawings (E-131 to E-143) are in the Engineering Archives, SFPUC, Millbrae, CA. Theodore Scowden, the hyudraulics engineer who had built the Greek Revival Louisville Water Works, the Dayton and Louisville Greek Revival Water Works of 1860, was hired in the early 1870s by the City and County of San Francisco to assess the current and future water supply. He recommended in his 1875 report of the city and county water supply, that the City buy "a Calaveras site, on a branch of the Alameda Creek in Alameda and Santa Clara Counties, as the beginning of a future municipal water supply. The City was unable to act quickly and the Spring Valley Water Company effectively blocked this threat of competition by promptly purchasing the land and water rights for itself. …Construction of the earth and rock fill type dam did not start for another 38 years, until 1913. A series of misfortunes and engineering errors culminated in a failure of the partially completed dam on March 24, 1918, when the upstream face of the dam sloughed off and the water gate tower collapsed." The dam was rebuilt by O'Shaughnessy to a height of 215 feet, making it the tallest earth fill dam in the world in 1925. See Hanson, *San Francisco Water & Power,* 16.

California had its first rail connection to the East in 1870. There was not yet a cement industry in California, hence the cement for Lower Crystal Springs Dam was imported from England. The Construction methods used for the dam, which were specified and rigidly enforced by Hermann Schussler, Chief Engineer of the Spring Valley Water Company, were about a half-century ahead of their time, because they were devised at a time when masonry blocks were the usual building material, and concrete technology was in its infancy.[554]

Schussler devised a system of irregularly-shaped, interlocking concrete blocks, poured in place and "staggered" in arrangement "so that there were no continuous horizontal or vertical joints through the dam."[555] Historian Marianne Babal describes Schussler's block system for the Lower Crystal Springs Dam in lay terms:

> The blocks were set in an alternating pattern and when the first course would dry and shrink, a second course would fill in the adjoining spaces in a checkerboard fashion. Each block had irregular projections on each side, to better "lock" with neighboring pieces. The result of this projectile and block system was that the dam sported no continuous vertical or horizontal seams, but instead held together like an immense jigsaw puzzle.[556]

This made the dam literally quake-proof: it suffered no damage in the 1906 earthquake, a remarkable fact, considering the retrospective discovery that the Crystal Springs and San Andreas reservoir chain lies directly upon the San Andreas Fault rift upon which the 1906 temblor centered.[557]

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554 Eric B. Kollgaard and Wallace L. Chadwick, eds., *Development of Dam Engineering in the United States* (New York: Pergamon Press, 1988), 13-15, 47-52. The Lower Crystal Springs Dam is the first all-concrete gravity dam in the United States, and Schussler's interlocking block technology was unique. Technically, the San Diego area Sweetwater Dam's last, concrete, renovation was completed earlier than the Lower Crystal Springs Dam, but either one can gain "first" billing for confronting different situations in concrete dam engineering. Sweetwater Dam was originally a curved stone masonry dam, which was eventually converted materially to concrete in a series of construction and improvement phases. The Lower Crystal Springs Dam, by contrast, was the first all-concrete curved gravity dam in the U.S. For the Sweetwater Dam, see Kollgaard and Chadwick, 235-37, 319-30.

555 Kollgaard and Chadwick, *Development of Dam Engineering*, 51-52.

556 Marianne Babal, *The Top of the Peninsula: A History of Sweeney Ridge and the San Francisco Watershed Lands, San Mateo County, California* (San Francisco: Golden Gate National Recreational Area, National Park Service, 1990), 94. The same type of construction was planned for the Pacific Gas and Electric Company's 1913 Lake Spaulding Dam in the Sierra Nevada Mountains, and apparently for a dam in Australia. See Hermann Schussler, "Admirable From Every Viewpoint; Would Bear Still Greater Development," *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 84-86.

557 Geologically, this long valley that directly cradles all three dams and their reservoirs is a major fissure of the San Andreas Earthquake Fault. In the 1906 earthquake, pipelines and other supply infrastructure

After Hermann Schussler completed the Lower Crystal Springs dam in 1888, the San Mateo County reservoir system comprised the three reservoirs—Upper Crystal Springs, Lower Crystal Springs, and San Andreas—which lay in line directly upon the San Andreas fault on the Peninsula south of San Francisco.[558] **[Figures 156, 159, 198]** From the Crystal Springs and San Andreas reservoirs, water moved to San Francisco's city reservoirs, first by flume, then through canals, pipelines, and tunnels, for urban distribution. In addition to waterworks design in Pleasanton and Sunol, Polk also designed a new pumping station across the bay at the base of Crystal Springs Dam, as well as the new Central Pumping Station for urban distribution.[559] Willis Polk's 1912 "City"-style Crystal Springs Pump House at the base of the dam replaced previous pumping structures to pump added water volume at low reservoir levels from the two (Upper and Lower) Crystal Springs Reservoirs into the San Andreas Reservoir, and from

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broke, but the dams suffered no structural damage: "The Pilarcitos pipe-line to San Francisco was destroyed and never restored, Pilarcitos thereafter becoming a feeder to San Andres. In the city distributing system there were numerous breaks where the pipes crossed filled ground, and service connections were lost throughout the burnt district. But the distributing reservoirs in San Francisco, the great catchment reservoirs of the peninsula, the submarine pipes, the miles of tunnels on both sides of the Bay, and the costly pumping stations escaped. …" See "Water Supply of San Francisco," 32. The dam and reservoir were known as "San Andres" until 1931, when the "U.S. Geographic Board re-declare[d] the name of San Andrés to be San Andreas." See Hanson, *San Francisco Water & Power,* 6-7, and "Chronology," 49-54.

558 In addition to the works and reservoirs maintained within San Francisco, Spring Valley Water Company maintained two suburban water company administrative headquarters and industrial plants. One, the San Mateo Division, with offices located at Millbrae on the peninsula about 30 miles south of the city, originally collected and distributed the Pilarcitos and San Mateo creek watersheds, beginning in the 1860s. The other division of the company, the Alameda Division, is across the bay and south of the city at Sunol. Work in Alameda County began in 1887, and the trans-bay aqueduct pipeline conveying the water to the Crystal Springs Reservoir was complete by 1900. The San Mateo Division is geographically located at the confluence point for the San Mateo County watershed, but industrially it was the point of confluence for the entire imported water supply, since the trans-bay supply was also stored and processed in the San Mateo Division reservoirs and plants. The San Francisco Public Utilities Commission continues to operate both divisions, in addition to the Hetch Hetchy system.

559 All dams and their reservoirs on the San Andreas/Crystal Springs system are in use today, and at the time of writing are undergoing a comprehensive, massive, and continuing Water System Improvement Program (WSIP) of the San Francisco Public Utilities Commission, work on which began in 2004. See "Water System Improvement Program WSIP," San Francisco Public Utilities Commission, accessed March 5, 2015, http://www.sfwater.org/index.aspx?page=114. For an apparently impartial outside overview of the WSIP, see "Water, Water Everywhere: A Look at San Francisco's Urban Water Plan," *The Urbanist*, no. 490 (March 1, 2010), accessed March 5, 2015, http://www.spur.org/publications/article/2010-03-01/water-water-everywhere.

there to distribution reservoirs inside the city of San Francisco.[560] A decade later, the Calaveras Dam became the newest priority for the Spring Valley Water Company, in the second attempt producing the tallest dam in the world at the time. Three years later, in 1928, the company raised the San Andreas Dam, and on a hillside nearby, built an octagonal Outlet Temple over the underground outlet pipeline works. **[Figures 193, 199, 200]** This San Andreas Outlet Temple was the last ornamental water temple Spring Valley added to its system before turning it over to the City of San Francisco in the 1930 purchase.

A HISTORY OF AESTHETIC WORKS AT THE SPRING VALLEY WATER COMPANY

From its very first construction in the 1860s, the Spring Valley Water Company considered aesthetics in its waterworks designs. Long before the Spring Valley Company was founded, San Francisco's first imported water supply had come from San Mateo County's Pilarcitos Creek watershed on the peninsula south of the city, the same local watershed the San Andreas-Crystal Springs reservoir chain collects and stores today. **[Figure 156]**. The first dam the company built, in 1863, was the Pilarcitos Dam, enlarged in 1874 with the company's earliest historical revival waterworks flourishes. "The dam's Lower Outlet Tunnel, a brick-lined bore through the base of the dam, was capped with a dressed granite portal," which still survives.[561] **[Figure 194, 195]** On the Romanesque

560 Hanson, *San Francisco Water & Power*, 11. The Millbrae Meter House was a major terminus for the Sunol Aqueduct's trans-bay pipeline route. After the Sunol supply was measured at the Millbrae Venturi Meter House, the water was apportioned through pipelines and tunnels for storage in Crystal Springs-San Andreas and San Francisco reservoirs. Over time, conduit routes for the Hetchy Hetchy and Alameda supplies, around and across the Bay, through the Crystal Springs-San Andreas facilities, and into San Francisco, have changed as the system has been renovated, upgraded, expanded and modernized. Work continues to this day: in October 2014, a new trans-bay pipeline to Crystal Springs Reservoir was completed and dedicated, and a new tunnel between the San Antonio Reservoir outlet pipeline, near Sunol, and the Irvington trans-bay pipeline portal nears its 2015 completion at about the same rate of speed as this dissertation.

561 Babal, *Top of the Peninsula,* 76-77. Reliable evidence also exists in a 1913 unpublished Spring Valley manuscript, which confirms that "when the [1874] Pilarcitos Dam was constructed, a brick and dressed granite outlet was provided through the center of the dam." In "History and Description of the Constructed Work of the Water Division of the Spring Valley Water Company, Preliminary Draft," an unpublished typed manuscript hand-dated 1913. If the dating is correct, which one surmises it to be, since the latest date mentioned in the text is 1913, I suspect it might have been written to prepare for the comprehensive

portal, rusticated voussoirs curved up around the tunnel outlet to a keystone arch supporting a frieze topped by a shallow pediment. A course of horizontal granite blocks flanked the upper arrangement, with the portal below framed by a broad banister ledge whose upper and lower cheekblocks featured pyramidal caps which tapered to the ground. In addition to this architectural portal, the Pilarcitos Dam's 1874 downstream-face wasteway, or spillover, received a relatively refined red brick finish; the Gothic-revival portal façade was in the form of a three-tower rampart centered above the tunnel opening, with the open outfall conduit finished in brick. **[Figure 196]**

These examples of early architectural treatments illustrate the value of the outlet as a celebrated position on a waterworks system, even for drainage. Customarily throughout history, the mouth of a water supply conveyance tunnel, an aqueduct's terminus, is a celebrated feature in architecture. It promotes the engineering feat of successful tunneling, and celebrates the magical rush of water far from its source. It goes without saying that dam development signals reservoir development. New reservoirs in turn birth conduit systems—canals, pipelines, and tunnels—to convey water from one reservoir to another. Tunnel engineering on the Spring Valley Water Company system from its founding in 1860 makes clear that a tunnel dedicated to water supply was still conceptualized as an open canal—more precisely for the time period, a flume.[562] The California flume was a broad, open, wood or metal channel running above ground on a wood-frame trestle, a technology developed during the Gold Rush for high-volume, long-distance water conveyance for high-pressure hydraulic mining and for early water-powered machinery. San Francisco's first aqueduct line, built by the Spring Valley Water

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company Inventory the company compiled in 1913; the author of the inventory may have been the author of the mss. Regardless of authorship, the 1913 draft was certainly part of the research that made the extensive 1914 Inventory possible. The rusticated Romanesque granite-dressed outlet façade that survives at the base of Pilarcitos Dam is original to the 1874 enlargement of the dam, as is the wasteway and its brick-dressed Gothic Revival tunnel portal façade. The Photography Archives, SFPUC holds photographs of both outlet portals, collected in a 1913 photo album. (The Lower Outlet photo, hand-titled "Pilarcitos Reservoir Drain Outlet," has no photo reference number, but is hand-numbered as page 24 of the album. The Wasteway Outlet image is hand-titled "South Side Pilarcitos Portal Wasteway Tunnel," hand-reference-numbered and dated "D1-11 [or P1-11?] 1/1/1913," and hand-numbered as page 11 of the album.)

[562] The word *flume* derives from the Latin *flumen*, river. In Italian, river is *fiume.*

Company in 1860, was an open wood flume that delivered water from the Pilarcitos Reservoir, along the coast, to the San Francisco waterfront at present-day Aquatic Park. The aqueduct was a cross-watershed conduit, that is, it transferred water from the Pilarcitos Creek's own natural watershed (which drains southwest into the Pacific Ocean) into the lower San Mateo Creek watershed drainage (which drains northeast into San Francisco Bay). For any water supply to cross from one watershed into another, a tunnel, or series of tunnels, is necessary to puncture the mountain ridge that divides the discrete watersheds. Tunnels allow water diversion from one watershed to another.

The first Pilarcitos Tunnel for this purpose was conceptualized not simply as a hollow cylindrical tunnel, as one would envision today, but as a two-part instrument. The tunnel's cylinder created a viaduct for a flume: "the tunnel was timbered its entire length and a flume built through it." It was soon discovered that timberwork in closed tunnel conditions decayed rapidly, which it did not do in the open air. For five years, the company persisted in resolving maintenance problems with the two-part, flume-and-tunnel system. Interim improvements included, first, a partial brick lining for the flume, then abandoning the flume and laying a pipeline through the tunnel. Only then, when "the unlined portion of the Tunnel was reported in a dilapidated condition," did engineers decide to install a continuous brick lining. In 1867, engineers finally omitted the second element of water supply tunnel design, the open flume or pipeline, and for the second tunnel the company built, Spring Valley innovated a direct-flow, brick-lined tunnel.[563]

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[563] Prior research of my own on the first aqueduct of ancient Rome, the subterranean Aqua Appia of 312 BCE, might add to the growing discourse on urban water infrastructures in California. The two cultures, early urban San Francisco and early urban Rome, are analogous at the point of this common initiating moment in water technology, when the *form* of a traditional mining technology for both cultures was adopted for new use as an urban water supply conveyance system.

For the first aqueduct into Rome, the Aqua Appia of 312 BCE, I argue that this new technology, a water supply conveyance system ("water in"), borrowed tunnel technology from existing drainage systems ("water out"). My research into this problem for Rome's first aqueduct, the Aqua Appia of 312 BCE, offers an *apropos* conceptual analogy. The first Roman aqueduct was a completely subterranean water supply tunnel modeled on Etruscan mining drainage technology. The Aqua Appia was revolutionary in that it inverted the function of drainage tunnel technology, by "draining" a desired supply of water *into* a specified area, rather than by directing unwanted waste water *out of* an area. The form was initially the same, but function was different—and not just different, but inverted, what one might call an "opposite' function. Rina Faletti, "Aqueduct as Hegemonic Architecture: A Case from the Roman Republic," in *Ideas of Water from Ancient Societies to the Modern World,* series 2, vol. 1 of *A History of Water,* eds. Terje Tvedt and

Pilarcitos tunnel engineering poses particularly interesting questions regarding the ways in which *drainage* and *supply* were conceptualized with the company's first waterworks designs. The question engineers had to engage was: what differences exist between a *drainage* (or "water out") system and a *supply* (or "water in") system, when local engineers confront this problem for the first time? Addressing this situation for the first time required Pilarcitos engineers to reconceptualize the conditions of water's movement in time and space based on the water system's purpose. Primary conceptual distinctions exist between *drainage* and *supply* that must contend with distance, speed, and volume. Drainage systems generally do not have to contain, regulate, and direct flow over the long distances of managed flow aqueducts require, so relatively unchecked flow in a drainage system is not a problem for drainage technology itself, and often is not a problem at point of delivery, except during a flood.[564]

Terje Oestigaard (London: IB Tauris, 2010), 147-91. Classical engineering historian Trevor Hodge observes the historical continuity of the form without analyzing the change in function: "The Aqua Appia was itself entirely underground and in engineering, if not in purpose or function, can have differed but little from an Etruscan *cuniculus*." See A. Trevor Hodge, *Roman Aqueducts and Water Supply*, 2nd. ed. (London: Duckworth, 2002), 47.

Analogously to the Pilarcitos water supply tunnel developments, Roman engineers learned after the first instance of adapting drainage tunnels to supply, with the underground Aqua Appia, to build an aqueduct and not simply adopt a drainage tunnel into new use. As the Pilarcitos engineers from the first to the second tunnel they built, in order to adjust the form for the second aqueduct, Roman engineers had to create new methods of masonry construction and new kinds of survey methods to accommodate both above and below ground segments. Similarly, Spring Valley engineers learned 'again,' we might say, by trial and error on the first Pilarcitos Tunnel how to build an aqueduct tunnel, and not simply direct an open flume underground: in order to advance the form, they needed to dispose of the familiar form of the flume altogether and to standardize new material alternatives to effect long-distance water supply conveyance for urban use and distribution. In ancient Rome, this process was complete within about 35 years—the time between Rome's first, underground aqueduct in 312 BCE, and the second in 272, which was longer, drew from a surface source, and included above-ground bridged segments. By analogy, Pilarcitos engineers built the first closed tunnel within a decade after the first experiment with an enclosed flume, between about 1860 and 1867. Clearly, from a historical point of view, such a cultural shift does not take long, but once made, it is permanent, but only within the context of its own culture: thus, for example, the insidious colloquial admonishment in our own age not to "reinvent the wheel."

[564] The cultural shift under discussion involves a change in concept from the idea of "water out" to the idea of "water in," and this leads to developments in thinking and problem-solving that can conceptually separate drainage and supply technologies, for the first time. I suggest a conceptual shift in engineering practice occurs just at the moment when it becomes apparent that a major hydraulic technological development is necessary, but when the problem is so new that a series of adjustments will be made before a new form of technology arises. This transition period of adjustments occurs only *when a problem is new*, that is, *when the need for the problem is first discovered*. At that moment, shifts in customary practice with the existing technology must precede the possibility for innovation and invention—because shifts in

Flumes for hydraulic mining were supply and not drainage systems, but they did not control volume or distribution with the complexity demanded of urban supply systems. Large supplies fast-moving water were required for 'hydraulicking,' in which water under extremely high pressure was forced through hoses fitted with monitor nozzles. These blasted away entire hillsides and silted up entire watersheds. **[Figure 197]** Resulting run-off from the powerful erosion caused by hydraulicking and other hydraulic

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thinking and behavior ground invention. First is the discovery of a new problem—Pilarcitos water must cross out of its own watershed in order to flow in the right direction and downhill to San Francisco, and that means it must pass through a mountain. This leads to the realization that the function of existing technologies can be inverted—an open-air flume must travel underground, *and* the only technology that can pass through a mountain is a tunnel. A process of synthetic problem-solving combines or re-appropriates the existing technologies to effect the outcome that solves the problem—bore a tunnel so the flume can pass through the mountain. The key that will lead to new needs and new problems with this "intermediate" technological solution are the variables that permit improvements in efficiency and economy—of labor, of materials, of time. In the case of new water technology developments, solutions revolve around gradient, distance, temperature, velocity, and volume. Only after this occurs can a successful new technology be developed for the new situation. Ideal *and* material means must change.

Such a cultural shift invariably takes place more gradually than seems logical in historical retrospect: that is, for later observers, when a problem has been solved for so long, with so many subsequent developments, the newness of the problem is lost; the problem seems old. In the current mode of cultural thinking the past situation can no longer be reconstructed, and the "solution" discovered in the "past problem" seems obvious. When this happens, the observer—here, innovator, inventor, historian—must deconstruct her own cultural thinking to a point where she is able to conceive the problem as new, as never having existed. This means she has to "back up" a little further: there was once a present moment—like our own—when the problem did not yet exist, and, people in that present moment were no better than we are at creating a problem that doesn't yet exist for us.

Thomas Ashby, classical Roman aqueduct archaeologist, put it best when he exposed as retrospective tautology the assumption that all ancient aqueducts ran above ground on arches. He figures this out by placing himself in the proper situation of a Roman aqueduct engineer, in his time: "Granted their outlook, it is idle to consider whether they could have solved a problem to which they had not applied their minds." In Thomas Ashby, *The Aqueducts of Ancient Rome* (Oxford: Clarendon Press, 1935), 36. As innovations in "inverted-function drainage" (the adoption of existing drainage technology to effect a water supply function) necessarily came to terms with the problems that direct-function supply delivery provoked, resulting engineering solutions created new technologies whose forms identify more closely with the new function. We promptly forget the old ones. Drawing an analogy between the two cultures I compare—4th-century BCE Rome as against 19th-century California—is of course imprecise and exposes its own faults. Rather than suggesting a direct comparison, I mean to focus on an art historical and cultural problem: How can art historians better approach the nature of thinking about change in material forms of technology so that history engenders thinking about new problems, their conceptualization, and their "solutions" in terms of design, materials, and methods? I suggest that some human approaches to hydraulic engineering questions are similar at different times, even when the historical situations are different, because regardless of the specific local conditions, and the deeply different historical ones, they are comparable in the requirement for an altered conception of ways in which water behaves in time and space, in topography and and distance. Although it is hard to believe now, for example, early Roman hydraulic engineers did not understand scientifically that water increases in volume when it increases in velocity. It is true now as it was then, that there are only so many ways to contain and move water.

mining processes yielded mountains of waterlogged sediment drainage. This "slurry" was processed for gold and other metals and then released downstream back into the rivershed. In essence, hydraulic mining created a perpetual flood situation. The silts pushed miles downstream to the Sacramento and San Joaquin River Delta. Within a decade, silting eventually clogged river beds and raised the floors of the San Francisco Bay, obstructing water navigation at the Carquinez Strait, the mouth of the combined confluences of the California Central Valley's entire watershed. In 1884, a federal injunction permanently outlawed hydraulic mining. Today, the average depth of the San Francisco Bay is 14 feet.[565] This shallowness is in part a permanent result of Gold Rush hydraulic mining sediment runoff, an example of hydraulic technology focusing on the development of supply conveyance without considering drainage.[566]

The Pilarcitos Dam's flume-and-tunnel solutions to their cross-watershed problem, then, were products of hydraulic mining's long-distance water conveyance system, a prevailing technology at the time. In conjunction with local urban conditions that differed from those encountered in the Sierra Nevada Mountains for mining needs, the new problem of large-scale water conveyance for urban water distribution required new technological solutions—like the separation of tunnel from flume—and the eventual departure from flume technology for long-distance urban water supply conveyance through tunnels, canals, and pipelines.

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565 "San Francisco Bay covers 400 square miles and has an average depth of 14 feet with depths plunging to 360 feet at the Golden Gate. The Bay has shrunk by a third in the last 150 years, and only about 25 percent of its original wetland, riparian, and tidal mudflat habitat still exists." See "At a Glance," The Bay Institute, accessed March 14, 2015, http://thebayinstitute.org/page/detail/95. The effects of various environmental, technological, and other historical factors upon the depth of San Francisco Bay become graphically clear with a visit to the Bay Model of the U.S. Army Corps of Engineers in Sausalito, California. "The Bay Model is a three-dimensional hydraulic model of San Francisco Bay and Delta areas capable of simulating tides and currents. The Model is over 1.5 acres in size…." See "The Bay Model Journey," U.S. Army Corps of Engineers, accessed March 14, 2015, http://www.spn.usace.army.mil/Missions/Recreation/BayModelVisitorCenter/TheBayModelJourney.aspx.

566 See Williams, *Energy and the Making of Modern California*, 97. According to Williams, "the essential account of hydraulic mining rise, fall, and environmental impact," is Robert L. Kelley, *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley* (Glendale, CA: Arthur H. Clark Co., 1959)." See Williams, 396 n. 12.

After Pilarcitos, Hermann Schussler built the San Andreas Dam in 1870, and within a few years raised its height. Its only outlet at that time was a brick tunnel with outlet works on the east side of the dam. This outlet sent water through pipelines and tunnels to San Francisco for urban distribution. In 1928, the company increased San Andreas Dam's height again, which necessitated a second pipeline outlet and metering facility. Here, the Spring Valley Water Company built another fine Outlet Temple—the company's last aesthetic statement in architecture—as a marker for the underground San Andreas Outlet No. 2 pipeline and housing for regulating outlet meters.[567]

SAN ANDREAS RESERVOIR OUTLET TEMPLE: GARDNER DAILEY'S STAMP

The San Andreas Outlet Temple is a small octagonal temple of reinforced concrete, painted white, with full-height Doric pilasters, one at each of eight corners. **[Figures 193, 199, 200]** Red tile on a two-step, raftered roof with a stacked-cylinder finial on an octagonal lantern, the temple reveals a sophisticated aesthetic. The raked tile roof extends from the base of the lantern clerestory, reaching out beyond the main drum in overhanging eaves. Eight narrow unglazed windows run in a horizontal band around the base of the cupola, and below the roofline on the main drum are cut eight high windows in diamond-shaped filligree. Windows are perforated into a herringbone pattern of zig-zag and triangle motifs in a revival of Moorish and Spanish Baroque detailing. With the clerestory, these admitted light and air movement into an otherwise closed interior industrial works. Advanced handling of relief and mouldings on the pilasters creates an impression from a distance that a ring of Doric columns encircles an interior cella with ornamental perforated stone windows. The resulting play of positive and negative space, upper and lower regions, and raised and relieved surfaces creates

567 SFPUC archival photographs taken during and after construction confirm the San Andreas Outlet Temple's 1928 date, which coincides with the raising of the dam's height and the construction of the reservoir's second outlet; maps confirm the temple's placement in the same location as the outlet. Temple construction photographs are dated May 18, 1928, for example, with photographs of the completed temple site dated December 28, 1928. For a general map of the San Francisco water system showing San Andreas outlets, with Outlet #2 showing diagramatically as a pipeline exiting the reservoir's center east side, see "Diagram of System: San Francisco Water Department" in Hanson, *San Francisco Water & Power,* 26.

dynamic sets of relationships. Together, the varied ornamental details elaborate a simple concrete octagon into a complex and eclectic interplay of textured spaces.

The rural setting for the 1928 San Andreas Outlet Temple, on a hillside with the San Andreas Reservoir out of sight just over the crest, was crafted by design decisions that altered the landscape of the site. Like the Sunol Temple, the temple drum enclosed the large pipeline and monitoring works, which were then buried with backfill so that the temple appeared to rest upon the ground. The area around the temple was graded in undulations to appear natural, and an access road created a curved approach that molded with and framed the newly-sculpted hillside site. Company photographer George Fanning's well-composed photographs emphasize a balance between the Mediterranean structure and its landscape. **[Figure 200]** One can readily suppose the structure was meant to integrate in style with prior Polk works, and not only with the Sunol Water Temple. The San Andreas Temple's architectural companion in the system was the Millbrae Meter House four miles down the hill. **[Figure 119]** This octagonal temple was certainly inspired by the 1910 Sunol Temple aesthetic, and by Gardner Dailey's recent 1925 octagonal Calaveras Outlet Temple, its immediate predecessor.[568]

I have found no record of who designed this fine little temple, but it must have been Gardner Dailey. We can assume he took Polk's place in waterworks design after the architect's 1924 death, and we can suppose Dailey's direct hand in new and ongoing water company designs, given his recent involvement in so many Spring Valley Water Company aesthetic enterprises. His 1924 memorial plaque at the Sunol Temple and the 1925 Calaveras Outlet Temple, both in memory of Willis Polk's work, stand out in the context of this argument. Dailey's 1923 office building roof garden, and his participation in the interior art committee with Polk, both speak to an established collaboration. And the landscape architect's 1924 design of equestrian trails at the Company's developing Lake Merced golf club in San Francisco attests to a larger, central place in the company's

[568] I have visited and examined the temple, which survives with its interior pipeline works; measuring instruments located inside and directly beneath the temple in the drum base have been updated. The only original Venturi Meters I have seen still *in situ* are the two Venturi Meters inside the Millbrae Meter House; they no longer function since the meter house technology was long ago declared obsolete.

broader design planning.[569] Given that Dailey had a close professional association with Polk, both within and outside the water company, it seems beyond question, judging from the water purveyor's prior practice of relying on a single, well-known architect, that the company would have asked Gardner Dailey to take Polk's place.

By 1927, a year before the 1928 San Andreas Outlet Temple opened, *San Francisco Water* hailed Dailey as the architect and designer "to whom Spring Valley Water Company refers all its artistic problems."[570] Visual analysis of the San Andreas Outlet Temple in relation to other company architecture points to him even without this literal exhortation. To my eye, Dailey clearly intended the San Andreas Outlet Temple to recall and coordinate with its system cohort, Willis Polk's 1912 Millbrae Meter House. The Spring Valley Water Company had been far less systematic than PG&E in devising a coherent architectural scheme, to be sure, but the water company asked Polk to guide its architectural design program. That "program" showed no indication of centralized image planning as the more expansive PG&E's did. Unlike the gas and electric company, the water merchant did not include an in-house company architect's position, but Polk served in lieu of this role. He had, indeed, replicated the "City" style substations he initiated with PG&E's Station G in his pumping station at Crystal Springs Dam, but this was an anomaly. In the main, for the water company, Polk continued to develop a rural-style, red-tile-Renaissance design idea, in line with his Sunol Temple aesthetic, and a corollary to PG&E's "Out of Town" designs. Polk's Millbrae Meter House was a small but outstanding example of this design type, particularly in Polk's original intentions for it.[571] [**Figure 119]** The stylistic integration of the 1928 San Andreas Outlet Temple with Polk's 1912 Millbrae Meter House naturally draws further associations with Polk's work, pointedly with the round Sunol Water Temple, of course, and recalls the genealogy of round and octagonal temple design in the United States.

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569 See "Lake Merced Trails," *San Francisco Water* 3, no. 4 (October 1924): 1.

570 Edward F. O'Day, "Fountains Dispersed Abroad," *San Francisco Water* 6, no. 3 (July 1927): 11.

571 A copy of this design was made at the base of the Crystal Springs Dam in 1939, alongside a new powerhouse of this Spanish Renaissance Mission Revival type. All coincided with the Pulgas Temple and Hetch Hetchy Aqueduct improvements.

The association with Polk's Sunol works naturally leads one to Gardner Dailey's 1925 Calaveras Outlet Temple, similar in scale and design to the San Andreas example, with dramatic differences between the style of their exhibition and the relation of each to its landscape. Calaveras: suspended like a pendant, or like a sculpture on a pedestal, hovering erect over and reflected in the reservoir, exclamation mark to the dam beside it, tourist destination; San Andreas: jewel box on the outskirts of its city, embraced within the curves of its hillside, hidden just out of view from its resesrvoir, standing its ground as the water supply pushes beneath it. Each incites such poetic description, to the degree that the design (and the sentiment behind it) still grasps to its romantic pastoral cultural context. For this reason, it is also interesting to consider the memorial function. If the Calaveras Temple was explicitly meant to memorialize Polk's Sunol Water Temple, it also consciously joined with those works symbolically, as twin temples. A similar artistic case can be made for the relationship of the San Andreas Temple to Polk's Millbrae Meter House on the opposite side of the Bay. Purely visually, but also in scale and cultural heft, the Sunol-Calaveras pairing is the grander of the two. That makes sense considering the remoteness of the rural sites, still off the map in terms of Bay Area development, the Sunol Temple's reception, and the various whirlwinds of fame surrounding the Calaveras Dam. The San Andreas-Millbrae works have a more intimate case to make, as little suburban bungalows off the main highway to the country-house enclaves of San Francisco's rich. But they, too, represent advancements of modernism, with their state of the art Ventuir Meter technology, increasingly streamlined to measure flows of vast water supplies traveling in several directions and to multiple endpoints. By this time, San Francisco's water by no means served only San Francisco, but many water providers all along the Peninsula and the South Bay.

Further comparison of Dailey's 1925 Calaveras Outlet Temple and the 1928 San Andreas Outlet Temple reveals them to be remarkably aligned not only in style and aesthetic sensibility, but also in engineering function and technical advancement. **[Figures 190, 193, 199]** Each of the two new Outlet Temples from the 1920s was associated with a waterworks system companion piece by Polk, with Polk's earlier structure setting a stylistic standard for each of the later Outlet Temples: the San Andreas Outlet Temple was to the Millbrae Meter House as the Calaveras Outlet Temple was to the Sunol Temple. Moreover, both the Calaveras and San Andreas Dam projects were associated with major expansions related to Hetch Hetchy's timeline. There was an enormous increase in water volume crossing the bay from Alameda to Crystal Springs-San Andreas reservoir storage after the completion of the new Calaveras Reservoir. This make clear that both the Calaveras Outlet Tower and San Andreas Outlet Temple not only functioned aesthetically as architectural and cultural markers for outflow toward the city, they were symbolic markers for technological advancements in major urban hydraulic works. As such, they were in form and function allied with the Sunol Temple, which had marked the original feat of Spring Valley's combined underground outflow of several water sources into the Sunol Aqueduct and on toward the metropolis across the bay to the Crystal Springs-San Andreas Reservoirs.

It might seem to be a stretch to argue, without direct evidence, that these two pairs of temples were consciously planned to function together as I analyze their relationship now. But without evidence, and judging from the importance the company had placed during Polk's architectural tenure upon formal and symbolic coherence—indeed, upon *visual meaning*—for its architecture, it stands to reason that Gardner Dailey would follow suit. Considering Dailey's design ideas in his work on the garden and interior planning for the company's Mason Street office building, one imagines he would have integrated design continuity in the process of creating the two Outlet Temples, as well. I see no reason to believe he would not have contemplated the two pairs of temples in tandem, to fall in with the larger scope of Polk's public works design leadership since the turn of the century. Dailey continued the coherent, cohesive, and "dignified" image in highly visual waterworks architecture. He joined with Polk in the spirit not only of reviving historical forms in design, but also of shaping history into modern form, with a contemplative and refined eclectic aesthetic.

The Outlet Temples for the 1925 Calaveras Dam and the 1928 San Andreas Reservoir expansion were the last temples built for Spring Valley before the company was merged with the City's Hetch Hetchy Aqueduct system in 1930. At that time, the Spring Valley Water Company changed its state, so to speak, from a private to a municipal waterworks. We can interpret the last two temples Spring Valley built as closing a full and rich cycle of aesthetic water temple design for San Francisco. In 1930, when William Bourn handed over the waterworks keys to the City in anticipation of the Hetch Hetchy Aqueduct's imminent completion, he also proffered a legacy of finely-conceived historical revival temple architecture for a sophisticated American waterworks infrastructure system. San Francisco took up the offer and continued to build upon that architectural legacy in a similar spirit.

CHAPTER 10

Merging Eden and Empire: The Pulgas Water Temple, Terminus for the New Hetch Hetchy Aqueduct

When the Hetch Hetchy Aqueduct finally opened in 1934, water piped from Yosemite National Park's Tuolumne River headwaters saw the light of day at the west portal terminus of the Pulgas Tunnel.[572] Water exited in a roar, ran in the open canal for several hundred yards, then tumbled down a stepped cascade into Upper Crystal Springs Reservoir. Previously, this same reservoir held only the water that had crossed the Bay from the works beneath Sunol Water Temple. This open concrete canal and outfall cascade had been completed in 1923, after the 1922 decree that the two water providers would merge when Hetch Hetchy was complete. When the P.O.T. first opened, nothing but the utilitarian basics existed: tunnel mouth belching Alameda Division water down a modest canal into the lake.[573] Several 1923 photographs of the spot carry a purely utilitarian title: "Pulgas Tunnel—Outfall Canal and Drop Structure."[574] The Pulgas Tunnel was a project of the Hetch Hetchy system, begun in 1922 and completed in 1924, but until San Francisco's project was completed ten years later, the future Hetch Hetchy tunnel carried Spring Valley water, "under a lease agreement six years before the City

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572 Similar to the earlier Pilarcitos tunnel I discussed earlier in this dissertation, the Pulgas Tunnel had also gone through several changes in its history, the most recent of which was the boring of a new Pulgas Tunnel in 1924 in preparation for the Hetch Hetchy Aqueduct. After the tunnel was bored, the Spring Valley Water Company's Alameda Division water supply crossed the Bay through the Sunol Aqueduct and began using the the new Hetch Hetchy tunnel (rather than the original Spring Valley Water Company Pulgas Tunnel), with the Spring Valley Water Company leasing the right to run water through it from the City of San Francisco. The SFPUC annual report for 1937-38 reports that "The Peninsular division includes the Pulgas Tunnel, 10 ¼ feet in diameter, and the outfall canal discharging into Crystal Springs Reservoir, a total length of 1.89 miles." See San Francisco Public Utilities Commission, *Report of San Francisco Public Utilities Commission, Fiscal Year 1938-39* (San Francisco: San Francisco Public Utilities Commission, 1939), 106.

573 Between 1934 and 1939, the abbreviation "P.O.T.", to indicate "Pulgas Outfall Temple" in reference to the two different water temples built to mark the Hetch Hetchy Aqueduct terminus durng that five-year period, was in common use in documents, photographs, and publications of the SFPUC.

574 See photograph showing the newly completed concrete outfall cascade, "9064. 12/29/23. Pulgas Tunnel-Outfall Canal and Drop Structure," Photography Archives, SFPUC.

was to purchase the private water system in 1930."[575] When the Hetch Hetchy did open, four years into the City's debut ownership, the City built a temple to mark the terminus—the historical record sheds little light on the process of when, how, and by whom the temple was designed. In borrowing from Willis Polk's Sunol Temple to give initial form to the Pulgas Water Temple, the City laid its claim to a direct hereditary line between its predecessor—the private, historic, Spring Valley Water Company—and its own, new, public San Francisco water system. But it did much more than simply *lay* claim. The City *staked* its claim, quite literally. As the Sunol Temple had done in 1910 for William Bourn's newly-acquired Spring Valley Water Company, the Pulgas Temple would do for the City's new Water Department: proclaim historical continuity in the business of urban water supply delivery with a work of resounding architecture set down in a pastoral garden. Again, a temple would complete the circle. Not just any temple, but one whose specific form and cultural appurtenances—social, political, economic, historical, aesthetic, religious—fixed it to the ground: stable, immovable, triumphant.

The Pulgas Tunnel terminus site came to be hallowed for its dramatic aesthetic monument, the Pulgas Water Temple, conceived in two separate phases. First, in 1934, the city straddled a temporary temple structure over the Pulgas Outfall canal to celebrate the official public opening of the Hetch Hetchy Aqueduct's first water release. More than four thousand spectators reportedly attended the public "Completion Celebration" on October 28, 1934, which featured a stage full of dignitaries, San Francisco's municipal brass band, a handsome program printed in color, and a live national radio broadcast.[576] To stage the ceremony, the San Francisco municipality built a modest copy of Polk's Sunol Water Temple at the Outfall and Drop Structure. **[Figures 127, 128, 185]** In short, the first 1934 Pulgas Outfall Temple was a temporary grandstand stage built for a single publicity event and was demolished soon after. Four years later, the San Francisco Public

[575] Warren D. Hanson, *San Francisco Water & Power: A History of the Municipal Water Department and Hetch Hetchy System* (San Francisco: City and County of San Francisco, 2005), 41.
[576] San Francisco Public Utilities Commission, *Report of San Francisco Public Utilities Commission, Fiscal Year 1934-1935* (San Francisco: San Francisco Public Utilities Commission, 1935), 29. See also photographs D-2442 and D-2443, Photography Archives, SFPUC.

Utilities Commission raised a permanent water temple, stood it by a reflecting pool, and surrounded it with formal gardens, the whole designed and built as a federal Public Works Administration (PWA) project in conjunction with the City and County of San Francisco. **[Figure 129, 186, 187]** Beneath each of these successive temples ran the healthy channel of aqueduct water from the Hetch Hetchy Aqueduct terminus.

Today, aqueduct water bypasses the temple: water system renovations, treatment plants, pipeline expansions, and rerouting over time have redirected the water supply through a veritable maze on its way to San Francisco and Bay Area cities. Water still flows beneath the open oculus of the viewing platform as one stands between Corinthian columns and leans over the rail to look in. The water running beneath the temple now is a trickle. Look up a few yards down the canal and the force of the full aqueduct crashes into the canal, diverted through the new treatment plant hidden behind the trees on an adjacent property. The temple and grounds now are ceremonial only, a reminder of the original purpose of the Bay Area's two famed water temples, to mark and display a city's water, and the engineering technology that brought it.[577]

TEMPLE PRO TEMPORE: REPLICA OF POLK'S SUNOL TEMPLE AT THE HETCH HETCHY TERMINUS

The first Pulgas Outfall Temple of 1934 was a hastily-constructed look-alike of Willis Polk's Sunol Temple. **[Figure 201]** To discuss this, I return to the temple series image published in Edward F. O'Day's 1922 article, "The Architecture of the Water Temple," which I discussed at length in my analysis of Willis Polk's design process for the 1910 Sunol Temple. The throw-away temple designed for the Pulgas Outfall in 1934

577 After the year 2000, industrial renovations diverted aqueduct water into an adjacent treatment plant. Although the water running through the underground gallery beneath the temple today is purely ceremonial, the memory of its powerful rushing sound is still intact, as the redesigned water course through the treatment plant rediverts and releases the aqueduct water into the original canal just a few yards downstream, into the same channel into which the temple water runs. The sound is so powerful and so suggestive, that one imagines, as one peers down into the exposed subterranean gallery, that the little stream running below is indeed what is making that rushing noise. In other words, planners retained the sublime effect even in the modernization, which is strong evidence of the persistence of water's cultural value, the attendant cultural need to display it, and San Francisco's continued actions that the sensual aspect be retained as part of its broader cultural service.

was a variation on the fifth image in the temple series image. **[Figure 202]** It bridged the Outfall Canal on a tall, exposed drum foundation punctured at the base with a barrel arch to clear the canal. This temple was positioned just at the point where the water cascaded down the stepped cascade of the Drop Structure into the reservoir. **[Figure 203]** Water from the Spring Valley Water Company's Sunol Aqueduct across the Bay had been delivered to the reservoirs here for more than 50 years, but the City of San Francisco placed the terminal marker here.

The "copy" of the Sunol Temple, the temporary Pulgas Outfall Temple, was a round, peripteral plan which reproduced the same biblical quotation on the frieze. In every detail beyond the basic temple form and the identifying Bible excerpt, the temporary Pulgas Temple was a caricature of its model. Twelve smooth columns without bases—whose capitals were reputed anecdotally to have been cast from leftover molds from the 1915 Panama Pacific International Exposition—bore no relation to the Tivoli temple's capital order. The temple was raised above ground upon the tall drum that had been rejected as disproportionate for the Pulgas design. The temple's roof was surfaced with plain, smooth panels featuring no roofing material, revealing every seam and every flaw. Although the peripteral columns were arranged in a ring, the structure was not circular in plan, but an offset ovular shape with a crescent protruding to one side to make room for enough dignitaries to be seated as on a stage. As in the fifth image in the temple series image, the foundation base was a tall drum run through with a barrel arch; this arched base bridged the open Outfall canal. The mouth of the barrel arch beneath opened on the other side of the temple to the stepped cascade Drop Structure, the roar and foam here suggesting that the water actually issued from the temple itself. This first, temporary, Pulgas Outfall Temple was not a functioning waterworks, as the Sunol Temple had been before it and as the second, permanent Pulgas Temple would later be.

This ceremonial model was an unsung cosmetic copy of Sunol. Structurally, it was wood-framed and finished with smoothed plaster. Its smooth rather than fluted columns are topped by squared composite capitals similar to Polk's, but not identical. They are not casts of Polk's reproductions of the ancient Roman Round Temple at Tivoli for the Sunol Temple, but they may very well have been casts (or cast-offs, for that matter) from the 1915 Panama-Pacific Exposition capitals—evidently, plaster casts were stored, and sometimes reused, for years after the Exposition, until they were eventually lost.[578] Capital edges protrude from beneath the shallow eaves of the wood-framed and plastered roof, revealing their precarious support function. Unlike the studied rafter ceiling at Sunol, the temporary Pulgas temple ceiling was plastered board, its surface scored into a basic articulation of a segmented roof of board and plaster painted terracotta red. The upper frieze inscription carried the same biblical phrase as the Sunol Temple: "I will make the wilderness a pool of water and the dry land springs of water the streams whereof shall make glad the city."

A series of dated pictures taken by George Fanning in the ten days before the Completion Cerremony depict the temple in basic framing. Three days before the event, the structure still scaffolded, a plasterer smoothed a still-uninscribed upper frieze with a trowel. **[Figure 128]** The biblical phrase was applied in time for the ceremony; photographs suggest it was inscribed or stamped into wet plaster, or perhaps even painted upon the plaster frieze, a day or two before the special day.[579] **[Figure 127]**

Built upon its drum-shaped perch, the temple stood well above ground level, so a steep, curved stairway was built to access the temple platform and stage. **[Figure 204]** The round temple sat asymmetrically on a noncircular platform. The steep access stairway rose outside the proper circle of the ring of columns, so that visitors lighted on a crescent-shaped stage whose extent swelled to create an open stage for dignitaries and the press sat to sit in arranged chairs. The temple, centered behind them, made for symmetrical group photos. One of Fanning's photographs, taken on celebration day, shows a microphone stand, labeled "CBS" (for the radio broadcasting company covering the event) centered on the stage.

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578 Mike Housh, SFPUC Historian, personal communication with author, May 28, 2013.

579 See photo D-2422, October 24, 1934, San Francisco Public Utilities Commission (SFPUC) Digital Collection, San Francisco Public Library, accessed March 5, 2015, http://sfpl.org/index.php?pg=2000084701. I have examined details in high-resolution photographs within the Photography Archives, SFPUC. The SF Public Library scans are of lower resolution with details unclear under enlargement.

The Spring Valley Water Company annual report for that year made a point of announcing the Completion Celebration at the Pulgas Temple site, but it made no mention of its predecessor: neither Willis Polk nor the Sunol Water Temple were credited.

> An especially constructed temple, a replica of the structures which graced the ancient Roman aqueducts, provided an impressive background for the ceremonies amidst the setting of hills, lakes, and forest.[580]

One assesses this comment with the critical irony of distance, knowing that the Pulgas Outfall Temple was not a replica of a Roman temple but rather a copy of Willis Polk's Sunol Water Temple, which is not mentioned. Yet, to be fair, neither was Polk's a replica of the ancient Roman model, though the architect did, to his credit, reproduce the column order of the Round Temple at Tivoli, but his model appears to have come directly from a popular 19th-century book of archaeological drawings, a standard reference for students and architects of neoclassical architecture.

The Hetch Hetchy opening celebration was broadcast nationally on CBS radio from the temple stage:

> Accompanied by the Municipal Band, Public Utilities President Lewis Byington introduced the builders of Hetch Hetchy. Interior Secretary Harold Ickes, Mayor Angelo Rossi and Supervisor Jesse Colemen addressed the assemblage and the

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580 *Report of San Francisco Public Utilities Commission, Fiscal Year 1934-193*5, 3. No mention in the official report of the fact that the temple was actually a "replica" of Willis Polk's 1910 Sunol Temple, down to the identical Biblical verse stamped on the plastered architrave frieze. The 1934 temple has been described as a "temporary paper mache" look-alike of Polk's Sunol Temple from 25 years earlier. "Paper mache": Babal 1990: 107. In lieu of assuming the1934 temple's material was literally "paper mache", one looks to an example of construction materials for prominent temporary structures from the approximate period, for example, the Palace of Fine Arts in the Panama-Pacific International Exposition, which consisted of a cast steel and wood frame, on concrete pier caps below the water line, with walls and roof of thin cement plaster over metal lath; rotunda and colonnade sculptural ornamental details made from " 'plastic travertine…composed of gypsum…combined with hemp fiber and a coloring pigment.'" See "Palace of Fine Arts, Baker Street Between Jefferson & Bay Streets, San Francisco, San Francisco County, CA," Library of Congress, accessed March 5, 2015, http://lcweb2.loc.gov/master/pnp/habshaer/ca/ca0600/ca0686/data/ca0686data.pdf. See SFPUC documentary photographs for the October 28, 1934 opening ceremonies for the Hetch Hetchy Aqueduct pipeline to Crystal Springs Reservoir, in Hanson, *San Francisco Water & Power,* 42. Selected SFPUC archival photographs are accessible online as part of the SFPUC Digital Collection, accessed March 19, 2015, http://sfpl.org/index.php?pg=2000084701. These include photographs of the 1934 and 1938 Pulgas Temples, searchable at the San Francisco Public Library's Historical Photograph Collection database, using the link on the PUC Digital Collection page.

> nation over the Columbia Broadcasting System [CBS] coast-to-coast radio network paying tribute to Chief O'Shaughnessy….[581]

The "tribute" was in eulogy for City Engineer and supervisor of the Hetch Hetchy project, Michael O'Shaughnessy, who had died about two weeks before the ceremony. It is not clear whether he had seen his own book on the Hetch Hetchy system, which was published in October.[582] He had, however, evidently been present for the technical completion of the work and the first actual water delivery through the aqueduct pipeline terminus, probably before the temple stage had been constructed.

Materially, the Pulgas Outfall Temple was a throw-away anomaly. Oddly, no viewing space was created on the temple platform to view the Drop Structure cascade. Dignitaries on the stage sat in chairs facing away from the temple and the waterfall, the reservoir, and the mountain views. Inside the temple, behind the frontal stage, columns ran flush to the platform edge, reinforcing this "back" side of the round temple. Photos show other ceremony participants crowded inside the circle of column. The site

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[581] A photograph of the completed temporary temple, framed so that the open canal leading from the tunnel terminal outlet is visible under the barrel arch of the temple's bridge foundation over the canal, appeared as the frontispiece of the *Report of San Francisco Public Utilities Commission, Fiscal Year 1934-1935*. The frontispiece caption reads: "After coursing 150 miles of tunnels and pipes, Hetch Hetchy water flowed into Crystal Springs reservoir at this beautiful spot for the first time on October 28, 1934." See photograph D-2439, November 5, 1934, Record No. 30596, Photography Archives, SFPUC. The photograph is remarkable in that it clearly shows that the temporary 1934 temple stood at the outfall on the shore of the reservoir, and it shows in clear view the future site for the permanent Pulgas Temple of 1938, which stands directly above the tunnel terminus outlet, marking the the open canal leading to the low cascade structure into the reservoir. This entire aqueduct terminus area was called the Pulgas Outfall, and the temples were referred to in SFPUC records as the "P.O.T." or "Pulgas Outfall Temple." Compare this 1934 view from the temporary temple site with an aerial view of the permanent 1938 Pulgas Temple, which shows the later, permanent temple's site location, at the Pulgas Tunnel outlet terminus, in relation to the end of the terminal open canal and outfall cascade into the reservoir, where the earlier, temporary temple had stood. See photograph D-3859, October 22, 1938, Photography Archives, SFPUC.

[582] M. M. O'Shaughnessy, *Hetch Hetchy: Its Origin and History*, (San Francisco: The Recorder Printing and Publishing Company, October, 1934). An O'Shaughnessy tribute statement was printed inside the back cover of the Completion Celebration program published for the event. It reads: "A Tribute to M.M. O'Shaughnessy. For twenty-two years M. M. O'Shaughnessy labored to bring Hetch Hetchy water to San Francisco. To him, in large measure, goes the credit for this miracle of modern engineering. To him, the people of San Francisco owe an incalculable debt of gratitude. M. M. O'Shaughnessy died sixteen days before he could see the fruition of his dream in these ceremonies." See "Celebration of the first delivery of Hetchy Hetchy Water to San Francisco, Crystal Springs Lake, San Mateo County, created "under the auspices of the Citizens' Committee of San Francisco…and the Public Utilities Commission of San Francisco," October 28, 1934, Box HPC-001, Documents Archives, SFPUC.

surrounding the temple was ungraded and unlandscaped, the ground uncleared even of brush grown up around the canal. Public visitors to the site stumbled around the uneven terrain surrounding the temple to look up at the stage during the Completion Celebration, and a few who chose to explore the site worked even harder to view the spillway cascade, clambering and sliding in the dirt and brush to see it. One spectator even held another up to get a peek at the water rushing down into the reservoir. **[Figure 205]** This detail is of interest: the spectacle of any waterworks structure that features moving water is the overwhelming roar and forward rush of a moving, fluid mass. It would appear the temporary Pulgas structure was designed to do the opposite: it obscured the water spectacle "behind" the structure, away from the broadcasting stage. One might guess loud water sounds would have interrupted the public broadcast and provided publicity photographs, with a dropback of temple, reservoir and mountains.

The SFPUC's statistics in the same *Annual Report* of 1934-35 showed high numbers of spectators visiting the temple during the few weeks following the Completion Celebration:

> Since the turning on of the Hetch Hetchy water on October 28th [1934] the Pulgas tunnel outlet property has been open to the public on Sundays and holidays to view the flow of Hetch Hetchy water. At the opening celebration, approximately four thousand cars were present and since that time over twelve thousand more cars were checked, or an estimated number of 50,000 people entering the property since November 4th.[583]

Visitor statistics from the Completion Celebration taught organizers and designers not only to make room for tourists, but also to make the long drive worth their while. Early photographs of the Pulgas Temple site plan, laid out before construction began on the new permanent temple's construction, show large parking areas off the county road, and reveal the permanent temple situated within a formal garden landscape, with a large rectangular reflecting pool, drinking fountains, formal landscaping, and an formal temple

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[583] *Report of the San Francisco Public Utilities Commission, Fiscal Year 1934-35*, 29. See photographs D-2442 and D-2443, Photography Archives, SFPUC. Later photographs confirm that by 1936 a large parking area had been created on the site, adjacent to the county road that passed the site parallel to the lake shore.

as an architectural centerpiece. **[Figure 206]** Clearly, tourism was planned for and expected.

In the above *Annual Report* excerpt, November 4 was set aside as a reference date for special mention; I have no evidence for why this specific date is important, but on the following day, November 5, 1934, Spring Valley Water Company photographer George Fanning took a series of photographs of the temporary Pulgas Outfall Temple.[584] **[Figures 203, 204]** These views are surprisingly striking, formal building portraits that contrast sharply with the Completion Celebration pictures snapped at the event. Fanning's took the November portraits in dramatic cast light, the temple standing alone with the reservoir and the watershed's largess as a backdrop. The most striking of the series are those Fanning composed to suppress grandstand features and highlight neoclassical details, as if to record the building in its best light. My guess is that these were final photographs taken before the building's demolition—possibly before winter rains began to wear at the temporary wood and plaster structure, and tourism dwindled. In 1937, when the site was being prepared and photographed for the permanent Pulgas Water Temple construction, all material traces of the temporary grandstand temple had disappeared. **[Figure 206]** The triumphal spirit and symbolic intentions behind the display temple were not lost, however, in its absence. Rather, the SFPUC, the City of San Francisco, and the PWA newly embodied those ideals in plans for a permanent Pulgas Water Temple to rise in its place. **[Figure 207]**

HONOR AND DIFFERENCE: PERMANENT PULGAS TEMPLE FOR THE NEW SFPUC (1938)

In 1935, the year after the Completion Celebration at the grandstand temple, the PWA approved funding for a permanent Pulgas Temple as the Hetch Hetchy Aqueduct terminus:

> An ornamental temple of classic design, housing a circular weir, [will be] erected at the outfall of the Pulgas tunnel at Upper Crystal Springs reservoir, making the western terminal of the Hetch Hetchy aqueduct. Plans contemplate the

[584] Fanning's photographs can be found in the Photography Archives, SFPUC.

> landscaping and planting of the area immediately surrounding the temple and its approaches, the preliminary grading for which [will be] done during the year.[585]

The Pulgas Temple contract was won by the practice of W. P. Day, Architect, and H. M. Michelson, Associate (I will refer to Day as the principal designer of the Pulgas Temple).[586] Day had founded his career as a civil engineer in the teens, becoming a

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[585]San Francisco Public Utilities Commission, *Report of the San Francisco Public Utilities Commission, Fiscal Year 1937-38* (San Francisco: San Francisco Public Utilities Commission, 1938) lists a notice reporting the general details of the project, SFPUC Contract No. 166, supported by a "1935 PWA [Public Works Administration] Grant, PWA Docket No. 1132-6f," listed as follows: "Contract Let Under 1935 P.W.A. Grant—P.W.A. Docket No. 1132: Contract No. 166—Providing for a Temple and other improvements at the Pulgas Outfall, was completed on July 28, 1938, and marked the completion of all work under this P.W.A. program. The main features of the contract were construction of a 25-foot diameter by 60-foot high ornamental cast stone temple with a 12-foot circular weir in the substructure, moving 5,978 cubic yards of earth for landscaping, and placing 3,622 square feet of crushed rock and stone walks. Contract for this work was awarded to W.O. Tyson on January 14, 1938, and was completed on July 28, 1938, at a contract cost of $38,439.77." This same annual report announces 1935 PWA project and notes its 1938 completion, accompanied by an aerial photograph of the temple in its new site with the landscape still incomplete. Yet, earlier in the same report, the following appears: "Further steps were taken in beautifying the Pulgas Outfall Temple grounds. A sprinkler system was installed to water the planted area. Native oak, redwood, laurel and madrone trees were planted and wild cherry, lilac, manzanita and red berry bushes were transplanted from the adjoining woods. Deer roam the grounds and cause some difficulty by eating the young growth on the trees and shrubs. Many people visit this spot daily and on Sundays, hundreds stop to inquire about the temple and to view the flow of water over the circular weir in the substructure" (15-16, 21, 32, 38, 47). A copy of the contract can be found online at "Report of the San Francisco Public Utilities Commission," San Francisco Public Utilities Commission, accessed March 5, 2015, https://archive.org/stream/reportofsanfranc1938sanf#page/38/mode/2up.

[586] Day was well-known; Michelson is not prominent in the historical record. Day's trajectory from Civil Engineer to Architect is of distinct relevance to his work on the Pulgas Temple. In an article Day penned on reinforced concrete bridges in 1910, he labels himself a Civil Engineer, and he is listed as Engineer in Charge of Construction on a new bridge of note in Piedmont, across the bay from San Francisco, with the architect of the "artistic…Spanish Mission type" bridge listed as Albert A. Farr. See *The Architect and Engineer of California* 21, no. 3 (July 1910): 42-50, esp. 42, 43, 50. Day was at that time in business with John B. Leonard, a leading designer and builder of reinforced concrete bridges in California, and an editor of *Architect and Engineer of California* from 1906 to 1912. In 1913, Leonard and Day self-published a book in pamphlet form, *The Concrete Bridge: A Book on Why the Concrete Bridge is Replacing Other Forms of Bridge Construction* (San Francisco: 1913); the cover is imprinted with the title *The Concrete Bridge: How It Has Proved Itself in California*. In 1916, Day and Charles Peter Weeks announced their new architecture and engineering practice office, in the Phelan Building on Market Street in San Francisco, in *The American Architect and Building News* 110, no. 2130 (October 18, 1916): 255; Weeks was listed as Architect, Day as Consulting Engineer. In 1917, Weeks & Day announced plans to build "a palatial country home" near Napa, California for D. P. Doak. See "With the Architects," *The Architect and Engineer of California* 49, no. 2 (May 1917): 107. I will elaborate further on Day throughout my discussion of the Pulgas Temple. Details of Michelson's career in the historical discourse seem limited, for example, to having served in 1911 with Frederick Meyer and others on the Membership Committee of the San Francisco Architecture Club. See "San Francisco Architectural Club," *Architect and Engineer of California* 24, no. 3 (April 1911): 97.

concrete specialist for bridges and other utilitarian structures, and, by 1938, had formed an architecture practice. Day was appointed Vice-President and Director of Works for the 1939 Golden Gate International Exposition, which was in its planning and building stages at the same time the permanent Pulgas Water Temple was being planned and built, between 1935 and 1938.[587] I will elaborate further on his work in the course of my discussion of the temple.

In 1939, a photograph of the Pulgas Temple appeared in the Public Works Administration's publication showcasing a sampling of its completed projects.[588] The publication presents only a sampling of the Administration's noteworthy public works buildings, both Federal and Non-Federal, with at least one example included from every state.[589] The water temple was one of a small handful of identifiably neoclassical

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587 Also co-appointee with Day was architect George Kelham, who had been on the architectural commission for the PPIE. See for example, "The Panama-Pacific Exposition Architects [from the *Western Architect*," *The Architect and Engineer of California* 28, no. 3 (April 1912): 67.

588 A photograph of the completed temple, without landscaping, appeared in the PWA book by C.W. Short and R. Stanley-Brown, *Public Buildings: A Survey of Architecture of Projects Constructed by Federal and Other Governmental Bodies Between the Years 1933 and 1939 with the Assistance of the Public Works Administration* (Washington, D.C.: U.S. Government Printing Office, 1939), i-xvi. All quotations in the remainder of this paragraph come from this publication.

589 Short and Stanley-Brown distinguish Federal from Non-Federal projects as follows: "The allotments were divided into two classes. One consisted of Federal projects which, with very few exceptions, had been planned and designed by architectural and engineering organizations of the various departments of the Federal Government; the other consisted of Non-federal projects which had been planned and designed by architects and engineers in private practice, employed by the owners. The outstanding accomplishments in planning of both Federal and Non-federal buildings are the elimination of waste space, economy in cost, and proper consideration of light, ventilation, and sanitation; while in design, careful study of line, scale, and proportion, greater simplicity and an extremely sparing use of ornament, and a skillful and effective handling of materials, are noteworthy characteristics. The architectural quality of the Federal projects is far better than that of the buildings constructed by the Federal Government during the two previous decades. Many of the post offices and courthouses and other buildings designed by the Public Buildings Branch of the Procurement Division of the Treasury Department (now the Public Buildings Administration of the Federal Works Agency) have a high degree of architectural merit. The Navy Department has erected some excellent structures, and the great dams built by the Reclamation Service and the Army engineers are among the finest examples of modern design. The small structures erected by the National Park Service in our national parks have great architectural interest and charm, and many other Federal agencies have contributed much to the advancement of architecture. Traditional design predominates in Federal work although some trend toward the "modern" may be noted, particularly in the Middle West where the traditions of the architecture of western Europe are not so deeply rooted. Viewed as a whole the average architectural quality of design of the Federal work appears to be higher than the average of the Non-federal. However, there are a greater number of really outstanding examples of architectural design in the Non-federal buildings than can be found in the Federal work." See Short and Stanley-Brown, *Public Buildings,* i-xvi.

structures, a virtual anomaly in this collection. Flipping through the publication, photographs on every page, gives the impression that public works service buildings in the PWA's typical program, such as post offices, schools, and utilitarian civil works, featured an industrial variety of Art Deco characterized by rectilinearity, monumentality, geometrical stylization of classical details, and low-relief wall surfaces—in short, "simplicity and an extremely sparing use of ornament." In the relative lushness of its ornament, the classically-inspired Pulgas Temple differentiates itself considerably from the normative style the book presents. Yet, the WPA's interest was in highlighting buildings with "a high degree of architectural merit," showing "careful study" of formal elements, and "skillful handling" of ornament and materials. In this, the Pulgas Temple is an exemplar.

In several brief introductory essays, the authors succinctly define the Administration's policies, practices, and scope of study, as well as its ideological intentions and underlying tenets. Terms such as *architecture*, *design*, *public works*, *education*, and *modernism* dominate the text in relation to the architecture of the PWA. California stands out prominently in examples included, and in program project statistics: PWA projects and the total dollars of grant support were greater there than any other state. The report lauds PWA architecture in California for its technological and design advances over other parts of the country, reporting that "some of the best architecturally outstanding buildings in all types may be found in California," due in part to good design, innovative uses of finish concrete, and "the protective requirements against seismic disturbances."[590] Waterworks, and other utilitarian structures, received special note: "The greatest architectural advance has been made in the designing of utilitarian buildings, such as those connected with …water-supply systems, which in former times were

590 Short and Stanley-Brown report in *Public Buildings*: "The extent to which public works were constructed during the 6 years prior to 1939 may be seen from the fact that up to January 1, 1938, allotments were made by the P. W. A. for 15,976 Federal and 10,498 Non-federal projects, a total of 26,474 projects, of which 8,259 were for building projects only. Approximately 17,300 buildings were erected, of which 2,200 were accessory to projects for sewers, gas, power, and water supply. The buildings or structures illustrated herein represent 620 selected projects. As of October 1, 1939, 7,993 additional projects, including 10,350 buildings, have been completed or are under construction under the 1938 appropriation of Congress."

invariably ugly but which in many cases in the past 6 years have become structures of great aesthetic merit."

The 1938 permanent Pulgas Water Temple is a far cry from the first Pulgas Outfall Temple, the quick, temporary shadow of the Sunol Temple that staged the 1934 Hetch Hetchy Completion Celebration. In general form and structural function, it draws a likeness to the Sunol Temple, and, like every round temple structure I have discussed in the Crystal Springs system, it certainly honors its locally renowned predecessor. Like the Sunol Temple, it is a round, peripteral temple in the Corinthian order with a water-related Biblical verse inscribed on the frieze of its entablature. And like the Sunol example, the 1938 temple exposes underground waterworks to the open air through an ocular viewing platform inside the colonnade, dramatizing the surprise of the water's rush. Similar in form, tied in lineage, they are companion pieces: the Pulgas Water Temple announces "Terminus" to the Hetch Hetchy Aqueduct for San Francisco's municipal public utility domain, as the Sunol Water Temple uttered "Fount" to the Sunol Aqueduct for the Spring Valley Water Company's private, turn-of-the-century, capitalist debut. Where William Bourn the capitalist declared, "Here it begins," the City government resounds: "Here it ends." Beyond the general likenesses and the complicated analogy, close and comparative analysis reveals that, far from being a direct protégé, W.P. Day's permanent Pulgas Water Temple is an original declaration *and* a sophisticated art historical response to Polk's initial utterance. The 1938 temple distinguishes its waterworks aesthetic on its own merits.

W.P. Day's final product takes a decidedly academic approach. The round peripteral temple in the Corinthian order is roofless, open to the sky above a substantial entablature supported by 10 columns.[591] **[Figures 208-213, inclusive]** The entablature

[591] I have examined two of W. P. Day's drawings (E-1164, "Section and Plan of the Temple," and E-1165, "Detail Plans and Elevations") held in the Engineering Archives database, SFPUC, Millbrae, CA, which confirm that W.P. Day of H. M. Michelson and Associates, San Francisco, did the design. These provide only a part plan, a part elevation, and a section, with column, capital, base, and entablature ornamentation lacking specific detail. The copies available to me were low-resolution digital copies, or perhaps scanned photocopies, and therefore imprecise. The SFPUC's engineering database lists the SFPUC Contract for Pulgas Temple, No. 166, as including nine drawings, numbered E-1162 to E-1170, inclusive. Drawing A-

presents high but balanced contrast between plain and ornamented surfaces: the architrave immediately above the capitals has a geometrical "Greek Key" fretwork pattern, and above it, the plain frieze of stone blocks emblazons a Biblical passage: "I give waters in the wilderness and rivers in the desert, to give drink to my people."[592] **[Figures 129, 130]** The temple elevates contrast—precise, complicated ornamentation adjacent to large expanses of smooth, unadorned plains; highly ornamental surfaces silhouetted against broad open-air spaces; deeply carved capitals butted visually into low relief garlands; a dense entablature barrel emptied of its roof, revealing a circle of sky. **[Figure 131]** It is as clipped and dramatic as theater. It is the prominence of these stark, linear, geometric, aspects that I think illustrate that its style does approach the industrial Art Deco the WPA lauds. At this point in my discussion, it is difficult to call this temple "academic eclecticism," judging by the same terms Richard Longstreth used to label Polk's work as such.

No style is isolated in history. As I have mentioned in my discussion of one of Polk's first studies for Sunol, the round Ionic temple with dome and oculus, the design idea with which Polk began for the Sunol Temple, the Ionic, was in wide use in the early twentieth century, particularly suited to Greek Revival. Polk's final temple modeled its column order directly on an identifiable ancient Roman source, but with his confident inclusion, for example, of rafters under red tile brightly painted in Arts-and-Crafts renditions of Mission Church interior wall patterns, Polk incorporated clear regional references to California's 20th-century Mission Revival and Bungalow aesthetics. Recall that, in the 1890s, in Polk's essays in the local publication *The Wave*, the architect had criticized a rampant and disjointed Beaux-Arts-inspired eclecticism he deplored in local architecture. He cautioned architects against designing, and the public against accepting, an incoherent eclecticism that drew discordant historical revival features into the design

969 shows the PWA sign for the project. I have yet to examine records on the Pulgas Temple in the PWA archival files, held in the National Archives; these files may contain clarifying information. My search for the complete material for the Pulgas Temple is ongoing.

592 Excerpted from Isa. 43:20 American Standard Version (1901). I discuss the passage in a preceding section of this dissertation.

of a single building. Again, Longstreth insists that Polk's broad, consciously-reasoned neoclassical eclectic forced San Francisco architecture to remain grounded just outside the boundaries of Beaux-Arts strictures.

Even though it appeared 25 years after the Sunol Temple, the Pulgas Temple clearly draws upon its predecessor. Without a doubt, the SFPUC and the architects wanted the Pulgas Temple to offer up Polk's Sunol Temple as its primary inspiration, and the result tied the two to poles on a continuum line. Geographically, the two do connect, end to end, from east to west across the bay, as they trace the new line of the City's Hetch Hetchy route over the older line of Spring Valley's Alameda system. **[Figures 156, 158]** Yet, an examination of the Pulgas architect's play of responses to the Sunol Water Temple reveals art historical debts to other design ideas prominent in post-earthquake San Francisco architecture, as well. This becomes plain in close analysis of the Pulgas Temple's column capital within its own historical context.

CAPITALS UNFURLED: COLUMN ORDERS AND THE IMPORTANCE OF CAPITAL ORNAMENTATION IN DISTINGUISHING A TEMPLE

American Beaux-Arts architecture from the late 19th and early 20th centuries worked from standardized Ionic and Corinthian capital styles, just as classically-inspired architecture has done throughout history, from Vitruvius to Palladio and from the Renaissance forward. The identifying detail in a capital in the Ionic order, historically a Greek order that preceded the Corinthian, is the top of the capital crown: the Ionic is a horizontally-oriented crown cap formed as two large volutes spring horizontally away from one another, the whole laid directly atop a column shaft. **[Figures 71, 74, 221]** By contrast, Corinthian capitals distinguish themselves with their splaying, upward reach, as rows of acanthus leaves in the round spring from the head of the column. Leaves spring open and furl upward. **[Figures 77, 211, 214, 217, 219]** A crowning pair of opposing volutes, in the form of up-reaching tendrils, springs from the topmost row of acanthus leaves. All of this "springing" among volutes and tendrils in Corinthian capitals appears to derive from between the leaves of the acanthus rows around the base as new green shoots sprout up.

These springing volutes have two parts: the main volute, directed into its corner, is a *cauliculus*. At the base of each cauliculus springs a smaller volute, like a tendril, called a *helix*. At point in a standard Corinthian capital, through history, the interior facing bolster curves of the helix, typically abut one another, like two closed fists, at the center of the capital crown. **[Figure 220]** When we examine the capitals of the Sunol and Pulgas temples, it becomes clear that they differentiate themselves by doing something different with the capital crown helix volutes. These helix volutes do not abut; rather, they entwine. **[Figure 219]** This aspect becomes a significant detail in the ways each of the temples distinguish themselves architecturally.

In the larger surrounding leaves of Corinthian capitals, the uppermost leaf tips in their rounds of reaching flatten outward and square themselves as they push up: a crowning pair of opposing volutes springs laterally to create scrolled corner heads on each of four "sides" of the capital's crown, which is square in plan. Laid horizontally like a ceiling upon the head of this flattened capital is the *abacus,* a tablet with edge mouldings; it creates the flat and proper surface upon which the entablature rests. Protruding abacus edging creates a transition between the sculptured capital on its round column shaft and the mass of the geometrical entablature above it. Corinthian capitals stand upon fluted columns, serving with their repetition of close parallel lines to further emphasize the vertical quality of the order.

Along the timeline of neoclassical architecture, capitals in the Corinthian order were represented in exemplar architectural drawings in a highly typified way: they were drawn with butting helix volutes as a generic feature. Palladio's and Vignola's sample Corinthian capital renderings are good examples of this, and draw sharp contrast to an architectural drawing of a specific column order or capital, such as Gromort's drawing of the Monument of Lysicrates capital. **[Figure 220]** This differentiation is true along the timeline of neoclassical architectural drawings, from Andrea Palladio's Renaissance standardizations of revived Greco-Roman features, to 20th-century American Beaux-Arts variations—the rule even includes examples drawn by Vitruvius during antiquity, to a certain extent. In drawings by McKim, Mead and White in the 19th century, as in those by Palladio in the 16th century, the element of abutting volutes on Corinthian capitals is standardized to the point of being stock. Neoclassical architects of any period, from Roman antiquity forward, would be well aware of this feature and of traditions for its replication. It followed, then, that an important building distinguished itself for posterity when it featured an inventive and unique variation on the design of its capital. This specific new feature often focused at the center of the capital crown where the crowning helix volutes typically abut. In antiquity, the assertion of a new design at this center point on the capital crown created a unique column order, and that new column order marked a specifically identifiable temple. In other words, the new and unique order will be forever identified with that one, specific building. Any future reference to that order refers directly to the temple that originated it. And any "copied" reference marks the new classical work with the distinction of the original.

Return to Willis Polk's replica of the Round Temple at Tivoli column order. The temple is not in any way an exact copy of the Tivoli temple as a whole, as I've suggested, but Polk did directly replicate the column order in its entirety. To be more precise: Polk made an exact copy of the Tivoli column, as it had been drawn by 19th-century French architects Gabriel-Auguste Ancelet and Paul Nenot, in their famed 1905 compilation of classical architecture, *Fragments d'Architecture Antique*. **[Figure 214]** Both men had chaired the school of Architecture at the École des Beaux-Arts in Paris; their 19th-century "reconstructive" drawings were edited by Beaux-Arts faculty member Hector D'Espouy.[593] The Sunol column order appears to be a direct copy of Ancelet's and

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[593] Drawings by Gabriel-Auguste Ancelet (1829-1895) and Paul Nenot (1853-1934) of the Round Temple at Tivoli—often referred to in the 19th century as the Temple of Vesta at Tivoli or Temple of Sybil at Tivoli— were published in Hector D'Espouy's (1854-1929) *Fragments d'Architecture Antique d'aprè les Relevé & Resaurations des Anciens Pensionnaires de l'Académie de France à Rome* (Paris: Massin, 1905), a 6-volume compilation of "reconstructive" drawings made by Prix-de-Rome-winning architects during their study of classical architecture in Italy: "architects who have won the Grand Prix of Rome are required, in the first three years of residence in Italy, to send to Paris work based on the best fragments of ancient architecture." Drawings were "reconstructive," in that they presented probable renderings of ancient buildings and their ornamentation based on available fragments and information for each structure

Nenet's architectural drawing, and is quite similar to Gromort's rendition of the Tivoli temple order, which he had published in 1904. Gromort was friends with prominent San Francisco architect and Beaux-Arts student Arthur Brown, with whom Polk worked closely in San Francisco. These associations make it probable that Gromort and his drawings, and with them the New York Beaux-Arts, were influential in San Francisco, even if they were clumsily applied according to Polk's public utterings in his essays in *The Wave*.

Looking closely at Willis Polk's large central flower at the crown of his Sunol Temple capital illustrates clearly that with it he honors, by copying, the unique order of the Round Temple at Tivoli. In so doing, he distinguishes his own work. This flower dominates the entire top third of the capital, as the bloom stands out and away from the composition. It reaches up, into, and around the space created by the convex curve of the abacus. The simple and unique treatment of this flower is so prominent as to make it immediately recognizable to those who pay attention to such things. This capital in the context of the round form of the Tivoli temple was incorporated into neoclassical buildings with some frequency in the 19th century, and we must assume Polk to have become aware of these examples. Judging from *San Francisco Water* editor O'Day's report, Polk researched and refined the Sunol Water Temple over the course of a year, and in more than 50 versions. Once the architect decided to model the ancient round temple at Tivoli's famous cascades, his capital design made an authoritative reference to an ancient temple directly associated with water.

In the case of the 1938 Pulgas Water Temple, Day and Michelson replicate the overall form of the round Sunol Temple, but also conspicuously avoid the Tivoli temple column order. At a glance, it is clear the central flower is "omitted" from the capital.

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depicted. Ancelet (1851), Nenot (1877) and D'Espouy (1884) had all won the Prix de Rome. Quoted segment from Hector D'Espouy, ed., *Greek and Roman Architecture in Classic Illustrations*, trans. Henry Hope Reed (New York: Dover Publications, 1999), pref. D'Espouy taught at the Ecole des Beaux-Arts in Paris at the time he published the work. Both Ancelet and Nenot had chaired the Beaux-Arts architecture department: in 1895, the death of the famed Ancelet left his chair vacant, and Nenot, known as the architect of the Sorbonne, was elected to fill it. See notice in *Building News*, reprinted as "M. Nenot, Member of the Academie des Beaux-Arts," *The American Architect and Building News* 50, no. 1089 (November 23, 1895): 92.

Formally, eliding the large flower exposes the entire capital crown, opening visual space for innovation. Pulgas Temple architect W. P. Day took full advantage of this space, ascertaining on historical precedent, and habits of certain social behaviors Veblen (and perhaps Day) would deride, that viewers would make a certain value judgement about his work on this exact detail. Day did not want to create a copy of Sunol, and he makes his point at this very spot on his own column capital. The large flower's absence reveals that, instead of typically abutting center helix volutes, Day's design has created volutes that open toward one another, and, even more unusually, they intertwine. This feature, of intertwining helix volutes, alludes to a different ancient Roman temple order, one renowned precisely for this feature. That is, the ancient Temple of Castor and Pollux in the Roman Forum. [**Figure 217, 218]** Throughout neoclassical art and architectural history, intertwined helix tendrils are an unusual exception to the rule of abutted helix volutes at the crown of a Corinthian capital, as I have suggested, so the Castor and Pollux reference is immediate and incontrovertible. In antiquity, the Castor and Pollux was a temple of supreme importance, first built during the Roman Republic and subsequently redesigned and rebuilt several times, the last being in the second century during Empire.[594] It is the last, Imperial, innovation, that is best known in neoclassical architecture and it is the version that inspired the Pulgas Temple order. In 1904, George Gromort described the Temple of Castor and Pollux to be "very likely the most complete and the most beautiful of the orders that remain from the epoch of Imperial Rome."[595]

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594 The temple of Castor and Pollux was rebuilt three times during antiquity; the Corinthian version Michelson and Day refers to the column order of the 2nd-century Imperial renovation, which was the last. See John W. Stamper, *The Architecture of Roman Temples: The Republic to the Middle Empire* (Cambridge: Cambridge University Press, 2008), 144-50.

595 Georges Gromort, *The Elements of Classical Architecture*, ed. Henry Hope Reed (New York: WW Norton, 2001): 47; Gromort first published the work in 1904, in Paris, as *Choix d'elements empruntes de l'architecture classique*. His commentary on the Temple of Castor and Pollux continues: "This edifice, whose three high columns are surmounted by an entablature that dominates the Roman Forum to this day, probably dates from the beginning of the fifth century B.C. The temple was rebuilt several times, notably by Tiberius around A.D. 6, and then under Trajan or Hadrian at the beginning of the second century. The remains we see today are from this last rebuilding." Gromort's 45 plates "reflected his thesis that the Italians were not limited to the ancients but had actually wrought a new version of the classical which would transform French architecture and counter the thesis of Viollet-le-Duc that only the Gothic was truly French architecture. It was a thesis he would explore in several of his written works on the Renaissance. …

Clearly, W. P. Day did not merely *elide* Polk's flower, that direct reference to the Round Temple at Tivoli, from the Pulgas Temple's capital. Rather, he consciously and studiously modeled his column order on a temple even more highly celebrated than the Tivoli example. Day clearly wished to distinguish his Pulgas Temple from Polk's Sunol Temple. **[Figure 319]** Yet, like Polk (and Bourn), Day (and the SFPUC) associated the Pulgas Water Temple with a model of sophistication, refinement, and cultural status. Through Day, the SFPUC created a water temple that "dignified" the Hetch Hetchy Aqueduct terminus, its advanced hydraulic engineering, and the San Francisco municipality that created it as emphatically as William Bourn's had done when had asked Willis Polk to create a temple to mark the technological confluence point for his underground aqueduct in 1910. Day's academically astute capital design establishes the Pulgas Water Temple in an architecture of the highest order.[596]

As to the principal differentiating detail between the two temple orders, the intertwined helix volutes, so tightly woven, and so clearly articulated in high contrast, deep-relief carving, that an art historian might describe them as calligraphic, reminiscent of scrollwork or tracery. This lends to the bold, theatrical touch that permits this temple to approach the Art Deco aesthetic sensibility of its own time. This high-contrast theatricality continues above the capital in the tall entablature, whose lower base is encircled by a lone Greek key band, a simple pattern of geometric fretwork in low relief, which grounds a tall, smooth-surfaced, unornamented fascia. In the place of a crowning cornice on the open roof barrel, the entablature features a garland of open-mouthed lion heads alternating with large palmettes. The lion heads are an overt water feature.

He kept in rouch with the Americans he had known at the Ecole, notably Arthur Brown, Jr., architect of the San Francisco City Hall and the Pasadena City Hall. He co-authored several books with William Emerson, Dean of the Architectural School of the Massachusetts Institute of Technology." See Henry Hope Reed, "A Brief Biography of Georges Gromort," in *Elements of Classical Architecture* by Georges Gromort, 11-12. Gromort knew and remained friends with Brown and his partner John Bakewell, Jr., as well as with Bernard Maybeck. Arthur Brown collected Gromort's books, bringing Gromort's influence to San Francisco architecture, and presumably to Willis Polk, who was also a colleague of Brown's.

596 Figurative English phrases referring to something as comparatively of a "higher order" or "lower order" than something else developed etymologically from terminology describing the classical column orders. The Corinthian capital order—to include the Roman invention of the composite capital—is considered to be "the highest order."

Throughout classical and neoclassical architectural history, these were commonly used as gutter drain spouts. Where there were no working gutters, they symbolically gestured as spouts. The large palmettes underscore identifiably Greek aspects.

Unlike Polk, Day did not create a direct reference to an ancient water temple. He did not have to: Polk had already done it. In directly referring to Polk's Sunol Temple, Day also signaled the Tivoli water temple, by association. In addition, Day's temple heightened that connection when he embedded some clear if nuanced allusions to the Round Temple at Tivoli. He did this in the entablature ornament, addressing details from the Tivoli Temple that Polk had *not* included at Sunol. **[Figure 213]** One unusual, identifying feature at Tivoli is the festoon on its fascia frieze. **[Figure 214]** This festoon is as unique in architectural history as the temple's column order. Garlands of fruit and flowers drape ox skulls hung with ribbons. Day's upper entablature festoon includes variations on these obvious features, making reference to the Tivoli Temple in an inverted way, so to speak. I say "inverted" for two reasons: first, Day's festoon appears on the *inside* of the upper entablature rather than on the outside as at Tivoli; second, the Pulgas Temple festoon is *not* a Tivoli copy—it very obviously leaves out the ox skulls. One might dismiss this as making no reference to the Tivoli temple at all, but I would argue otherwise. Day's "starting point" had to be Polk's temple—this was an unavoidable association given the temple's history, and the history of the relationship between the Spring Valley Water Company and the brand new San Francisco Public Utilities Commission, which had swallowed the private water company whole. If Day had wanted to "forget" the Tivoli temple all together—which would have been an aesthetic mistake given the borrowing of the overall round form in the first place—he would have used a completely different kind of ornamentation. By making an almost blatant reference to an identifiable Tivoli Temple detail—the ox head, which Willis Polk did *not* use—Day underscored his dual task. First, he honored Polk's Sunol Temple and the Spring Valley Water Company, and, second, he differentiated his own temple: it uniquely belonged to the City of San Francisco's SFPUC. Associations with the Tivoli and Sunol temples are highly nuanced and allusive, but they are direct and definitive, made by way of highly specified representations of and differentiations from known details of temple form and ornamentation specifically applied to these two temples.

Neither did Day make a direct copy of the column order of the Castor and Pollux temple. Again, he did not have to. San Francisco's most highly visible post-earthquake symbol in architecture was the famed 1908 Bank of California building in the financial district's 400 block of California Street. The first major structure to be rebuilt after the earthquake, the California temple of finance was designed as a conspicuous "copy" of the Castor and Pollux temple.[597] **[Figure 216]** From its founding just before the 1868 earthquake, the bank was known for its boldness in architecture. Its 1868 structure survived that earthquake, making it a focus of study for new developments in seismic technology. The local reference would be clear, and by association would grant Day's temple conspicuous entrée to excesses of praise, to borrow from Veblen.

In addition to Day's clear reference to the column order of the Temple of Castor and Pollux, the architect also made iconographical references to other important classical buildings. For example, the palmettes on the entablature garland allude to the Greek anthemia pattern on the East Porch of the Erechtheon (421-406 BCE) on the Athenian Acropolis; this same pattern was a predominant feature of the McKim, Mead and White reading room of Columbia University's 1893 Library; Gromort singled out the library's column order for his influential 1904 publication on classical architecture. **[Figure 221]**

Together, then, the Pulgas Water Temple and the Sunol Water Temple of San Francisco combine, inseparably, to create a companion pair unique in waterworks history. Sunol brings a directed reference to a specific and celebrated water temple in antiquity, the Round Temple at the Tivoli cascades. Pulgas offers indirect but clear allusions, first, to Polk's Sunol Temple, its proper source, and second, to a studied collection of honorific

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[597] New post-earthquake buildings in the downtown and especially in the financial district began to open in 1908. Tracing the celebratory attention given to new architecture in the post-quake reconstruction offers a wealth of material for further study. A sampling of this press specifically related to Willis Polk's post-quake work appears in selective and consolidated form in Polk's surviving personal scrap books from 1908, in which the architect collected newspaper clippings specifically related to new post-quake architecture, especially his own. It is an apt period snapshot. See Willis Polk Scrapbooks, California Historical Society, San Francisco, CA.

source parallels, both ancient and modern. Together and apart, the two temples conform to and depart from American neoclassical traditions, contributing by virtue of their time, place, and situation a monument specific to water in San Francisco and California. Polk's and Day's academic eclecticism not only presents significant innovations in an American tradition of historical revivalism, but also further enlivens that architecture with the underlying dynamics of water: activating the structure's *raison d'etre.*

I have discussed formal and structural aspects of the Sunol Temple that made its influence a veritable *fait accompli* for the Pulgas Temple's design. In style, iconography, site design, and landscape setting, Day distanced the 1938 Pulgas Temple design from Polk's Sunol Temple while still paying tribute to it. The architect created a new water temple without inventing a new form. Not predetermined were specific strategies Day devised not simply to differentiate it from its referent, but to surpass it, so that the new City-built temple would take the place of the private Spring Valley temple as the primary cultural marker for water in the San Francisco Bay Area. The two temples are companions in a rare, continuous water history. Each stands solidly on its own aesthetic merits for its own place and time, but together they create a new context and bring new prespective to California's historical obsession with water supply as defining a keystone in the architecture of cultural values.

OFF THE RECORD: HISTORIOGRAPHICAL PROBLEMS OF UNSUBSTANTIATED ATTRIBUTION FOR THE PULGAS TEMPLE

At this point in my reconstruction of historical evidence for the Pulgas Temple, I am reminded of architectural historian Talbott Hamlin's attempts to attribute early 19th-century Greek Revival waterworks to architects in the absence of direct evidence. Hamlin reminds historians it is not uncommon to find that architects consulted on works projects for which official designs, explicit contracts, and/or signed drawings do not exist—and perhaps were never made. His methods and analysis insist that at no time are historians in the presence of complete evidence. This exhorts us to make reasonable judgements and to extrapolate intelligently and insightfully from the evidence we do have. The corollary is also true: sometimes existing evidence must reasonably be questioned, doubted, or even rejected, as misleading or incorrect. This latter problem nags at the problem of complete attribution for the Pulgas Water Temple's design. As I have shown, evidence is clear from the archival record that W. P. Day's architectural practice was contracted for the Pulgas Temple. With essentially nothing in publication on this topic, this historical fact is hardly common knowledge, even though the Pulgas Temple was, and is, well known as the terminus for the Hetch Hetchy Aqueduct, and even though it is on record as a federally-funded WPA project. The search to clarify the popular temple's design history is complicated by an anecdotal pattern in popular print discourse that persists in providing a completely unsubstantiated attribution of the Pulgas Temple's design to San Francisco architect William Merchant.[598]

Most of the time, attributions to Merchant consist in a simple, uncited declaration that Merchant designed the temple, with no further details and no source citations.[599] To

598 The Pulgas Temple does not appear in Merchant's project listing in the U.C. Berkeley Environmental Design Archive collections holding Merchant's work. See Merchant's project listing database at "Merchant, William," University of California-Berkeley Environmental Design Archives (EDA), accessed March 5, 2015, http://archives.ced.berkeley.edu/collections/merchant-william. I continue to work on tracing the origins of anecdotal print mentions of the relationship between Merchant and the temple.

599 For one prominent example of an unsubstantiated claim of Merchant's involvement in the Pulgas Temple—one in which evidence cited actually contradicts the claim—see the entry for the Pulgas Water Temple in UC Berkeley's online project The Living New Deal. The site entry includes a period photo of the newly completed temple: "Pulgas Water Temple Near San Francisco – Belmont CA," The Living New Deal, accessed March 5, 2015, http://livingnewdeal.org/projects/pulgas-water-temple-near-san-francisco-belmont-ca/. The narrative entry claims three architects worked on the 1938 temple: William Merchant, H. Michelson, and W. P. Day. Interestingly, the *same* website listing also appends a scanned (but unlabeled and unexplained) copy of what appears to be the PWA listing for the Temple, stamped and hand-dated February and March 1939, and it lists an unidentified "Docket number 1132-6f." I have confirmed this docket number to be the PWA Docket number for the Pulgas Temple. It appears as such in the SFPUC's *Report of the San Francisco Public Utilities Commission, Fiscal Year 1937-38,* in its mention of the award and completion of the 1935 PWA project contract for the Pulgas Temple, and in the PWA's 1939 publication on its completed projects, *Public Architecture*. On the scanned document included in the *Living New Deal* entry, two architects for the temple are listed—H. Michelsen and W. P. Day—but Merchant's name does not appear. The *Living New Deal* entry's narrative claim, that Merchant was one of the Pulgas Temple architects, contradicts itself with the primary evidence it appends with the PWA document. I think this is a prime example of the popular impression overthrowing even researchers in an professional historical endeavor like the UC Berkeley *Living New Deal* project, directed by Gray Brechin. I do not count other internet attributions of Merchant as designer, since most participate in a circular whirlwind of ungrounded claims. The pull comes from either the *Living New Deal* site, and/or from one internet site to another, which causes blanket repetitions and the need to cry foul for anecdotal claims. It is highly unlikely that information was culled from the historical source examples I cite in my analysis, since these do not

this point in my analysis of the Pulgas Temple's history, I have indicated that incomplete and difficult-to-obtain evidence for this temple confirms architectural attribution to Day, but it does not clarify the cultural preference for Merchant. Until further evidence surfaces, claims of Merchant's involvement must remain anecdotal, with provisos that do not permit rejecting him as a possible collaborator on the Pulgas Temple's completion. First, William Merchant was highly respected as a local architect, a celebrated friend to round temple design, and later in his career, to public works architecture.[600] Additionally,

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appear in Internet searches. I cite the confounding situation presented by The Living New Deal entry for the Pulgas Temple as an example of the way in which an underlying cultural desire based on some remnant material value persists, in defiance of conflicting evidence. It is also an incontestable example of the way in which anecdote or mere mention can become perceived as fact over time in the absence of historical research and in the presence of a paucity of evidence. In this case, the cultural need for or impression that locally lauded period architect William Merchant indeed designed the Pulgas Water Temple has lived on.

[600] As to temples, Merchant had assisted Bernard Maybeck on the Palace of Fine Arts during the 1915 Panama-Pacific Exposition (Maybeck was appointed by Willis Polk, PPIE architecture director). The elaborate round Beaux-Arts temple and curved colonnade was an architectural centerpiece of the 1915 fair, and the only building retained after the dismantling of the fair grounds. Merchant's architectural firm was the successor to the Maybeck firm name, and in 1960, Merchant's firm replaced the temporary Palace of Fine Arts with a permanent copy on its original exposition site. For more on the Palace of Fine Arts, see "Palace of Fine Arts." His public works career was extensive: he had been the consulting architect for the San Francisco Recreation Commission from 1932-1939. As members of the 1939 Architectural Commission of Golden Gate International Exposition, Merchant worked with W. P. Day and Maybeck, and with Gardner Daily, on several structures; the GGIE was supported by the PWA. Other public works buildings by Merchant relevant to this study are the 1948 PG&E Mission Substation, which I have discussed in this dissertation, and the 1957 renovation of PG&E's Mission office building, both in San Francisco. Merchant also designed a 1955 Morrow Bay powerhouse. From 1950-53, he worked on Camp Mather, the site of the former Hetch Hetchy Aqueduct and Reservoir mill camp, called Hog Ranch when it was a working construction camp for the Hetch Hetchy water and power system from 1914-24. Merchant's work in the fifties converted the former Hetch Hetchy construction camp into an overnight cabin campground for San Francisco residents (still in demand by lottery). The San Francisco Department of Parks and Recreation, for whom Merchant built many buildings and parks in the 1940s and 50s, completed this work on Camp Mather. On a related side note, during the long "Rim Fire" of Summer 2013, an uncontrolled Sierra Nevada wildfire that raged through the Hetch Hetchy watershed, Camp Mather was surrounded by the fire and should have been engulfed by flame, except for its local cultural and historical importance—the cultural value of which has endowed the campground with economic value—made Camp Mather a cultural priority, and it was saved, against the odds. A campground of similar vintage and historical importance in the area, owned by the City of Oakland, burned. I would argue this to be one interesting and patent example of the longevity of cultural value inherent in high-status waterworks and waterworks-related sites. Camp Mather was directly associated with Hetch Hetchy, and its status has remained high. He was a prominent local architect known for his collaborations with Maybeck on several buildings, including the Hearst family retreat estate Wyntoon (1902-03), among many prestigious residences and buildings. He built such landmark structures of high cultural status as the Chinatown Gate in downtown San Francisco, and the Bohemian Grove Clubhouse for the Bohemian Club, active to the present, an exclusive elite men's society, an American holdover from the Secret Society age. See the UC-

contemporary circumstances specifically during the time of the Pulgas Temple's design and construction do suggest a close association between Day and Merchant. In this respect, it is possible, and even likely, that Merchant did play a part in the temple's design and/or construction. In any case, Merchant's supposed temple design has overshadowed the actual, confirmed design work of Day, because the unsubstantiated surface discourse, persistently repeated and recycled back into circulation, insists on valuing Merchant's involvement over Day's actual work. I examine it here as a way of exposing a small but difficult type of historiographic problem deserving of questioning and comment.

First, to clarify the anecdotal evidence: the claim of Merchant's design of the temple amounts to a handful of brief mentions that have historical interest. Of those with potential historical merit, one allows by inference the probable nature and extent of Merchant's possible involvement. At the same time, investigating it sheds light on the complexity of the Pulgas Temple's actual fabrication, in the absence of evidence about that. In a 1987 historical study of structures built on the historic watershed lands of the Pilarcitos-Crystal Springs-San Andreas area, commissioned by the Golden Gate National Recreation Area, historian Marianne Babal briefly mentions the Pulgas Temple:

> The stone temple replaced a temporary paper mache structure erected for the ceremonial arrival of Hetch Hetchy waters to the Peninsula in October, 1934. According to Edward L. Fonseca, former manager of the Peninsula Division of the San Francisco Water Department, the stone temple was designed by W.P. Day of H. M. Michelson and Associates, San Francisco. Other sources contend that the temple was designed in miniature by artist William Merchant and constructed to scale by stone carver Albert Bernasconi.[601]

Babal's sources have led me to several brief, nonacademic articles written between 1950 and 1987 on the Pulgas Temple, and to a book by one of the cited article authors, which elaborates not only on the reference to Merchant, but also to the local stone carver Albert Bernasconi, who must have directed and/or fabricated the temple's remarkable

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Berkeley EDA archives summary and "Project Index" file at "Merchant, William," accessed March 5, 2015, http://archives.ced.berkeley.edu/collections/merchant-william.

[601] Babal, *The Top of the Peninsula*, 107.

ornamentation.[602] One of Babal's sources, Ruth Willard, wrote a brief essay on the temple in 1987; she included a brief biography on Bernasconi, who gained some local renown for his work on major ornamental masonry in San Francisco, notably Mayorial lifetime achievement recognition when he was near 80 years old.[603] Willard's 1987 portrait of the Pulgas Temple mentions some unattributed "facts" about the temple's background:

> By 1938 the completed temple stood in place. Commissioned by the Public Works Administration at a cost of $38,400, it is said to be one of three such American water temples, modeled after the *tholoi,* or round temples sometimes built near their waterways by the ancient Greeks.
>
> …Although often described as a duplicate of the Sunol Water Temple designed by Willis Polk and built in 1910, Pulgas was actually designed in miniature by artist William Merchant. Albert Bernasconi took Merchant's small model, scaled it up to the size he thought best (a difficult task), and built it, using California granite, cast stone, and concrete. Bernasconi—aritst, designer, sculptor, and above all master stonecarver—is one of those artisans who are secretly famous—little known to the public, but highly revered by those in the profession. He worked as a child in his father's stoneworks in Annecy, France, going on to take a degree in architectural ornamentation in Milan and to study at L'Ecole des Beaux-Arts in Paris before coming to San Francisco in 1911. Here he went to work immediately under John Galen Howard, chief architect of the University of California. He worked on so many buildings—in San Francisco the City Hall, the War Memorial Opera House, the Pacific Gas and Electric Company building, Grace Cathedral, St. Dominic's and St. Patrick's churches—that he said he forgot them after a while. But of Pulgas he said, "This is one I don't forget. I built the temple, myself."[604]

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602 Ruth Hendricks Willard, "Pulgas Temple," *The Book Club of California Quarterly Newsletter* 52, no. 4 (Autumn 1987): 94-96, cited in Babal, *The Top of the Peninsula*. Consulting Willard's book directly, I discovered that Willard, in turn, cites Dick Brill, "A Monument to Water in the Wilderness," *The San Francisco Progress* (August 4, 1978); to Jay Casey and John Wright (photographs), "Bernasconi: The Stone Carver," *The Christian Science Monitor* (December 4, 1969); and to Howard Hayden, "I Give Waters in the Wilderness," *San Francisco Call Bulletin* 8 (August 1959). Willard's article is a reprint of her essay, "Pulgas Water Temple," in *Sacred Places of San Francisco* by Ruth Hendricks Willard and Carol Green Wilson, photographs by Roy Flamm (Novato, CA: Presidio Press, 1985), 238-40. Bernasconi appears in the book several times, once in Willard's uncited report of Bernasconi's involvement in the temple's construction.

603 San Francisco Mayor Joseph Alioto honored Bernasconi with a lifetime achievement award in 1972. Bernasconi's work on the Pulgas Temple was reported in the brief article in the *San Francisco Chronicle*. Undated, unpaginated newspaper clipping, from an alphabetical file box (Letter "B") held in the Clipping Files, California Historical Society, San Francisco, CA.

604 Willard, "Pulgas Water Temple," 238-39. I do not know to which water temple Willard refers as the third.

Merchant indeed may have been contracted as a model maker for the temple, and Bernasconi seems to have been the clear candidate for the cast-stone details "tooled by hand."

What evidence exists to suggest that Day might have hired Merchant to assist in the design and/or building of the Pulgas Temple? Architect W. P. Day was the Vice-President and Director of Works for the 1939 Golden Gate International Exposition, which was in its planning and building stages at the same time the permanent Pulgas Temple was being planned and built, between 1935 and 1938.[605] William Merchant was one of the commissioners of architecture for the same Exposition. Since the temple opened in 1938, and Day and Merchant worked together on the fair, Day may have included Merchant's involvement in the temple's design process, or contracted him to create models, a part of the building process laid out specifically in the Pulgas Temple contract.[606] All temple details, especially ornament, were to be rendered in models;

605 Also co-appointee with Day was architect George Kelham, who had been on the architectural commission for the PPIE. See for example, "The Panama-Pacific Exposition Architects [from the *Western Architect*," *The Architect and Engineer of California* 28, no. 3 (April 1912): 67.

606 Clauses included in the contract for the Pulgas Temple (Contract 166) indicate that its materials would be reinforced concrete and cast stone. Columns were made from concrete column cores with internal reinforcing steel and fitted inside a hollow cast stone drum for each column ("Concrete Work," W.D. 166: 68-69). The part of the SFPUC contract titled "Cast Stone Work" (W.D. 166: 69-74, Sections numbered 155-169) specifies the work for the ornamental aspects of the Pulgas Temple as follows: "155. Work Included: The cast stone work required under Item 7 shall include columns, bases, and capitals; lintels and entablatures over columns; rail around well; floor panels and borders; steps; metal reinforcement in cast stone, anchors, dowels, and tie wires; concrete grout in back of cast stone; concrete fill under floor borders, panels, and steps; and waterproofing the front, back, and edges of cast stone. 156. General Requirements: All cut cast granite to be used shall be of good an even color, free from any and all defects, and shall, in the opinion of the Engineer, be equal in every respect to the standard sample in the Architect's office. The Contractor shall produce evidence that the cast stone he proposes to furnish is contained in at least two (2) buildings located in the vicinity of San Francisco, not less than five (5) years old, and that the physical properties of the cut cast granite used on them conform in every respect to the above mentioned sample in the Architect's office….161. Models and Inscription: Ornamental bands, cresting, capitals, and lettering shall be cast from models made in clay which have been approved by the Engineer. The modeler must be a skilled specialist on classic ornament, and must be approved by the Engineer. The inscription in the entablature will be composed of approximately eighty (80) letters. 162. Cast Stone Above Floor: The cast stone columns, bases, capitals, entablature, and rail around well shall be cut cast granite, composed of an intimate mixture of Portland cement, marble aggregates, and other inert ingredients necessary for a true imitation of granite. …After the cast stone has seasoned sufficiently hard, all exposed surfaces shall be tooled with a pneumatic cutting chisel; intricate parts of ornament shall be tooled by hand." See "City and County of San Francisco Public Utilities Commission, San Francisco Water Department Specification No. 166, For the Construction of a Temple and Other Improvements at Pulgas Outfall (In San Mateo County),

modelers were required to have the highest quality experience; and the choice of modeler was up to the architect. These aspects of the contract clearly indicate separate sub-contractors: presumably one or more for model making, one or more for the fabrication of the cast stone and related materials, and one or more to do the work of "tooling" ornamental details from the cast stone.

If Willard's unnamed source is correct, Day sub-contracted William Merchant to supervise the creation of models for the Pulgas Temple. Even though his supervision or fabrication of models would not have garnered him credit for the temple's design, the display of those models in some prominent location, or some public attention they gained, may have been enough to raise him to that status in the popular imagination, and for that impression to stick.

Federal Public Works Docket 1132-6f," N.A. Eckart, General Manager and Chief Engineer, January 1938, Documents Archives, SFPUC.

CHAPTER 11

Garden and Landscape Design for San Francisco Waterworks

SUNOL AND PULGAS WATER TEMPLES: THE PASTORAL AND THE BEAUTIFUL

Both San Francisco water temples' landscapes are inspired by estate gardens in the English tradition. These were adapted to American suburban culture by 19th-century garden designer Andrew Jackson Downing, and others. Sunol displayed a Picturesque garden ideal, a neoclassical monument nestled in a remote pastoral landscape: this temple draws the viewer in, where the discovery provides an intimate portrait of water enshrined in a natural site enclosed by the little valley in which it nestles. The Pulgas site, on the other hand, suggests the ideal of the Beautiful in garden design: the temple is displayed as the centerpiece of a grand, formal, symmetrical garden design that includes a variety of large-scale water features: a large reflecting pool set within broad lawns, symmetrically placed drinking fountains to display the water. The Pulgas Temple appears larger—rather than more intimate—as the surface of the reservoir and the mountain range open beyond it. The presence of low coastal fog during much of the year shrouds the temple landscape in the mystery of water's various states, its sources and its destinations, its natural and its engineered flows. Both temples expand viewer experience with the drama of the water's roar as it rushes beneath the temple. At both sites, one must climb several stairs, lean over an open, circular void, and look down into the rush through the underground crypt. The experience is one of being suspended in mid-air above a falls—even today with diminished, controlled flows. When the works were fully active, the power of the entire water supply flowing unimpeded beneath, the water's roar was audible as one approached the temple and climbed the base. At the moment one looked down into the "crypt," sight and sound of the water's rush combined and escalated into something of a shock, overloading the senses in a truly novel experience. As such, the water's rush activated the

Sublime—an overwhelming sense of awe, almost fear, in the face of nature's vastness and power. The Sunol Temple adds mystery by permitting a private and momentary peek into works otherwise invisible, as underground sources rush beneath the temple on their subterranean voyage through the aqueduct tunnel. At the Sunol Temple, one glimpses the hidden mystery. By dramatic contrast, the Pulgas Temple dispels mystery, exposing the full power of the Hetch Hetchy Aqueduct water supply as the tunnel releases its mass beneath the temple, and it crashes headlong into the long, open channel running out to the reservoir. The coastal mountain range of the local watershed rises behind it with the Pacific Ocean palpable, just over the crest to the west side facing the open Pacific Ocean. At the Pulgas Temple, then, one is struck by the grandeur of the expansive whole. Of the two, the Pulgas Temple completes an experience of water's power most forcefully. It transforms the temple into a building endowed with a Romantic agency: it brings water to the surface; it pushes water into the rush of the open canal; it makes the final transfer from its wild riparian origins in the high Sierra to the containment of the reservoir as the urban vessel for the city.

The Pulgas Temple site is in the direct vicinity of William Bourn's country estate, Filoli, designed between 1913 and the early 1920s by Willis Polk, with the landscape and gardens tended in turn by Bruce Porter, Isabella Worn, and Gardner Dailey, all prominent in Bay Area art, architecture, and landscape circles.[607] **[Figures 198, 222]** Bourn had built his house and formal gardens on a 650-acre estate he purchased entirely within the Crystal Springs Water Company watershed property. The entirety of the estate lands are contained by the bordering watershed lands of Bourn's own Spring Valley Water Company. The Hetch Hetchy Aqueduct terminus, the Pulgas Water Temple, was built more than a decade after Bourn's completion of Filoli and after the sale of his private company to the City and County of San Francisco. The temple stands in its formal garden about a mile from the Filoli mansion. This proximity heightens popular historical

[607] A prominent feature of Filoli has always been its formal gardens. The mansion is unusual in that the couple who bought it after the Bourns died in 1936, the William P. Roths donated it in 1975 to the National Trust for Historic Preservation, after spending years developing the 16 acres of formal gardens, which are currently maintained year-round and open to the public.

associations between Filoli and the Temple and between Bourn and Polk, and has retained the historical continuity between the San Francisco Water Department of the Public Utilities Commission, and the Spring Valley Water Company.

The immediate surroundings appear to be rural and remote, but the fact is that the temple stood directly on the shore of San Francisco's vast storage reservoir, which lay a few miles south of the City, and which was located along a string of hillside hamlets developed as suburbs of country estates for San Francisco's rich. Bourn's Filoli is a case in point. From the late nineteenth century, such enclaves as Hillsborough, Burlingame, Woodside, Atherton, and Portola Valley had been subdivided into country estate properties and elite suburban towns. These bordered such vast landholdings as those of Leland Stanford, William Crocker, and the Spring Valley Water Company. Many of these subdivisions were developed in conjunction with the water company. All used Spring Valley water to green acres of lawns and gardens.[608] Bourn contracted Willis Polk between about 1913 and the early 1920s to design and build Filoli; for many years before then, Bourn and his wife had rented a nearby country home owned by William Crocker. Given the history of these cultural surroundings, one might consider the Pulgas Temple and its garden setting to be an extension of the local country house and garden milieu the area represented at the time. Unlike the Sunol Temple, 45 miles across the bay from San Francisco in an undeveloped rural area, the "country" of the Pulgas Temple would be seen as an extended suburban residential setting. In the absence of the thousands of acres

608 A series of calculations on lists and spread sheets in the SFPUC archives calculates water use for 1913 among a dozen of the largest water-consuming estates in San Mateo County, primarily in Hillsborough. W.H. Crocker's 500 acres was the leader in property size, and used 39,000 gallons a day, or 15 million gallons a year, with an average use of 9 gallons per acre per day. Jennie Whitman Crocker's 157 acres, 12 to 15 acres of which were planted in lawn and which held several greenhouses, consumed 50,000 gallons per day, or 318 gallons per acre per day. The largest per-acre daily water use was by a handful of estates of fewer than 10 acres in size, each of which gulped nearly 2,000 gallons per acre per day. Hand-written at the bottom of a draft page appears the following note, which shows that families were not in residence year-round, and that water use was high even during periods when the house was vacant: "Note -- C. Templeton Crocker's place contains about 90 acres of which 6 acres lawn & 2 acres shrubbery use +/- 3,500 gallons per day 5 months when not here, 6,000 gallons per day when family is here & 80,000 gallons per day for 7 months = 10,000 gals per day per acre." See Spring Valley Water Company notes and spread sheet drafts regarding water consumed for lawns and gardens by various estates in San Mateo County, c. 1913, in Box MB-034, Folder 225, Documents Archives, SFPUC.

that a true aristocratic country estate would have encompassed, the Pulgas Temple, and even Bourn's nearby estate, would have appropriated the surrounding acreage of the water company as its own landscape, its own extended garden. In fact, in the Sunol watershed of the Spring Valley Water Company across the bay from the Pulgas Temple and Filoli on the shore of the Crystal Springs Reservoir, Phoebe Apperton Hearst did own over a thousand acres between Sunol and Pleasanton in the direct vicinity of the Sunol Temple. The water company owned the remaining entirety of the watershed lands surrounding the Hearst property, and to this day, the company remains encumbered by an original agreement between Bourn and Hearst to provide water to the private Hearst property.[609] Visiting local suburban "country" sites in the watershed conformed to a pattern of local tourism. For example, the first day trip of the local motoring club toured 50 miles, from San Francisco to the Lower Crystal Springs Dam and back to the city. Picnic areas with fountains were strewn about the watershed especially on the roads over and between dam sites to cater to day trippers through the 1920s.[610] Before the Crystal Springs Reservoir dammed the Crystal Springs Valley, the San Mateo Creek watershed had been a tourist destination, home of a popular hotel that drew tourism to the "country" from San Francisco.

WATERWORKS LANDSCAPES ON PAPER

Landscape design and garden settings were essential aesthetic elements of waterworks sites, with the Pulgas and Sunol Temples standing out as unique and exemplary. Landscape designs for the Sunol and Pulgas Temple sites—with Sunol's typifying a 19th-century picturesque or pastoral landscape, and the Pulgas Temple adhering to a more formal garden design at the immediate site, but apprehended as a pastoral garden viewed in the larger surrounding landscape—create bookends on a timeline between 1910 and 1938. Most of the structures I have discussed for the Bay Area to this point fall within that time frame. This was the period of most intense focus

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609 Author's personal communication with personnel in the San Francisco City Attorney's office, September 6, 2014.
610 "It Was Twenty Years Ago" *San Francisco Water* 2, no. 1 (January 1923): 15-16.

on designed landscapes for waterworks, and the examples I discuss from the San Francisco Bay Area typify—and in most cases precede—similar work in the rest of the state; I will discuss Southern California later in this dissertation. As these examples show, just as water and power companies sought out prominent architects to design water-related works buildings, well-known landscape architects were also called in to plan waterworks landscapes and gardens.

From the first issue of the Spring Valley Water Company magazine, *San Francisco Water*, in 1922, the water company articulated clearly the importance of aesthetic design in landscape and garden architecture for waterworks sites. That first issue included an article titled "Beauty and the Utilities," by Landscape Architect Mark Daniels, "Landscape Engineer."[611] Daniels was well known in California and the San Francisco Bay Area primarily for large-scale urban and suburban landscape designs. In his article, Daniels presents a historical overview of ideas in art history, garden aesthetics, and public utilities architecture animated by the point of view that environment nurtures human development, and that human intellectual, cultural, and ethical development, in turn, enhance urban improvement. He takes a moral stance: in addition to being profitable for a corporation, art and beauty in architectural structures signal good character, and indicate a collective and "progressive" cultural "intelligence." His work is also

611 Mark Daniels, "Beauty and the Utilities," *San Francisco Water* 1, no. 1 (January 1922): 15. After Mark Daniels (1881-1952) graduated from UC Berkeley, he became landscape engineer for Yosemite National Park, and then held the first Superintendent/Landscape Engineering position for the newly-formed National Park Service. During his early career, he laid out such residential developments as Sea Cliff, Forest Hill, St. Francis Wood, and Crocker-Amazon in San Francisco, the admired Thousand Oaks neighborhood in Berkeley, as well as "a development for a subdivision commissioned by the Spring Valley Water Company, and … an irrigation system in Butte County." In Southern California, he laid out Bel-Air and other residential and commercial projects in and around Los Angeles, including a plan for the Los Angeles Botanical Garden. Edward F. O'Day published a prospectus on that same project for Alphonzo Bell, the real estate developer who hired Daniels to design the luxury community. Daniels became further known in Northern California for developing Pebble Beach and the Seventeen-Mile Drive, and for work on the 1939 Golden Gate International Exposition. For a listing of Daniels' landscapes, architecture, and publications, see "Daniels, Mark," Pacific Coast Architecture Database, accessed March 5, 2015, https://digital.lib.washington.edu/architect/architects/302/. For more on this general overview, see Western Neighborhoods Project, accessed March 5, 2015, http://www.outsidelands.org and Berkeley Architectural Heritage Association, accessed March 15, 2015, http://www.berkeleyheritage.com.

promotional, in that he implies attention to aesthetics in waterworks architecture and landscape is akin to a philanthropic corporate gesture:

> There have been a number of instances in the past few years where large corporations, including public service corporations, have done considerable work in the landscape treatment of their properties. In every case the investment has paid dividends. It has created better conditions for employees, inspired workers to render more careful service, enhanced reality values not only on the land treated, but also in the vicinity, and won for the corporation the respect and good-will of clean-living, right-thinking people….
>
> Beauty is the product of creative effort, the visible or sensible expression of idealistic conceptions. …
>
> Observe a city that neglects its parks, streets, and public buildings, and you will find civic debasement. Investigate a public utility that is smothering in its own rubbish and you may discover large expenditures not remotely connected with ward politics.
>
> The reason for this is plain. We are developed largely through our environment. Our mental and visual horizons are closely related. …
>
> Environment and intelligence act equally upon each other. As we become more intelligent we seek better surroundings. Attaining these, our intelligence receives an added stimulus, and we strive still more to improve our surroundings.[612]

Daniels' propensity toward a romantic flair obscures clarity in his writing, but I quote him not only because he is one of a few landscape designers to comment on aesthetics in utilitarian works buildings. Daniels suddenly stands concisely on a point of central importance, that design aesthetics inspire public waterworks structures and sites.

> Utility is not enough. It is a higher impulse which prompts the householder to embower his home in blooms, the municipality to border its public walks with roses and its lanes with pomegranates, the water company (let us say) to lure the songs of birds with mulberries and magnolias…. Progressive intelligence is nourished on repeated contemplation of inspiring views.[613]

That "higher impulse" compels the use of aesthetics, through style in design, to convey cultural values and ideas. Daniels illustrates his remarks with descriptions of ornamental plantings. At the time Daniels published this article, he was designing a planting plan for

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612 Daniels, "Beauty and the Utilities," 15.
613 Daniels, "Beauty and the Utilities," 15.

Willis Polk's 1912 Millbrae Meter House.[614] **[Figures 119, 223]** Polk had designed an elaborate garden for the Aqua site—as the Millbrae Division headquarters was called—but his 1913 plan was apparently not built.[615] **[Figures 224, 225]** Daniels published his planting plan a decade later, in 1923, in the second issue of *San Francisco Water*. In his short article, "A Public Utility Planting," Daniels describes the literal function of the building as waterworks, as well as the figurative tone the architectural design sets as a temple to water.

> The subject to be treated was the Venturi Meter on the San Mateo Highway near the gates of the Company's pumping station at Millbrae. This master meter measures all the water flowing into San Francisco from the Alameda and San Mateo sources of the company. Its architectural setting is simple, dignified, and classical. Passers-by behold a shrinelike façade; and this is proper, for here is enshrined an immutable law of public utility service—the vigilant and scientific control of water flowing from its sources to serve a great metropolis.

He also describes a series of qualities he seeks to gain in any garden design process.

> Unity, variety, propriety, character, and finish are essential elements in landscape gardening—and they are lacking in many gardens. Do we not find cactus in churchyards, cypress in playgrounds?
>
> In gardening, as in the other arts, there is something to be expressed. The medium is trees and shrubs. Unfortunately, however, few persons have any idea of the meaning of trees and shrubs, or of the spirit they express. If you would learn propriety and character in trees, compare the willows of the meadows with the cedars of the mesas, study the stateliness of the sequoias, note the harmony of line in the rounded oaks that hug the curving hills.[616]

Daniels restricts his comments about the garden plan for the Venturi Meter House to the selection, placement, and cultural/symbolic meanings of plants, describing his plan for the Meter House as "one of a series of planting plans prepared for the Spring Valley

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614 See Mark Daniels' drawing in "Public Utility Planting," in *San Francisco Water* 1, no. 2 (April 1922): 15. Daniels' plan seems to have been carried through, at least in part, based on a 1926 photograph of the site in "The Water Supply of San Francisco," *San Francisco Water* 5, no. 1 (January 1926): 16.

615 Willis Polk's undated hand-colored Millbrae Meter House drawing and his 1914 architectural blueprints for the garden design project are held in the Document Archives, SFPUC. Mark Daniels' 1926 plan leaves out the grand architectural design elements Polk envisioned for the garden, but archival evidence shows that many elements of Polk's plan were eliminated, and no evidence has yet surfaced to substantiate whether any of his plan was carried out.

616 Daniels, "Public Utility Planting," 15.

Water Company."[617] Daniels matches each of his planned plantings with one of his five elements of artistic perfection, selecting plants whose characteristics "emphasize the water motive" as underlying the "meaning" of the waterworks site.[618]

> Nothing can express the glory of water like grass, the child of the meadow. Three beds of lawn were placed at the entrance…With an eye to unity…the twelve Lombardys and the two Irish yews were chosen, for they are architectural, and the dominant note must be the shrine…Further to recognize the architecture and introduce a note of steadfastness, the slow-growing, evergreen, columnar Irish yew was placed on either side of the little temple…For propriety, the Lombardy combines with the drooping leaves of the eucalyptus. For variety, the bloom of the acacia and the scarlet eucalyptus give contrasting colors and blending foliage in the background while bedding plants and flowering shrubs form a frame of color around the lawn. The character notes are the Lombardys and yews. Finish is neatly attained by neatly trimmed boxwood hedges, lawn borders, and privet hedges.
>
> So much for the thought. There remains the execution. …Care and attention must be lavish until the planting has achieved sufficient growth to show the result of thought and order.[619]

Daniels creates a viable mandate for conceptualizing a fused joint purpose for waterworks sites: utilitarian in origin, aesthetic in cultural effect.

Willis Polk's elaborate garden design was not constructed as he designed it; an executive decision was made to lay out and plant the garden but to "omit" the pool, fountain, and statuary. Polk's drawings and plans survive, revealing compact but elaborate formal garden landscape centered in front of the 1912 Venturi Meter House, with a central fountain flanked by pools, lawns, and walkways. **[Figures 224, 225]** Daniels' basic tripartite division of the garden site conforms in plan to Polk's original 1913. **[Figure 119]** The three rectilinear pools in Polk's design in Daniels' plan—with the Meter House centered behind a large pool and fountain, all clearly visible at the passing boulevard—show small lawns divided by narrow concrete walks. A 1926 photograph published in *San Francisco Water* shows that Daniels' plan was undertaken

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617 I have found no evidence of other projects in the "series of planting plans" Daniels mentions, nor have I yet found evidence for why Polk's 1913 garden design for the Millbrae Meter House was apparently abandoned, and if any garden design was implemented between 1914 and 1923.
618 Daniels, "Public Utility Planting," 16.
619 Daniels, "Public Utility Planting," 16.

at least in part from the view of mature plantings on the grounds in arrangements that correspond with Daniels' published drawing. His proposed curtain of tall trees framing the meter house in his drawing is not in evidence, although a small grove of eucalyptus stands up behind the Meter House. The three sections of lawn divided by concrete walkways organized the foreground as proposed, the planned pair of Irish yews stand flanking the water "shrine," and several of Daniels' prescribed "finish" elements—boxwood hedges and other smaller plant groups show that part of his plan was implemented.[620]

Polk's central features for his Millbrae Meter House garden project, the sculptural fountain and its reflecting pool, are examples of types of garden elements the Spring Valley Water Company introduced but did not fully develop. An important aspect of the display of prosperity in the form of water comes with a fountain, a common form of water architecture much-studied in art and architectural history. Polk had designed or included fountains for company waterworks buildings before—I mention several in this dissertation. His plan for the Meter House presents the most elaborate fountain the company seems to have considered. It was rejected, but the company did present other, more modest fountains as "gifts to the public."[621]

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620 See the photograph in "Water Supply of San Francisco," 16. The caption reads: "The Venturi meters at this station on the Highway twelve miles south of San Francicso are master-meters, measuring all the water that enters the City from Spring Valley sources. This station stands at the entrance to the Millbrae pumping station, the headquarters for the Peninsula Division, as Sunol is for the Alameda Division, of the Company."

621 I have compiled a separate history of fountains commissioned by the Spring Valley Water Company and their locations within the watershed. I will not elaborate that history in this dissertation but the company's fountains include, briefly, the two 1910 corner fountains at the Sloat Boulevard station; the 1912 entrance gate fountains at Sunol; two 1909 -12 octagonal "well head" fountains, remnants of which I have seen and photographed at Sunol and at the Stone Dam picnic area; from before 1922 the balustrade fountain(s) at Sunol and possibly at Pilarcitos Dam (which may be one and the same); the 1938+ drinking fountains at Pulgas Temple. In 1914 Willis Polk planned a project, probably unbuilt, for the Millbrae Meter House garden, which I discuss in this dissertation. There was also an ornamental fountain on the site of the Keeper's Residence at College Hill Reservoir, listed as "Fountain, C. I. [cast iron?] Ornamental," weighing 600 lbs., according to Leonard Metcalf, *Inventory of the Physical Properties and Structures of the Spring Valley Water Company in San Francisco, San Mateo, Santa Clara and Alameda Counties, California, As of December 31, 1913* (San Francisco: Spring Valley Water Company and City of San Francisco, 1914), 228. A fountain of unknown date with water issuing from a lion's mouth remains on the grounds of the Sunol Temple administration compound, pointed out to me by SFPUC archivist Alison Moore

NO GARDEN WITHOUT WATER: GOLDEN GATE PARK'S DUTCH REVIVAL LANDFALL

Waterworks landscaping is one way in which landscape design was incorporated into waterworks sites. But water supply went hand-in-hand with larger urban park development in the United States, and San Francisco's Golden Gate Park is one pertinent example. In a preceding chapter, I discussed waterworks landscape gardens outside of California that developed earlier, throughout the course of the 19th century. The earliest and most prominent I have mentioned is Philadelphia's Fairmount Park, which arose around the city's Fairmount Water Works on the banks of the Skuylkill River. From that city's initial Center Square Water Works, positioned as the umbilical architectural marker in the city's literal Center Square, to the later Fairmount Water Works away from the city center on the Skuylkill River, waterworks architecture played the leading role in the design of that city's urban parkland: the high cultural status of waterworks was met with garden design of equal stature. Fairmount Park grew and developed steadily as a major pastoral urban park for Philadelphia, as Central Park did for Manhattan. By the end of the 19th century the Fairmount landscape's cultural effect had spilled over onto both sides of the river: the entire area became the grounds for the 1876 Centennial Exposition. When the former reservoirs on the eminence above the waterworks were closed, the site converted into the city's cultural Parnassus when the hilltop became the site for the massive new neoclassical Philadelphia Museum of Art building. While by contrast Manhattan's Central Park was from the outset an enterprise of formal planning specifically dedicated as urban parkland, it, too, served a major waterworks function as a major reservoir site for the Croton Aqueduct, as I have discussed in a previous chapter.

San Francisco's Golden Gate Park was the West coast's major 19th-century urban park.[622] The park's design did not grow up around waterworks as Fairmount's had, nor

[622] The land for the park was assigned by about 1860; not until the 1870s were an architect and plan selected, after which planting began. A major development thrust for a built environment in the park came when the developing park staged the 1894 Mid-Winter Exposition, a modest and highly criticized fair pushed through by Michael DeYoung as an immediate follow-up to the 1893 Chicago World's Columbian Exposition. The general site layout along with several of the buildings and attraction grounds became the permanent footprint for the center of the park, and, to this day, that footprint defines the park's centerpiece. Surviving structures and grounds from the 1894 fair include the Beaux-Arts-style band shell and its sunken

did it accommodate the city's water supply reservoir as Central Park's did, but Golden Gate Park, too, became a designated waterworks site. Just after mid-century, a thousand acres was set aside as future urban parkland in the unincorporated expanse of oceanfront sand dunes known as the "Outside Lands." The plat was unplantable without an immense water supply. Through the 19th century, the Spring Valley Water Company supplied park irrigation water, but it was insufficient and expensive.[623] A large-scale, dedicated water supply was crucial to complete the undertaking.

In 1902, the City approved placement of a full-size working Dutch Revival windmill at the northwest edge of the park grounds, directly adjacent to the beach, to tap the ample groundwater supply discovered beneath the coastline. **[Figure 226]** Six stories tall and cedar-shingled, the Dutch (later North) Windmill's broad cylindrical tower tapered up to a shingled dome cap upon which turned a traditional oversize wheel lattice with four sails; a tail fin perpendicular to the main sail armature perched on the dome. A second windmill was completed by 1908, the largest in the world and "a sophisticated example of wind-powered hydraulic engineering." Dubbed Murphy's Windmill, or the South Windmill, it filled an irrigation lake two miles to the east, on a natural rise in the park called Strawberry Hill.[624] Wood-sheathed and slate-shingled, this octagonal smock

garden, the Japanese Tea Garden, and the plan for the Botanical Garden, as well as the Conservatory of Flowers greenhouse and the park's two major museum sites, Michael De Young's museum for his private art collection, and the Academy of Sciences.

623 "When construction of Golden Gate Park began in 1871, much of the thousand-acre tract of land stretching westward from Stanyan Street to the ocean was a windswept expanse consisting of sand dunes and scrub vegetation. Imported topsoil and water were needed to keep the introduced plantings alive in such a harsh environment. From the 1870s until 1900, the Parks Commission purchased water from the Spring Valley Water Company but the sandy soil quickly soaked up the water and the average bills were over a thousand dollars a month. State engineers and others knew about the existence of vast reserves of fresh water under the park but due to political infighting an adequately functioning pumping apparatus was not constructed until 1902, when the Dutch Windmill was completed." See "Designating the Murphy Windmill and Millwright's Cottage, at the West End of Golden Gate Park, as Landmark No. 210 pursuant to Article 10 of the Planning Code," Ordinance No. 122-00 (2000), City and County of San Francisco, Board of Supervisors, accessed March 4, 2015, http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances00/o0122-00.pdf ..

624 "The Murphy Windmill was designed in 1905 but due to problems arising from the 1906 Earthquake and Fire, the Parks Commission was not able to begin construction until early 1907…. The Murphy Windmill was designed by Mr. J. C. H. Stutt in 1905. Mr. Stutt was a mechanical engineer, with offices located at 417 Montgoeme3ry Street in San Francisco. According to Lukas Jozef Vergij, a windmill restoration expert from the Netherlands, the Murphy Windmill is very similar to the nearby Dutch

windmill tapered on an octagonal base up to its copper cap. Like the North Windmill, it supported four sails and a tail fin assemblage, all of which turned on the rotating cap to operate the interior waterworks.

The Murphy Windmill site also included an "artistic Dutch cottage," a Dutch Revival, shingled millwright's residence. The cottage was a *pro bono* design by prominent San Francisco architects James and Merritt Reid, whose firm Reid Brothers, Architects had designed such local architectural landmarks as Golden Gate Park's band shell for the 1894 Mid-Winter Fair, the 1898 Call Building, the 1906 Fairmont Hotel, the 1910 California-Pacific Building, and within view of the windmills, the 1909 Cliff House at Land's End, the dramatic northeastern point of Ocean Beach in view of the mouth of the Golden Gate.[625] The 1910 brick, wood and slate shingled Millwright's Cottage, was in Georgian Revival style elaborated by "Dutch arts and crafts details;" together with the windmill standing next to it, the architecture defined a Dutch Revival aesthetic for San Francisco.

Windmill, although the Murphy Windmill is somewhat larger. Alpheus Bull of the Standard Electric Company designed the Dutch Windmill in 1902 but he was not involved with the design of the Murphy Windmill." The report also credits John McLaren, Assistant Superintendent of the park under park architect John Hammond Hall, and Superintendent from 1886 to 1943: "He was a strong backer of the construction of both the Dutch and Murphy Windmills and he played a significant role in selecting their design." Quotes from "Designating the Murphy Windmill and Millwright's Cottage." The report includes details of the windmill's original dimensions, structural components, interior waterworks mechanisms, and water yields: "Together, the windmills supplied the reservoir on Strawberry Hill with 1.5 million gallons of water per day." The reservoir is today's Stow Lake. Soon thereafter, Spreckels built the surviving model boat lake in the park.

625 See "Designating the Murphy Windmill and Millwright's Cottage." According to the report: "The Reid Brothers, Architects, of San Francisco designed the Murphy Millwright's Cottage for the Parks Commission in 1909. Although the Hotel del Coronado in San Diego is probably their best known work, the Reid Brothers (James and Merritt) carried out the majority of their work in San Francisco…and became one of the pre-eminent architectural firms on the West Coast. The firm's strong political connections, as well as their ability to execute large commercial buildings, allowed the brothers to play an important role in the rebuilding of San Francisco after the 1906 Catastrophe…. [They] worked in a variety of styles, although Neoclassical Revival was their favored mode…. The Murphy Millwright's Cottage is one of the Reid Brothers' lesser-known commissions." The architects built the Cottage *pro bono* for the Park Commission. Other period buildings near the North windmill site, are the Cliff House, a restaurant first opened in 1863, and the former site of a large public natatorium, the Sutro Baths, first opened in the early 1890s. Adjacent to the North Windmill stands a later but notable 1925 Beach Chalet, Willis Polk's last building. Originally it was a public beach changing room, with interior ornamentation known for its figurative wood staircase and its later WPA murals.

> Georgian Revival dwellings typically feature rectangular plans, symmetrical facades, brick exterior finishes and restrained classical detailing. Common Georgian Revival architectural motifs include: gable-roof dormers, fan lights and porticoes featuring broken pediments and Doric columns. The Murphy Millwright's Cottage embodies many features typical of the Georgian Revival style, including: symmetrically arranged elevations, exterior brickworks in the Flemish Bond pattern and a portico with a broken pediment and Doric columns and a denticulated cornice. However, the Millwright's Cottage also displays Arts and Crafts detailing on the interior and the arrangement of lights in the window sashes…. The design quality of the Murphy Millwright's Cottage is subtle and restrained and its crisp Georgian Revival exterior contrasts sharply with the more exuberant styles popular for residential architecture in San Francisco around the turn of the century.[626]

Even though the Cottage was a small commission for the architects, it "displays the same concerns with craftsmanship and high-quality design that typically characterize their more prominent commissions."[627] Evidence of that high quality came when the building was examined during the application process for Landmark status in 2000: "The interior of the Murphy Millwright's Cottage has remained largely intact since its construction. The interior is simple but makes use of sturdy, high-quality materials and building techniques. The durable nature of the design is proven by the current condition of the cottage interior, which is surprisingly sound after little maintenance for over ninety years."[628] The San Francisco City Ordinance that declared the Murphy Cottage a Landmark comments on the aesthetic intentions for the utilitarian waterworks structure: "although a functional structure, the Murphy Millwright's Cottage was intended to augment the "old World" pastoral associations created by the windmill…, an unusual structure by virtue of its dual role as a practical machine and scenic landscape element."[629]

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626 All quoted segments in this paragraph are cited from "Designating the Murphy Windmill and Millwright's Cottage."

627 "Designating the Murphy Windmill and Millwright's Cottage."

628 "Designating the Murphy Windmill and Millwright's Cottage."

629 "Designating the Murphy Windmill and Millwright's Cottage." The report comments further on the architecture: "Parks Commission minutes from 1909 ambiguously refer to the Murphy Millwright's Cottage as being in the 'Dutch Style.' It is difficult to ascertain whether they meant Dutch or Dutch Colonial but regardless of the classification, the stylistic features of the cottage share more in common with

The windmills and their respective cottages, different from anything else I discuss in this dissertation, are premium examples of waterworks engineering housed within an architectural design informed by cultural values. High-quality, visually-provocative design of buildings to house works that collect, process, and move large quantities of water laud these human waterworks, the culture that made them, and the past cultures that preceded and influenced them. More than any other examples I cite, the windmill sites celebrate in a single gesture the perceived marvel of waterworks engineering function, with a high-quality historical-revival architectural marker. For Golden Gate Park's windmills, a unique and critical element of their formal, conceptual, and cultural success is their location, on the absolute border between the highly fabricated landscape of Golden Gate Park, and the raw open coastline of Ocean Beach. **[Figure 227]** At the time the windmills were built, the Great Highway had not been constructed, the park was only partially laid out, largely due to water concerns, and the area was still known as the "Outer Lands" of low brush and sand dunes.

> Together, the Murphy Windmill and the Murphy Millwright's Cottage constitute a unique historical, engineering and architectural landmark in the western reaches of Golden Gate Park. The Murphy Windmill is a sophisticated example of hydraulic engineering, as well as a picturesque element within a contrived pastoral landscape. When completed in 1907, it was the largest windmill ever constructed and it pumped as much as 40,000 gallons of water per hour for irrigation purposes. The Murphy Windmill was a critical agent in the transformation of acres of scrub and sand dunes into Golden Gate Park.[630]

The windmills in the landscape that backs them—Golden Gate Park—identifies a 19th-century pastoral/picturesque aesthetic, while at the same time, the windmills in must directly confront the landscape they face—the open ocean—which activates a sublime

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the Georgian Revival stle. Interest in indigenous colonial American architecture had grown considerably during the 1880s and 1890s, as a result of the 1876 Centennial Exhibition. The genesis and popularity of the Georgian Revival residences in Newport, Rhode Island of the 1880s and 1890s greatly influenced an entire generation of American architects. Local San Francisco builders did adopt various motifs of the Colonial and Georgian Revival styles after 1900, but these features were merely applied to the façade of the typical San Francisco row house." See also Raymond H. Clary, *The Making of Golden Gate Park, The Growing Years: 1906-1950* (San Francisco: Don't Call It Frisco Press, 1987).

630 "Designating the Murphy Windmill and Millwright's Cottage."

effect on a viewer, a 19th-century Romantic characteristic the Ocean Beach shoreline has always engendered.

At the same time they honor historic forms as representations, they ultimately glorify the Modern: that is, they honor technological advancement in the historical period to which they refer in architectural form, and to their own time, in the currency of contemporary engineering design and function, and technological practice.

> According to Lukas Jozef Verbij, the Dutch windmill restoration expert, the design of the Murphy windmill displays a thorough familiarity with Dutch windmill technology. Although the engineer, Mr. J. C. H. Stutt, may have examined windmills in the Netherlands, he developed unique technical innovations that set the Murphy Windmill apart from its European counterparts. These innovations allowed Stutt to design the world's largest windmill and boldly place it next to the ocean, where it would be subjected to severe weather conditions. The Murphy Windmill featured the longest sail of any windmill ever constructed, and, interestingly, the sail stock was made from a single, continuous, 114-feet long section of Oregon pine.[631]

The Dutch Revival windmills at Golden Gate Park literally straddle a boundary, one that joins and divides several landscapes: open ocean and cultured park; sea water and fresh water; sublime and pastoral; wild and tamed; exposed and sheltered; natural and engineered. Every structure I discuss in this dissertation includes some combination of water-inspired dichotomies, but the windmills in particular stake visual claims with evident cultural implications. Not least of these, for this study, is the striking reality that ample fresh water lay just under the edge of the raw salt Pacific and that wind power from that open salt coast was the key to accessing fresh water lying just beneath it. Wind power alone delivered ample water to the park until 1913, when advancements in electricity prompted the City to contract PG&E to install supplementary electric pumps inside the windmills, supplying added water pressure for new park development outside Golden Gate Park. The windmills and cottages were occupied and maintained until the

[631] Period reception of construction projects was typified by high interest. I cite mention by analogy the public fascination when Willis Polk installed monolithic column shafts on his Hibernia Bank portico, an undated newspaper clipping in Willis Polk Scrapbooks, California Historical Society; see also "Designating the Murphy Windmill and Millwright's Cottage." The North, or Dutch, Windmill was reconstructed in 1980s; Murphy Windmill and Cottage recently completed renovation, in 2012.

1950s, when they languished until public campaigns succeeded in restoring them: the North (Dutch) Windmill reopened in 1978, and the North (Murphy) Windmill and Cottage in 2012.[632]

So, while Philadelphia's Fairmount Park grew up from the city's prominent waterworks site, and Manhattan's Central Park grew around the city's long-distance aqueduct reservoir, we might say that San Francisco's urban centerpiece, Golden Gate Park, was itself transformed *into* a waterworks site. Gardens that accompanied waterworks architectural design for San Francisco's water system, primarily the Sunol and Pulgas Temple gardens, were comparatively smaller in scale, of course, than these large urban parks.

Within a garden design context, the value of the Sunol and Pulgas water temple sites, rests on rural landscape extent. Each was set within the relatively vast watershed lands they occupied, tracts of contiguous lands measured in hundreds of square miles, not in hundreds of acres. Moreover, the temple sites were much more remote from the urban center than designed urban gardens—and in a way, they still are. It goes without saying that the major 19th-century city parks were initially planned in relatively remote, "Out of Town" spaces, with the plan that the city would eventually grow around them. The Sunol and Pulgas landscapes were developed intentionally spaces of rural tourist retreat. Given the continuous preservation of these landscapes as closed watershed lands, the sites still retain the remote, rural, and pastoral quality of country estate gardens, as it were, making them unique and unprecedented in California waterworks garden history.[633]

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632 A detailed description of windmill dimensions, technical capacity, and interior works, as well as details of electrical equipment first installed in the windmills by PG&E, appear in A. L. Harris, "'Pacific Service' as an Aid to Nature in Golden Gate Park," *Pacific Service Magazine* 6, no. 7 (December 1914): 248-50, with photographs of the windmill exterior and interior gear works. The (North) Dutch Windmill is San Francisco Designated Landmark No. 147.

633 This important aspect of my study is still under development. Both the Sunol and Pulgas Water Temple sites have strong historical and cultural connections to the large country estates of Bay Area wealthy families in the areas, a connection which remains to be explored and examined thoroughly. A significant area for continued research is the relationship between the Bourns and the Hearsts, for example. The vast land holdings within and around the Spring Valley Water Company's Alameda Division were not held by the water company alone; Phoebe Apperson Hearst's 2,000 acre country estate, with its 50-room hilltop Hacienda del Pozo del Verano, occupied the entire western hillside adjacent to the San Francisco watershed from Sunol to Pleasanton, and Hearst was instrumental at moments in assisting Bourn with his

Over time, the proper water temples—Polk's 1910 Sunol Temple, its 1934 replica at the Pulgas Outfall, and W.P. Day's 1938 Pulgas Water Temple—became prominent and permanent markers in the rural watershed. In their own time, these were fashioned as visual statements of corporate and cultural philosophy—signs of "dignity" in the words of the corporate aims of the day, as I have discussed. As such, they served a promotional function as they drew civic-minded tourism. But beyond their patent function as marketing tools for utility companies, or as appurtenances to corporate mission statements, waterworks temples served as aesthetic markers in a larger cultural scheme regarding water supply and public service, in which architects and landscape architects, and their patrons, figured water systems statements articulated in the architectural language of historical revival.

development of the watershed property. To this day, San Francisco's water company is bound by an original agreement to provide that land with water. Similar historical and cultural connections exist for the Spring Valley Water Company's San Mateo Division watershed property of William Bourn, as well, who bought and built his own country estate, Filoli, on a 650-acre parcel adjacent to the Upper Crystal Springs Reservoir holdings of the water company. The entire surrounding piedmont region had been subdivided for development into country estates beginning in the late 19th century. Full examination of such social, political, and economic interconnections have much to reveal about cultural values regarding water, architecture, landscape, and culture in California. Similar lines of examination can be followed for the Pacific Gas and Electric Company and other public works and utiltites, private and public. For Southern California, connections between public water and hydropower supplies and the estate-holders who developed them ranges from the private water and hydroelectric enterprises of Henry E. Huntington to the architectural portfolios of Southen California Edison Company, the Los Angeles Department of Water and Power, the Metropolitan Water District, and others. All (and more) are works in progress.

PART 4

HISTORICAL REVIVAL, STRUCTURAL ART, AND AESTHETIC AMBIVALENCE IN SOUTHERN CALIFORNIA WATERWORKS ARCHITECTURE

It does not pay to carry economy to excess in dam building and there is nothing quite so satisfying as a big solid mass of concrete.

--John R. Freeman, dam engineer, 1911-12[634]

…Such deep ambiguities lie at the very center of [Thomas Jefferson's] temperament. To charge him with inconsistency, after all, is to imply that a firm grasp of the facts or the rigorous imposition of logic might have improved the quality of his thought. But that is a mistake. The "inconsistencies" just mentioned are not the sort that can be swept aside by a tidying up of his reasoning. They are not mere opinions. They stem from a profound ambivalence—a complex response to the conflicting demands of the self and society….He expresses decisive contradictions in our culture and in ourselves.

--Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America*, 1964[635]

The disciplines of structural art are efficiency and economy, and its freedom lies in the potential it offers the individual designer for the expression of a personal style motivated by the conscious aesthetic search for engineering elegance. …But the modern world is filled with examples of works that are faulty, excessively costly, and often ponderously ugly.

--David Billington, *The Tower and the Bridge: The New Art of Structural Engineering* (1985)[636]

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634 John R. Freeman to Guy C. Earl, October 11, 1911; and John R. Freeman to A. W. Bullard, February 23, 1912, Box 63, Freeman Papers, MIT, quoted in Donald C. Jackson, *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* (1995, repr., Lawrence, KS: University of Kansas Press 2005), 116, 285 n. 34.

635 Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), 135-37, 141, and 375 n. 43-49. Marx was speaking about contradictions in Thomas Jefferson's understanding and articulation of pastoral and agrarian ideals. Marx's identification and understanding of this profound type of ambivalence—a type I have identified in dam and hydraulic engineer John R. Freeman and will discuss in this section—was helped by Marx's reading of Richard Hofstadter's *The American Political Tradition and the Men Who Made It* (New York: A. A. Knopf, 1948), 24-25. In his discussion of this point, Marx also cites Van Zandt, *The Metaphysical Foundation of American History* ('s-Gravenhage, The Netherlands: Mouton, 1959), chs. VIII, IX.

636 David P. Billington, *The Tower and the Bridge: The New Art of Structural Engineering* (New York: Basic Books, 1983), 6.

CHAPTER 12

The 1928 St. Francis Dam Failure and the Suppression of Aesthetics in Southern California Dams

The epigraphic quotation from Leo Marx reintroduces the problem of aesthetic ambiguity. Marx was analyzing Thomas Jefferson's understanding and articulation of differences between American and European points of view regarding pastoral and agrarian ideals. In a broad analysis of Jeffersonian idealism in American literary and artistic production, Marx finds that "tragic ambivalence…is the hallmark of our most resonant pastoral fables"—both in literary and visual artistic imagery.[637] This profound American ambivalence is evident in reactions to dam design by American hydraulic engineer John R. Freeman, a prominent water systems engineering and architectural design in the late 19th and early 20th centuries. Arguably *the* leading hydraulic engineering consultant in the United States, Freeman created the initial 1912 design for San Francisco's Hetch Hetchy Aqueduct. His report dedicates a significant section on the cultural aesthetics of leisure use for the water system, sharply focused on the value of the picturesque lake that would rise behind the future Hetch Hetchy Valley dam. **[Figures 228, 229, 230]** Freeman's report asserts a specific character for the system's civic image, in words and pictures, proposing Hetch Hetchy would harness a blend of romantic and contemporary European and American values regarding water and landscape. These derived from a Scandinavian or Alpine vision of pastoral purity for mountain "wilderness" landscapes. His vision ran the gamut from the value of fresh air and the simple life implied by peasants in *lederhosen* leading mule carts along gravel hiking paths, to the high-end "ecotourism" of the 19th century's Alpine hiking, skiing, and mountain climbing craze of the day. Freeman's report was the primary guide for the aqueduct's shape, technically and culturally. The specifics of architectural design would

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637 Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964), 144.

develop over time, but the initial and overall vision was imprinted by Freeman's forceful and thorough planning.

Leo Marx's analysis in the above epigraph illustrates the historian's method of drawing a generalization about American culture from the thinking of a historically influential individual. Similarly, I will draw from John Freeman's prominence in hydraulic engineering and system planning at the beginning of the 20th century to extrapolate values at the heart of hydrological aesthetic practice in California. As Freeman's ideas pertain to design for waterworks architecture, certain self-contradictions—such as the one I present in the first epigraph above—seem to align within an ingrained but apparently highly subtle ambivalence regarding architectural aesthetics for waterworks structures. My focus is guided by Marx, in that it regards pastoral and agrarian ideals as crucial to the development of certain American values of landscape and water, and the architecture that is associated with water technologies. I also draw from Roderick Nash's parallel work on the idea of "wilderness" in American cultural thinking and practices.[638] As key representations of the modernization of pastoral, agrarian, and wilderness ideals in the United States, hydraulic works give visual form to a host of cultural values. As conflict and contradiction play out within and around a large-scale waterworks object, ambivalence results when viewers and commentarists fail to sort out the terms of the conflict. As should now be clear from my preceding discussion, and as I will argue with a specific case in this chapter, hydraulic works require serious and considered aesthetic attention toward the complexity that arises when industrial utility conjoins with architectural design, and when water and landscape combine with these to form a visual statement of a cultural problem. I introduce the term "aesthetic ambivalence" as shorthand for various expressions of ambivalence toward the aesthetic embellishment of engineered waterworks structures: in this case study, dams. Part of the ambivalence I identify seems to result from the association of "elegant" engineering (in Billington's terms) with aesthetic beauty. Any aesthetic form that would

[638] Roderick Nash, *Wilderness and the American Mind* (1967, repr., New Haven, CT: Yale University Press, 1976), 1-83.

seem to have been introduced for the sake of aesthetics alone might give rise to such ambivalence. In the cases I discuss here, however, there is an added underlying dynamic, that is, fear of a threat (or perceived threat) to public safety. In the cases I discuss, it seems that ambivalence arose when critics of elegantly engineered structures implied that these dams were introduced for the sake of aesthetics alone. This implication underlay efforts to deface and/or abandon them, and then replace them with decidedly inelegant structures that were not necessarily as structurally sound. As in these cases, preoccupation with elegance (or inelegance) as a sole critique of a waterworks structure exposes an ambivalence that can denigrate and degrade the cultural value of aesthetic structures.[639]

My discussion to this point has looked primarily to Northern California. In both the San Francisco Bay Area and Los Angeles, discussion of sources for long-distance urban water supply works had begun before the turn of the 20th century—recall Scowden's San Francisco water supply surveys from the 1870s and discussion for a Los Angeles aqueduct as early as the 1880s.[640] The turn of the century brought the thrust of what we today call modern design for long-distance and large-scale water systems in California. The ambiguity I mention above is strikingly evident in the architectural and landscape aesthetics on the 1913 Los Angeles Aqueduct, designed and built by William Mulholland, Chief Engineer for the City of Los Angeles. The LA Aqueduct features almost no artful structure: its principal characteristic is its almost absolute utilitarian quality. From this standpoint, one might call it culturally invisible, especially taking into account the aqueduct route's extremely remote desert terrain, running along the east-facing Sierra Nevada mountain range watershed into a vast desert.[641] The Aqueduct is a

639 Thanks to Richard Shiff for suggestions for defining "aesthetic ambivalence" for this dissertation.
640 "A special study committee headed by city engineer T. R. Scowden" created its report and recommendations on the city's current and future water supply of San Francisco in 1875. See Warren D. Hanson, *San Francisco Water & Power: A History of the Municipal Water Department and Hetch Hetchy System* (1985, repr., San Francisco; City and County of San Francisco, 1987), 16.
641 There are three architectural structures on the system: one modest canal gate house, an outlet tower, and a small powerhouse, all featuring Spanish Revival/California Mission gestures (red tile roofs and arched

study in the action and the material of an engineered hydraulic water supply: unlined dirt or concrete-lined canals and spillways moving an entire watershed; earth, rock, and concrete dams impounding it; rows of rivets on metal pipelines transporting it to the *urbs*.

The Los Angeles Aqueduct diverted the entire supply of the Owens River just above its natural terminus, the land-locked Owens Valley Lake, converting an agricultural, ranching, and wetlands environment to total desert.[642] A clear view of the outline and terrain of the former lakebed is visible from a height above the lake, either from the air or from a high road that climbs a steep ridge adjacent to the Owens lakebed. From the same elevation one must climb in order to see this phenomenon, one can also view the line of the aqueduct canal as it skirts that former lakebed and parallels the highway along it. **[Figure 231]** To follow the route of the Los Angeles Aqueduct is to experience what we might call a "structural sublime," an expansive and awe-inspiring,

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windows on an otherwise plain utilitarian structure). The Alabama Gate House became culturally visible, to an inordinate degree, in the 1920s when residents of the Owens Valley forcibly occupied it, opened the flood gates, and released the entire flow from the aqueduct canal into the desert. In addition, several other desert stretches of the aqueduct pipeline were destroyed by dynamite during this period. Characterized as the "Water Wars" era, aqueduct destruction was organized locally in protest against the desertification of the Owens Lake—now called the Owens Lakebed—as a result of the Los Angeles Aqueduct's complete diversion of water away from the natural rivershed into the canal, and the subsequent annihilation of the region's economy, almost completely dependent upon agriculture and ranching. In 2006, a portion of water from the aqueduct canal was court-ordered to be diverted back into the Owens River, to begin the protracted process of rewatering the Owens Lakebed.

642 The Owens Lake may provide the most extreme and infamous example of watershed diversion from a natural lake to "reclaim" land or a water supply, but this was not an unusual practice. Other inland lakes decimated by diversion/reclamation: Tule Lake, terminus for Kings River; Buena Vista Lake, terminus for the Kern River and eventually "reclaimed" as a lake for California Aqueduct storage/water banking "the great Sutter Basin," "reclaimed" by PG&E during construction of the Spaulding-Drum electric line. "The water in this basin does not recede until sometime in August of each year and at the first big rainstorm is impassable again. This great basin is now being reclaimed, the project embracing about 65,000 acres. Huge dredgers are at work, and in the course of another year that great inland lake known as the Sutter Basin will be a thing of the past…. The reclamation of this basin finally provided for a levee 28 feet high to be thrown up parallel to and at a distance of two miles from the Feather River, it being the intention of confine and force through this section all of the water that was formerly spread out over the entire basin. It should not be aims to here call attention to the wonderful help that the Lake Spaulding dam is going to be to this reclamation project in storing a large quantity of the flood water that would find its way into this basin by means of the Yuba and Feather rivers, the former being a tributary of the latter. The Pacific Gas and Electric company is, therefore, going to serve this district twofold: holding back flood waters and supplying power to operate pumps and will of necessity be located on the drainage canals." See Will T. Jones, "Features of the Drum-Cordelia Tower-Line Construction," *Pacific Service Magazine* 5, no. 9 (February 1914): 309. On "conservation," from PG&E point of view, see Jones, 307-17; e.g. "…may [business interests] have the courage to increase the resources of our State so as to be builders; to adopt the policy of construction and help to abolish the powers of destruction in this our State of California."

almost frightening, masterwork of turn-of-the-century engineering technology, laid out upon the landscape in all of its simplicity the inconceivable scale of its effects on the landscape.[643] Originally, the aqueduct funneled the entire contents of the Owens River into 250 miles of canals, pipelines, tunnels, and reservoirs, bypassing its former natural lake terminus and transporting it by gravity to its terminal cascade at the head of the San Fernando Valley. The famed cascade is in the cradle of a grand freeway interchange today, but the terminus was a remote near-desert landscape when the aqueduct sent the first rush of water down the cascade in 1913. The effect of the Owens Valley's current appearance on a viewer is much more dramatic than other long-distance waterworks systems, primarily due to the sheer desert landscape. More surprising than this is the direct encounter with the vastness of the relatively small part of that landscape that was transformed by the wholesale withdrawal of water from what used to be a vast inland lake. The Owens Valley did not always look this way: the Los Angeles Aqueduct completely transformed it.

One of William Mulholland's first projects after finishing the LA Aqueduct was to design and build the Spring Valley Water Company's Calaveras Dam, which failed. San Francisco's Chief Engineer Michael O'Shaughnessy took over the project, finishing the rebuilt dam in 1925. By this time, more than ten years after the Los Angeles Aqueduct had opened, the LA Department of Water and Power had added water storage and power generation along the aqueduct route, and Mulholland had designed a pair of concrete dams along the aqueduct. The first, the Mulholland Dam in the Hollywood Hills above and in direct view of the Los Angeles basin, opened on Christmas Eve 1924. It created a new storage reservoir and aqueduct terminus in the Hollywood Hills. **[Figures 232, 233, 234, 235]** The second dam, the St. Francis Dam, was located in a remote mountain valley 50 miles outside of the Los Angeles metropolis and was meant not only

643 "Structural sublime" is a term made possible by the combined effects of post-industrial-revolution technology in combination with conceptions of nature, as I have discussed. Three landmark works of academic inquiry about this juncture in modernism represent the trajectory of this idea are: Marx, *Machine in the Garden*; John Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York: Grossman Publishers, 1976); and David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

for water storage but also for hydroelectricity development, with three architecturally noteworthy Art Deco hydropower stations below the dam. **[Figure 236]** The St. Francis dam was modeled on the Mulholland Dam in Hollywood, was completed in 1926, and took two years to fill. In 1928, one week after the reservoir had filled, water under massive pressure infiltrated unstable earth in the abutments and liquefied the foundation, causing the dam to uplift, which broke it apart. **[Figures 236]** A 200-foot-high water wall released into the dam's vacated space at nearly half a million cubic feet per second. The force of the monumental wave displaced broken chunks of dam weighing nearly 10,000 tons 1,000 feet downstream and completely washed away one of the powerhouses. **[Figure 237]** The massive flood increased in size and density as it roiled fifty-seven canyon miles to its natural outlet, a solid moving mass traveling at 5 mph when it reached the Pacific Ocean. The flood killed several hundred people in transit.[644]

I focus on the case of the St. Francis Dam failure in order to examine the cultural values it reveals in the consequences it exerted on dam aesthetics in California. The technical disaster led to a long-standing cultural disaster for dam aesthetics separated from "design," at precisely the moment in the development of structural modernism when the opposite should have occurred. An extreme consequence ensued, with aesthetics, *per se*, being stigmatized as dangerous and subsequently suppressed. Within a year after the St. Francis Dam failed, major new dam safety and oversight regulations became law, a logical consequence that mirrored events following dam failures in the past. Heightened attention focused on specific details regarding engineering, geology, and material physics, regarding site selection and preparation, and regarding elements of safety in the design, engineering, and construction of dams and other monolithic waterworks structures.[645] This increased emphasis on safety exerted an adverse cultural consequence

[644] Official counts placed the number of known dead between 350 and 450, but no official count was accurate, as unknown numbers of itinerant residents lived in the area. Fuller estimates range between 600 and 1,000. Bodies of known missing were reportedly found as far south as Mexico, and as late as 1992.

[645] On the Pacific Gas and Electric Company explication of the issues involved in regulatory law after the St. Francis failure, as well as its effects on dam building, structural planning, and perceptions of safety, see A.H. Markwart, "State Supervision of Design and Construction of Dams in California," *Pacific Service Magazine* 18, no. 3 (January 1931): 67-74.

by curtailing aesthetic design. This was predicated upon a cultural value that came to be articulated among dam engineers, and following their lead, among civic and business decision-makers: that a dam must look massive, heavy, and bulky in order to appear safe. Fears that existing dams would fail resulted in heightened vigilance, and as a result, when no definitive diagnostic list existed for identifying an existing dam about to fail, decision-makers relied on nontechnical criteria to determine the post-trauma response. The tie-breaking default criterion soon rested on a dam's appearance rather than the safety of its engineering.

The primary motivation for altering these two structures was to suppress their exemplary visual character. These cases clearly exhibit the logical extreme of aesthetic ambivalence. It resists, rejects, suppresses, and ultimately increases momentum to destroy originality and inventiveness. To judge from the contemporary record, this proceeded out of a belief that public safety lay in adhering to the psychological safety of a material *status quo*, even when technical evidence proved innovation likely to offer superior advantages. Ambiguous rhetorical argument reversed the value of patent attributes, displaying them as defects. From the point of view of art, decision-makers missed an opportunity to educate dam engineers, civic and corporate leaders, and the public about the merits of artistic innovation. Ambivalent in the face of beauty, these leaders made the opposite choice.

The first situation I will discuss is the disappearance of the concrete arch Mulholland Dam in Hollywood. In 1933, in direct response to the St. Francis Dam failure, the face of the Mulholland Dam was erased when a mountain of dirt and rock fill was pushed up against it. The volume of this massive earthen berm (called a "buttress" to imply it had a structural purpose) was twice the total volume of concrete used to build the dam.[646] **[Figures 238, 239]** The resulting berm was then terraced and planted with trees,

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[646] "Mulholland Dam (Lower Hollywood Reservoir), a Los Angeles Department of Water and Power facility, is located on the south flank of the Santa Monica Mountains in the Hollywood District of the city of Los Angeles. Mulholland Dam, which was completed in 1924, is a concrete gravity-arch structure with a maximum height of 195 feet above bedrock and a crest length of 933 feet. It impounds approximately 4,036 acre-feet of water at the spillway lip elevation of 720.7 feet, USGS datum. During 1933 to 1934, an earth and rock random-fill was placed as a buttress against the downstream side of the dam. The dam crest is 16

so that within a few years, the dam hid behind a growing forest. **[Figure 240]** The second situation concerns the bolstering of the Lake Hodges Dam, near San Diego. In 1936, the Lake Hodges Dam was "rehabilitated" by installing heavily reinforced, dam-height concrete panels between structural buttresses on the visible dam face. **[Figures 241, 242]** This addition, which evidence suggests was structurally redundant, altered the structural design of the dam in an effort to make the dam *appear* more stable. Both structures were elegant and visually striking, in distinct and discrete ways. The Mulholland Dam was a gravity dam in historical revival style, and the Lake Hodges Dam was a multiple arch dam, a work of "structural art." But the St. Francis Dam failure yielded a cultural rigidity toward aesthetics, a position that conflated beauty with weakness and danger. Consequently, the two dams were treated by aesthetic erasure: the Mulholland Dam's visible face buried in otherwise useless tons of earthfill, and the Lake Hodges Dam's structural aesthetic marred by needless, faux-structural tampering.

THE MULHOLLAND DAM IN HOLLYWOODLAND: SIGNS ON THE HILL

The first example of a way in which aesthetic ambivalence led to the destruction of an iconic cultural landmark was the visual erasure of the Mulholland Dam in Hollywood. The terminal water storage facility for the Los Angeles Aqueduct, the Mulholland Dam was the St. Francis Dam's immediate precursor and design model. **[Figures 232, 233, 236]** According to engineer testimony during investigative hearings after the St. Francis Dam failed, plans for the completed Mulholland Dam served as initial templates for the design of the St. Francis, whose construction began in 1924. The two dams were "twins"—concrete gravity-arch dams with a stepped downstream face and slightly battered, near-vertical upstream face. They were similar in size, shape, dimensions and materials. But their sites and locations were very different in character,

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feet wide, with a maximum base width of 164 feet. The total volume of concrete is approximately 173,500 cubic yards and the volume of the downstream buttress fill is approximately 303,000 cubic yards." A dam and buttress cross-section shows the downstream earthfill to be as tall as the dam, except for the neoclassical arcade running below the dam's crest, and twice as deep at the base (approx. 345 feet) as the original dam (165 feet). See Eric B. Kollgaard and Wallace L. Chadwick, eds., *Development of Dam Engineering in the United States* (New York: Pergamon Books, 1988), 91-92.

with the St. Francis Dam in the remote Santa Clarita Creek drainage in the mountains about 50 miles northeast of Los Angeles, and the Mulholland Dam site in the mouth of Weid Canyon in the Hollywood Hills overlooking and in clear sight of the Los Angeles metropolitan basin. **[Figure 243]** Planning for the Mulholland Dam by the LADWP began as early as 1912, with the dam's design finalized by 1920, announcement of its completion on Christmas Eve of 1924, and its public inauguration following in the next year. The St. Francis dam, completed in 1926, filled over a period of two years, reaching capacity to three inches below the crest of the dam in 1928. Like the Mulholland Dam before it, the companion St. Francis Dam had opened to accolades and was even a setting for advertisements whose photographs dramatized the association with the modern waterworks engineering marvel to sell new products**.**

The two dams were of similar design and appearance except that the Hollywood structure featured a neoclassical ornamental program that distinguished it aesthetically from other dams for its grace and overall visual effect. The Mulholland Dam made an overt and elegant aesthetic statement, and its placement showed it off to full effect as a monument of both Eden and Empire, an iconic monument for the urban image of Los Angeles and California. A gleaming white, concrete gravity arch dam with a stepped face, the dam's seat in the triangular notch of Weid Canyon in the Hollywood Hills placed the massive structure within direct view of the entire Los Angeles Valley, from downtown all the way to Santa Monica. Period photographs present a striking image. Comparing period photos over time—of the canyon mouth before the dam, during its construction, and after the dam's completion—one sees clearly the natural fit between dam and landscape: the dam literally fits into the inverted triangle notch on the landscape, the mouth of Weid Canyon. **[Figure 243]**

This dam also fits—or habitates—the bedrock foundations at its site in a way most massive gravity dams do not. It is unusual, from an engineering standpoint, for a dam site to require minimal earth and rock excavation to clear the area down to exposed clean bedrock, permitting a secure bond of concrete with the solid foundation to which the dam structure attaches. More often, dam site preparation requires extreme earth and rock excavation, from scores to hundreds of feet beneath ground level before reaching secure foundation bedrock. The St. Francis Dam's foundation, for example, extended nearly 50 feet under the ground surface. The Hetch Hetchy Aqueduct's O'Shaughnessy Dam for San Francisco is a prime example of the reason a so-called "rock clause" exists in engineering excavation contracts, stipulating that extra costs due to the discovery of subterranean rock cannot be predicted before the start of construction:

> Prior to the appointment of M. M. O'Shaughnessy as City Engineer on September 1, 1912, it had been thought that 30 feet would be ample depth of foundation for the dam across the Tuolumne River. Under his direction wash borings were made, which disclosed the fact that the damsite was at the terminal moraine of an ancient glacier and that the river channel between the cliffs was occupied largely by bolders with thin intervening beds of sand to depths of 90 feet or more below river level. During construction of the dam it became necessary to excavate to 118 feet below river level to the deepest point of the cut-off wall. Bedrock was encountered at 61 foot depth at the downstream toe and 101 feet at the upstream toe.[647]

[647] L. B. Cheminant and M. M. O'Shaughnessy, *The Hetch Hetchy Water Supply and Power Project of San Francisco* (San Francisco: San Francisco Public Utilities Commission, 1931), 3, 18-21. "The dam is of the arched gravity type with radius of 700 feet. Crest elevation is 3,726.5 feet. It is built of cyclopean concrete, which consists of plain concrete with about 8 percent of granite 'plums' of blocks of stone ranging in size from 1 cu. ft. to 5 or 6 cu. yd. embedded in the mass. …To comply with the requirements of the Raker Act, and for other reasons, the dam was built initially to a height of only 226.5 feet above stream bed. Plans for future development, however, require a dam 312 feet above stream bed, or of 430 feet total height. In building the present dam the foundation was built of ample dimentions to support the necessary 85½ feet extra height. The central portion of the dam, which now contains the outlet valves and conduits, was built to full section of the future dam or approximately 80 feet thicker than the other portions. The length of crest of the present dam, 605 feet, will become 900 feet in the future. The foundation has a maximum thickness of 298 feet and contains 77,346 cu. yd. below stream bed. Total concrete, inclusive of parapet wall, is 398,516 cu. yd. …The dam is surmounted by a concrete parapet rail, precast in sections, of most pleasing design, which gives it a very beautiful appearance" (19-21). Pertinent on this topic is current work at Calaveras Reservoir, originally built by William Bourn in 1901, and now part of the Hetch Hetchy system. The first dam there was designed by LA Aqueduct engineer William Mulholland; the hydraulic fill earthen dam failed and was replaced. "The existing earth fill dam is 88 years old and is located within 1,500 feet of the Calaveras Earthquake Fault. In 2001, [the SFPUC] lowered water levels in the reservoir to less than 40 percent of normal operating capacity in response to seismic concerns.… Construction began in August 2011 to build a new earth and rock fill dam adjacent to the existing dam.… In June 2012, [engineers] discovered unexpected geologic features during excavation of the left abutment area also known as 'Observation Hill'. These uncovered geologic features were not visible at the ground surface during the extensive geotechnical investigation work performed during the planning and design phases of the project. The findings have resulted in over 3 million cubic yards of additional material that needs to be moved in order to ensure the long-term stability of the slope during the performance life of the dam. Due to the additional time needed to excavate these materials we anticipate a 25-month delay to the original

The handsome 1938 Parker Dam on the Colorado River impounds Lake Havasu, dammed as the source for the Metropolitan Water District of Southern California's 1940 Colorado River Aqueduct. Parker Dam stands upon the world's deepest foundations, more than 235 feet of subterranean structure extending to its solid foundation beneath the visible 85-foot-high dam.[648] However, in the case of the Mulholland Dam, essentially no landscape change was required: it fit quite naturally into its slot, and therefore in shape and relative placement appears to be part of the landscape rather than an addendum rising up from and above it.[649] The shape of the dam conforms to the natural notch of the mouth of Weid

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project schedule which would put the completion of construction activity at the end of 2017." This has resulted in "unilateral Change Orders" in construction that will cost the project several hundreds of millions of dollars than the approved bids. See "Calaveras Dam Replacement (WSIP)," San Francisco Public Utilities Commission, accessed March 7, 2015, http://sfwater.org/bids/projectDetail.aspx?prj_id=141. For more detail on the nature, extent, and consequences of the ancient landslides discovered in geological testing during construction, refer to the "WSIP Regional Projects Quarterly Report" for the first three quarters of fiscal year 2012-13 (Q1/FY12-13; Q2/FY12-13; and Q3/FY12-13), in the cover letter preceding each report, find "Calaveras Dam Replacement" under "Major Construction Issues and Challenges." Regional report links online at "Quarterly Reports," San Francisco Public Utilities Commission, accessed March 7, 2015, http://sfwater.org/index.aspx?page=307.

648 Kollgaard and Chadwick, eds., *Development of Dam Engineering*, 428. A similar situation pertains to a Northern California dam in the high Sierra Nevada Mountains, the Lake Spaulding Dam, which was attached directly to the exposed granite foundation, with apparently no surface excavation required to reach this solid foundation. An article written about the site when the dam was being planned explains: "It is interesting how perfectly nature has made preparations for this dam and how many of the usual problems confronting the dam builder are already solved. Most important of all are the foundations, which are absolutely flawless. The granite bluffs rising just high enough on either side have been cleaned of all loose material by the glaciers on their advance towards the sea and have also left ideal quarries, bare of any earth, ready for use in the gorge below. Even the conformation of the canon at the point chosen is such that the arched dam will fit like a plug in a watermelon with the pressure on the outside." See R.G. Clifford, "Construction Methods at Spaulding Dam," *Pacific Gas and Electric Magazine* 4, no. 4 (September 1912): 117-21.

649 In fact, this was also advantageous to the security of the dam, that in being able to build the dam along the natural rock surface and not to cut into it, the dam had a surface of "lateral and downward depressions and irregularities sufficient to form an adequate key between the concrete and rock." In other words, the dam had more varied surface area to cling to, making it essentially impossible to move. A gravity dam's stability relies solely on the ability of the concrete mass "to withstand hydrostatic effects by its weight alone," that is, the dam's mass and therefore its weight must be greater than the weight and downward pressure of gravity and the weight of the reservoir's water mass pushing behind it. When a dam is built on a prepared surface rather than adhered to the natural contours of the rock, the risk of "shear failure" is heightened, that is, the likelihood that the entire dam might slide. Dams are designed to mitigate water seepage under the dam, between the concrete and its foundation, since seeping water will push *upward* on the dam from beneath it, causing a phenomenon known as *uplift.* This pushes the dam up, making space for more water to move under and around the dam, and the structure fails. The St. Francis Dam failed in part because of uplift, due to insufficient drainage within and beneath the dam. This situation was complicated

Canyon, which was prominent on the landscape before the dam was built. At a distance from the valley floor, it presents a pleasing instance, unusual for a massive dam, of the pastoral ideal, in which the landscape surrounds and envelops the monumental structure, so that the landscape scales it down to a size that a viewer can apprehend visually within its own context. Standing next to the dam, one yields to the sublime. Here, landscape and architecture conjoin in a visual representation of intertwined California myths of Eden and Empire. One embraces the pastoral ideal in the form of pristine nature; the other lauds technological and civic advancement in the form of urban architectural monuments.

The shape, design, placement, and vista of the dam formed a part of the identifiable urban image of the Los Angeles Hills above Hollywood. By 1924 when the dam opened, Hollywood was the center of the burgeoning film industry, the ten-year-old UCLA campus had joined the University of California as its second campus, and the entire area of the Hollywood Hills around the dam was under development as "HOLLYWOODLAND," the original wording on the famed hillside marquis. **[Figure 244]** At that time, the dam was as iconic a place marker as the HOLLYWOODLAND sign itself. The Mulholland Dam's program of Art Deco neoclassicism enhanced the

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by the fact that when unmitigated seepage of water between the dam and its foundation did occur, the water forced into the foundation and surrounding earth, and liquefied a type of rock in the foundation that was prone to change its state when wet. This geological condition was unknown until the inquest and investigation after the dam and its surrounding rock support failed catastrophically. See Kollgaard and Chadwick, eds., *Development of Dam Engineering*, 93-95. In 1913, R. G. Clifford, Construction Engineer for Pacific Gas & Electric Company during construction of the Lake Spaulding Dam, explains uplift in layman's terms: "If water can get under the structure it acts as a wedge tending to tip it over, and in several dams constructed the element of safety required a base thickness equal to the height." See R.G. Clifford, "The Common Sense Engineering Principles of the Spaulding Development," *Pacific Service Magazine* 5, no. 7 (December 1913): 223. In the same article Clifford describes the perfect conditions for a dam foundation as he describes the foundations of the Lake Spaulding Dam: "[Notice] the beneficent way in which Providence has provided for [Lake Spaulding Dam]. Glaciers have augmented the centuries of work done by the South Yuba River, and the marks can still be seen where all loose, overlying material was scraped clean until an absolutely solid base, free from seams of fissures of any kind, was left…. [T]he side walls converge on each side in such a manner that the pressure of the water in the reservoir tends to wedge an arch dam more tightly into the sides and the whole arch load bears at right angles to the granite walls. It will be notices, however, from the general view of the dam shown, that even at the present height of about 225 feet the canyon widens out and for the 305-foot height the top length is such that the arch must be fairly flat, the shortest radius practicable being about 400 feet. Since the cost depends on the thickness and the thickness depends on the radius of curvature, a variable radius modification of the arch type, developed within recent years by the F. G. Baum Co., was chosen as the logical solution of the element of cost, while the safety of the structure was also increased to a considerable extent." See Clifford, 223-27.

strength of the dam's visual and cultural impact, with its crowing ornamental feature, an embedded arcade of about two dozen arches in deep relief running the entire length of the dam crest. **[Figure 239, 244]** Arches with exaggerated voissoirs spring from squared, rusticated columns so that the arcade crowned the stepped dam face like a gallery arcade on an amphitheater.[650] The run of arches and the balustrade accentuated the dam's stepped curvature, as did the neoclassical balustrade lining the roadway along the crest curve. In the spandrels between the arches ran a series of sculptural bear heads—the Golden Bear is California's state mascot. The repeated icon, one between each arch, infused the structure's iconography with regional character. This theatrical touch added humor and intimacy to a sophisticated aesthetic design that brought the dam cleanly in line with Art Deco of its time, and with the local urban image of Hollywood as a film center. Yet, the insistence on traditional neoclassical design staked a clear claim to the Beaux-Arts and City Beautiful legacies. The roadway riding atop the crest was lined by a neoclassical balustrade; from a distance that balustrade rode above the arcade like a low

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650 The dam face steps were of 5 feet each. Such large steps mediate the structure's large scale, serving to make the dam appear less massive, to give it surface depth, allowing the eye to travel along and to rest upon the dam's surface, ultimately it "stepped" the gaze up to the arcade, the crowning ornamental program. This design was not unique to the Los Angeles system's dams. The Croton Dam's famously spillway was stepped and curved outward, giving it a strikingly artful appearance. The Big Creek #1 Dam, on Henry Huntington's hydroelectricity system, had a stepped face, as did the Hetch Hetchy Dam's first phase, which was completed in the same year as the Mulholland Dam. Engineers and waterworks architects as I have discussed elsewhere, were clearly aware of major waterworks developments, and so this was not an unusual form for the face of a dam to take. In December 1912, a report appears in Pacific Gas and Electric Company's *Pacific Service Magazine* that the company's Chief Engineer of the Hydro-Electric Department, F.G. Baum, accompanied a group who "recently visited the construction work in progress at the Big Creek project in the San Joaquin Valley and at the Los Angeles aqueduct. The first-named is located about 75 miles from Fresno and is of particular interest to the hydro-electric industry from the fact that when completed it will be the biggest high-voltage transmission system in the world, sending electric energy at a distance of 250 miles into Los Angeles at a voltage of 150,000. …They passed two days there, were most hospitably entertained and much impressed by what they saw. Three active days were passed at the Los Angeles aqueduct under the chaperonage of Mr. J.B. Lippincott, Assistant Chief Engineer. Mr. Baum speaks in enthusiastic terms of this wonderful piece of engineering. He says: 'It is the most marvelous piece of water conduit I have ever seen, travelling 237 miles over mountain ranges, through canyons and across deserts before delivering its water into the big reservoir near Los Angeles City.'" See "Items of General Interest," *Pacific Service Magazine* 4, no. 7 (December 1912): 254-55. Another example of evidence of general interest in works companies keeping abreast of one another's projects is that in 1914 "Mr. S. J. Lisberger, engineer of the [PG&E] electric distribution department, has given four maps covering the present and proposed water supplies of the Spring Valley Water Company and the city of San Francisco" to the gas and electric company library. See "James Hugh Wise Library," *Pacific Service Magazine* 5, no. 10 (March 1914): 351.

entablature, finishing the composition. **[Figure 233]** Graceful scrolls on the balustrades at each end of the crest rail harmonized with the sweep of the dam's curved-arch form.

The opposite, upstream face of the dam, visible today, features a deep, arcaded corbel table and provides a base of structural support for the crest roadway and balustrade. Visually, it appears as a parapet running the full length of the upstream face of the dam. A continuous arcade on the upstream corbel table serves in part to emphasize the arcade program on the downstream face. In conjunction with a single reservoir intake tower figured as a turret, this element projects Gothic Revival style rather than the white neoclassical downstream face. This mirrors aesthetic features from earlier massive American stone block dam traditions, such as those seen in New York's 1906 New Croton Dam and Arizona's 1911 Roosevelt Dam. These associations provide a bold visual impression of stability and permanence on the reservoir side, where its mass complements that of the water's extent. From that upstream vantage point, the landscape takes in a full view of the urban valley hovering in aerial perspective beyond it. With this, the dam's function, to hold that liquid mass in place, is clear.[651]

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651 In 1912, when the Spaulding Dam on northern California's Yuba River was announced by Pacific Gas and Electric Company, its preliminary design referenced both of these landmark dams: "…this splendid reservoir site…will be formed by the construction of a huge monolith of cyclopean concrete. The dam will be of a gravity type section, arched upstream for an additional factor of safety and a more substantial type of construction, thus insuring stability and absolute security against any possible failure. The dam will be 300 feet in height and will be built somewhat similar to the New Croton and Croton Falls dams of the New York Water Supply, and of cross section, approximating the Roosevelt Dam, which impounds such a vast quantity of water for the Salt River project, a part of the reclamation work of the United States Government." See James H. Wise, "The Newest and Greatest 'Pacific Service' Undertaking; the South Yuba and Bear River Hydro-Electric Development," *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 88. From a point of view of cultural values related to the natural sites for waterworks development are comments by Hermann Schussler, long-time Chief Engineer for the Spring Valley Water Company, when he was asked to pen an article about the Spaulding Dam, in the same issue in which the dam project was announced. Schussler comments: "The ideal location of the proposed dam in the precipitous narrow gorge of the Yuba, with its practically homogeneous rock bluffs on both sides of the river,fully excuses and justifies my above expressed desire of increasing the height of the dam above the contemplated height of 300 feet. When, about seven years ago, I stood—like last week—on the rock bluff, the main body of which will form the southerly abutment of the proposed arch-shaped dam, I could not help feeling and expressing delight at seeing one of the most admirably formed dam sites, that I had ever beheld—admirable both from a topographical as well as a geological point of view." See Hermann Schussler, "Admirable From Every Viewpoint; Would Bear Still Greater Development," *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 85. On the same point, of the ways in which nature is interpreted as providing "perfect" construction sites for the alteration of nature, note from the same issue the article "Nature Anticipates Man's Handiwork": "It's a wondrous, marvelous proposition. One doesn't need to be an engineer to see that.

As a concrete gravity arch dam, the Mulholland Dam's strength does rely primarily on mass and weight. Being part of "the massive tradition" coming out of the masonry age—what John R. Freeman in looser terms called "a big massive lump of a dam"—it does not qualify as "structural art" in Billington's terms, or as structural/tectonic architecture as I have discussed it in this study.[652] The Hollywood

Dame Nature has planned it, has furnished the groundwork; man will do the rest. Imagine a great bowl of rock scooped out of the mountain tops, with a narrow gorge at either end through which the snow-waters flow unceasingly. Picture to yourself at the lower end great buttresses of rock rising from either bank of the river to a height of several hundred feet as though jealously guarding the outlet of the stream. Doesn't the idea of constructing a dam there suggest itself at once? …Dame Nature has been more than generous, and …what she has given with so lavish a hand, man will accept and make the most of according to his powers." The understatement that creates the caption under a panoramic view of the massive granite-bowl dam site reads: "View of the country surrounding Lake Spaulding, near the summit of the Site. There will be some changes in the landscape when the new dam is built." See *Pacific Gas and Electric Magazine* 4, no. 3 (August 1912): 100-01. Of interest in this vein is a fascinating frontispiece, a photograph of the head office high rise of the Pacific Gas and Electric Company in 1912, of a 7-storey-high mural depicting a map of California illustrating and labeling the company's geographical service area. The caption reads: "'Pacific Service' to the people of San Francisco; the company's head office makes an excellent advertising medium." See *Pacific Gas and Electric Magazine* 4, no. 4 (September 1912): 116 (frontispiece).

652 John R. Freeman to Arhur P. Davis, September 26, 1912, Box 63, Freeman Papers, MIT, quoted in Donald C. Jackson, *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* (1995, repr., Lawrence, KS: University Press of Kansas, 2005), 123. I limit my argument to points related to aesthetics, but an engineering-focused argument also supports my claims. The St. Francis Dam failure was, as I have mentioned, a dam-design failure from an engineering point of view, at the foundation level. The foundation at the Mulholland Dam is completely different from that of the St. Francis Dam, and the Hollywood structure is extremely stable. This was known to have been so in 1928. A concise description of a gravity-style dam was penned by R.G. Clifford, the division engineer on the Spaulding Dam, in 1912, during the same period Freeman made his comment: "The type of dam to be constructed is what is known as the 'Gravity Type', which depends entirely on its own weight to resist the overturning effect of the water, and, to give added stability to the structure, the dam is built with an arched plan, the convex side being, of course, upstream so that the effect of the water pressure is partially transmitted to the granite bluffs against which the two ends of the dam rest." Of interest to both the points of nature's accommodations to human engineering and of the solidity of the Mulholland Dam's underlying bedrock foundations, which are similar to those of the Lake Spaulding Dam, I quote Clifford further: "It is interesting how perfectly nature has made preparations for this dam and how many of the usual problems confronting the dam builder are already solved. Most important of all are the foundations, which are absolutely flawless. The granite bluffs rising just high enough on either side have been cleaned of all loose material by the glaciers on their advance towards the sea and have also left ideal quarries, bare of any earth, ready for use in the gorge below. Even the conformation of the canon at the point chosen is such that the arched dam will fit like a plug in a watermelon with the pressure on the outside." In a 1913 issue of the company magazine, Clifford writes cogently about the topic of foundation principles, focusing from the point of view of differences between gravity and arch dams; Clifford's considered comments would seem to offer a counter to Freeman's reckless remarks. Clifford explains his purpose: "to enumerate a few of the practical conditions to be met with in the harnessing of the most useful of nature's elements—water—and to show why a dam is more than a giant mass of concrete plugging up the narrowest part of a gorge, with a hole at the bottom out of which the stored water runs…. [I]t is evident that although a certain type and design of dam may be the best in one case it may prove more expensive and be even less safe in another

case where conditions are different…. A review of the successful dams of the world shows a great variety of types, all supposedly built on the same basic principles. The variation, however, is chiefly among the lower dams under 150 feet, for above that height there are so far but two types, that depending upon its arch action and that based on its sheer weight or gravity action, both types being constructed of concrete. Now, you can put a load of some 140 tons on a square foot of good concrete before it is crushed, but it will resist only one-tenth of this strain applied as tension under the best conditions, and as hair-cracks frequently develop during drying out it is against good practice to put any dependence whatsoever on the concrete's tensile strength, unless the expense is nearly doubled by the addition of steel. It can be seen, then, that the gravity type is an expensive proposition, for the triangular-shaped block of concrete constituting a section of the dam must have a base varying from 75 to 100 percent of its height, depending on whether or not the foundations are porous. If water can get under the structure it acts as a wedge tending to tip it over, and in several dams constructed the element of safety required a base thickness equal to the height. In order to be justified in the choice of an arch dam there are two conditions of the site essential, namely, excellent foundations and narrowness of canyon…. [Notice] the beneficent way in which Providence has provided for [Lake Spaulding Dam]. Glaciers have augmented the centuries of work done by the South Yuba River, and the marks can still be seen where all loose, overlying material was scraped clean until an absolutely solid base, free from seams of fissures of any kind, was left…. [T]he side walls converge on each side in such a manner that the pressure of the water in the reservoir tends to wedge an arch dam more tightly into the sides and the whole arch load bears at right angles to the granite walls. It will be noticed, however, from the general view of the dam shown, that even at the present height of about 225 feet the canyon widens out and for the 305-foot height the top length is such that the arch must be fairly flat, the shortest radius practicable being about 400 feet. Since the cost depends on the thickness and the thickness depends on the radius of curvature, a variable radius modification of the arch type, developed within recent years by the F. G. Baum Co., was chosen as the logical solution of the element of cost, while the safety of the structure was also increased to a considerable extent." See Clifford, "Common Sense Engineering Principles," 223-27.

Clifford makes a revealing comment about ways in which nature was seen to be in the service of human industry in the context of waterworks development, and the resultant changes in landscapes that resulted. "The third important gift of nature is the three or four million feet of timber growing on the lands adjacent to the reservoir, all of which timber is rapidly being converted into lumber for buildings, bunkers and railroad ties, as well as for concrete forms to be used in the canal, tunnel and dam. Although much of the best timber has already been cut and shipped out to the Pacific Coast markets, there is ample left for construction purposes, and we have the benefit of several miles of track as well as a complete mill with a capacity of 30,000 F.B.M. per day, logging engines, railroad locomotive and cars." He also mentions that "Besides the new timber being cut, hundreds of old logs, left behind when John Spaulding created the present lake in 1892, have been rescued and cut up into timber, and it is hardly conceivable that a great deal of the sound timber that is now in use in the trestles and buildings comes from the logs that have been floating around like so many derelicts for twenty years." See Clifford, "Construction Methods," 117-21.

Lake Spaulding is the head storage reservoir on the historic Sierra Nevada Mountain watershed storage and conveyance system that evolved from the 1840s at the heart of the California gold and placer mining region. "Lake Spaulding forms the major storage unit of the system. …[I]t used to regulate the flow of an equal quantity of water stored in a chain of lakes located at elevations ranging from 5000 to 7750 feet above sea level within the 134 miles of catchment area. These lakes, like many of the company's ditches, had their origin in the early days of California's history, at which time they were constructed and operated by companies engaged in furnishing water for placer mining uses. While some of these lakes have been reconstructed and enlarged, the majority still exist essentially in their original form, each contributing its quota to the 150,000 acre-feet total storage capacity of the system." See H. W. Haberkorn, "Enlarging Water Conduits on Our South Yuba-Bear River System," *Pacific Service Magazine* 18, no. 5 (July 1931): 150-155. In the professional association literature of the electrical community describes the Lake Spaulding-Drum hydropower system at length, preceded by a note from "The Editors": "The subject presented covers the largest hydroelectric development on a single watershed on the Pacific Coast. It is dam's aesthetic character—that is, during the period when it was visible—derived from earlier historical revival trends, where aesthetic elements are external and ornamental, not structural. That said, the Beaux-Arts-inflected Art Deco ornamental program on the Mulholland Dam was sophisticated in its formal elements, was appropriate to the scale and mass of the curved concrete gravity dam and was remarkable in its relationship to its natural site. Taking into proper consideration the dam's massive scale, bulk, and weight as a concrete gravity dam, it is noteworthy that the design also took advantage of the dam's nestled position in the notched mouth of Weid Canyon. **[Figure 234, 243]** It activated the pastoral, the beautiful, and the sublime at once. The bright white of the concrete material and its various and varying shapes—triangular, pyramidal, curved—were all included in the surface design (the only thing possible to "design" in a solid, monolithic structure is its surface; its mass *is* its structure), whose formal elements worked to the structure's visual advantage. **[Figure 232, 233, 234, 244]** The design directed the eye to move dynamically along the composition, at all angles and in all positions, and physical movement on and around the dam and the site, where accessible, allowed full engagement with the formal elements. This "lightened" the structure visually with formal elements—line, relief, and shadow—and moved the eye upward along the

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particularly interesting from the fact that the entire run-off of this watershed is conserved and used for power seven times, having an aggregate vertical fall of five thousand feet. After leaving the last power plant, the water is used for irrigating over seventy thousand acres of deciduous fruit lands. It is probably the most complete exploitation of a watershed to be found." Van Norden begins his article with a characterization of watershed topography in the Western United States: "There is probably at no place in the world, an example of the total economic use of a watershed more completely exemplified than in the new project of the Pacific Gas & Electric Company, known as the Lake Spaulding-Drum development. A characteristic of California water powers is the high mountain storage of the winter flood waters, to be used during about one-third of the year when the natural runoff becomes a minimum. A second feature found in Western plants is the rapid fall of the rivers, which makes possible a short canal to supply the power plant, together with a high head, as a result of the topography of the country. Both of these features predominates to a marked degree in the South Yuba development. The new Lake Spaulding development embraces the entire watershed of the South Fork of the Yuba River, above Lake Spaulding; it is the final and complete utilization of this watershed." See Rudolph W. Van Norden, "Lake Spaulding-Drum Power Development," *Journal of Electricity Power and Gas* 31, no. 24 (December 13, 1913): 525-41, See photograph of the nearly-completed dam on both faces, 531, and a photograph of the Drum powerhouse by Frickstad, 536. For good photographs of the Spaulding-Drum Canal under construction and in relation to the Spaulding Dam, and for a comparison of the cost and construction of a canal as against a railroad grade, see O. W. Peterson, "Construction Features of the Drum Canal," *Pacific Service Magazine* 5, no. 10 (March 1914): 333-37.

inverted pyramidal shape of the stepped face, activating and engaging vertical, horizontal, and curved planes simultaneously. The treatment created a dynamic play among large-scale elements, permitted "human-sized" narrative elements in the running arcade, the repeated bear head sculpture and the low, graceful balustrade. This fostered an intimate experience with a massive structure.

As an overt urban centerpiece, then, Mulholland Dam was unique. The large scale of the embedded arcade on the dam's main facade, the graceful repetition of the arches along the wide dam curvature, and the addition of the bear head centered on each of the spandrels distinguished the Mulholland Dam when it opened in 1924. It was a self-conscious aesthetic waterworks statement on the Los Angeles skyline, and a rare instance of a dam as a visual element of downtown and a prominent feature of the city's urban image. The cultural value of the Mulholland Dam's urban placement is, perhaps, comparable to historical urban-center works such as Philadelphia's 1804 Center Square Water Works or Manhattan's 1842 Croton Reservoir, whose architecture celebrated a defining role in turban image for both cities. The Mulholland Dam, the most prominent monumental object on the urban landscape, grounded an image of industry and promise for 1920s Los Angeles. A successful and original symbol for California as a modern technological metropolis nested in a sublime landscape, it fell to aesthetic erasure.[653]

FORM, FUNCTION, AND STRUCTURAL AESTHETICS: SHIFTING FOUNDATIONS FOR URBAN MODERNISM'S 20TH-CENTURY WATERWORKS

Sullivan's renowned late-19th-century admonition that "form ever follow function" became a predominating architectural value and cornerstone of 20th century modernism, but the idea was hardly new. Discussion of aesthetic interrelationships between form and function had been developing for decades in the United States before the Chicago architect coined the phrase that stuck. In 1876, for example, engineer Alfred Boller made the case in his *Practical Treatise on the Construction of Highway Bridges*

[653] I am currently working to develop this point further, most specifically on the role the dam's neoclassical form and its "natural placement" in the landscape played in the urban imagination image of Angelinos and tourists, and the role the dam's "disappearance" after the 1934 earth buttressing in the aftermath of the St. Francis failure played in transforming the urban image.

for the Use of Town Committees that structural function should *determine* aesthetic form. In a section titled "The Architecture of Bridge-Building," he argued in favor of an architectural aesthetic, "the art of producing pleasing effects."[654] His comments apply in this discussion of period attitudes toward form, as it applies to waterworks architecture, and he extrapolated from his tenets of bridge design to reflect on aesthetics in utilitarian public works design in general. Boller specifically addressed conflicts in period thinking between the sometimes discrete aims of architecture and engineering, pointing out differences between "art" and "utility." He believed that art and utility should go hand in hand when designing public works structures. He insisted that new technological materials should be used, and seen, as harboring inherent aesthetic potential in the nature of their structural functions. That is, structural designers must acknowledge and activate the "natural" aesthetics of structural materials as they are put to use for utilitarian functions. Aesthetic effects are inherent in building structure, and those effects should instruct ornament. When these gestate together, interior structure and exterior form meet as equals. This complementarity defines structural beauty: internal and external parts in sum express balance, integration, coherence, elegance, and interest, *to a surprising or inspiring degree*.

In the case of bridges, thought Boller, engineering defines ways in which a crossing addresses its structural purposes: it spans, it stands, it bears and it transfers load. Aesthetic effects proper to structural function conform to and reveal, even dramatize, the structure's purpose through its materials. In the case of waterworks, proper structures reveal not only the building's structural functions. Their form should also articulate procedural function—their material capacity for movement, holding, transfer of water, as well as its change of state.

Billington's (and Sullivan's) structural approach overthrows the cultural justification for historical revival styles: it disallows disguise. Boller is clear: where the architectural aesthetic and the engineering design have been regarded as separate aspects

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654 Alfred Pancoast Boller, *Practical Treatise on the Construction of Highway Bridges for the Use of Town Committees* (New York: John Wiley & Sons, 1876), 82.

of a works structure, the aesthetic face (or architectural design) being of greater overall cultural value than the structural skeleton (or engineering design). In this case, the two should be inter-identified, with structural engineering guiding architecture. But now these should come under the heading of "architecture" in general, redefining and expanding the term for public works:

> In the true sense of the term architecture, unadorned construction is as much a part of architecture as the more popular idea that [architecture] simply covers the art of producing pleasing effects. A man cannot be a good architect before he is a good constructionist, no matter how dexterous he may be in devising graceful forms, or artistic in his selection of colors. To an educated person, correct construction always produces a sense of satisfaction, for in it is involved the idea of proportion and appropriateness for the service to which it is put. Concealment of constructive forms, by mouldings, panels, or other devices, to suggest something else than what the construction really is, is vulgar as well as dishonest. To construct a girder bridge, and give it the *appearance* of being an arch, illustrates what is here meant by falsity in architecture, specimens of which more than one of our public parks contain. Possibly to bridges more than to any other class of public works does the Ruskinian axiom (which cannot be repeated too often) apply: 'Decorate the construction, but not construct decoration.' Such a principle conscientiously kept in view cannot but result in else than good work. Its violation results in a senseless fraud, demoralizing to the taste of the community where such violations can occur. Public works, in a certain sense, play a part in the education of a people, and their authors and builders have consequently, to that extent, a responsibility in addition to the mere utilitarian idea of endurance and safety.[655]

Boller illustrated his critical judgment with a comparison of two Philadelphia bridges over the Schuylkill River, the Fairmount Bridge and the Girard Avenue Bridge**,** both new at the time Boller was writing. He wrote within five years of Frederick Graff's completion of the Fairmount Water Works in 1872. **[Figures 120, 121]** As I have discussed, the Fairmount Bridge was in view of the waterworks, and the two were often depicted together, showing that the Fairmount riverside area was apprehended as a single cultural site. In fact, the entire site, on both sides of the river, was planned for development as Philadelphia's 1876 Centennial Exposition grounds.

[655] Boller, *Practical Treatise*, 82-83.

In the 1876 article, Boller attacked the Fairmount Bridge as "architectural fraud," while praising the downstream Girard Avenue Bridge as exemplary, according to his standard for the structural elements of architectural support to be inseparable from its aesthetics: its "pleasing effects." His objection to the Fairmount Bridge was that it applied an ornamental program consisting of a false arcade to the exterior surface of the lower span of the double-deck bridge, making it appear from a distance that the bridge's roadway runs supported on arches, when in fact it is a suspension bridge. He was further incensed, for example, that the faux-arches are not architecturally correct and therefore do not even represent arches, since they "spring from nowhere." He observed: "…A thirty minutes' walk will carry a spectator between…two extremes of very good and very bad bridge architecture. …*[A]rchitecturally,* [the Girard Avenue Bridge] is certainly one of the finest, if not the very finest, bridges in America; while in the same sense the Fairmount Bridge, is the worst, and probably the worst in the world."[656]

Boller's primary set of criteria for judging a bridge to be architecturally, as opposed to structurally, sound show a synthetic move in architectural theory and practice, a synthesis that applies itself soundly to public works, when public works are structures engineered to serve material needs for the greater public good. The public works aesthetic, then, creates a building whose architecture—structure *and* ornamental style, inner workings *and* public face—should contain and express a coherent and cohesive statement of its material utility and its beauty. In conjunction with the architecture, the material utility becomes a cultural utility as well, transforming interpretations of the building's appearance.

As a guide for municipalities groping with the design of utilitarian works buildings in expanding American urban centers, Boller's work informed building committees in the 1870s regarding differences in "constructionism" and "architecture." Recall that at this time, in the early-to-mid 1870s, Frededrick Graff was completing the Fairmount Water Works, and Theodore Scowden, Chief Engineer of several city waterworks, including Louisville, was consulting with San Francisco on the future of its

[656] Boller, *Practical Treatise*, 84.

water supply and reporting on a second phase of American waterworks development for major cities. Twenty years later, when Sullivan uttered an architect's updated version of engineer Boller's thesis, he challenged, from a star-studded stage, the architectural community at large in what today we would call a global forum. In doing so, he admonished the field of architects and engineers to define the modern American urban image in tandem.

By 1902, a critical article examining the idea of a coexistence of function and form, with function taking a lead role in design, appeared in a mass market magazine in New York City, evincing the debate's circulation in public discourse, beyond municipal board rooms and architectural firms. Frank S. Arnett's "The Doorways of New York: One of the Best Features of New York Architecture" appeared in the popular *Munsey's Magazine*. East-coast publisher Frank Munsey's publication was one of the nation's first mass-produced popular magazines, with a circulation of 300,000 at the turn of the century. Arnett appealed to readers to look closely at small utilitarian details—doorway hardware features—to find examples exhibiting a standard of fine aesthetic architectural practice.

> [I]n general, our doorways are as miniatures in architectural art. And, too, while seeking and not finding magnificence, you may be shocked at noting how our architecture has long been a matter of changing fashion—hence the reincarnation of architectures that should have been allowed to remain forgotten, the utter lack of unity, the continuous lines of quarreling styles and heights. Numerous, also, are individual incongruities and inharmonious proportions. Despite all this, seldom will you fail to find one perfect detail. Almost always a portcullis, a gateway, or a door will amend the hideousness of the rest. [657]

Arnett took on the task of educating the public in fine aesthetic structural details, following from a 19th-century Arts and Crafts ideal that values workmanship and materials in handcrafted architectural details like hinges, grates, and doorknobs—or apparently handcrafted, perhaps rusticated, or copied in the style of Arts and Crafts objects. He referred to these elements as works of art, created by artists—a

[657] Frank S. Arnett. "The Doorways of New York: One of the Best Features of New York Architecture—The Artistic Excellence and Great Cost of the Entrances of Many Metropolitan Residences, Club Houses, and Business Buildings," *Munsey's Magazine* 28 (October 1902), 101.

characterization he implied also applies to architects: "It is not surprising that living artists of repute do not disdain to design a hinge or grille, or that workmen of high ideals should now busy themselves with doors in bronze and wrought iron."[658]

> [T]he entrances we already have may be looked upon as entrances to a future of more wide spread worth in our civic architecture. We Americans are so accustomed to venerate the architecture of Italy, believing it all to be that of the Italy of romance, that it comes with something of a shock when Ruskin reminds us that if Dandolo and Foscari "could be summoned from their tombs, and stood each on the deck of his galley at the entrance of the Grand Canal, … the Doges would not know in what spot of the world they stood, would literally not recognize one stone of the great city." ...For in these doors and doorways, in these grilles and gates and fences, is there not promise of the time when the American architect will have realized that his is indeed "the art which so disposes and adorns the edifices raised by man for whatsoever uses, that the sight of them contributes to his mental health, power, and pleasure"?[659]

Arnett's reliance on Ruskin from memory and without citation, is another reminder that these values in early 20th-century American modernism were preceded and informed in part by the 19th century British Arts and Crafts Movement. Inspired by Gothic Revivalism, Arts and Crafts approaches give equal credit for the beauty of any construction to worker, workmanship, and materials, and the supreme example of Gothic architecture as a model for these ideals. Arnett's reference to Ruskin's famous essays on architecture underscore his influence, and that of the Arts and Crafts movement, on debates regarding the relationships between utility and beauty in architecture and in *structure,* as American modernism developed in the late 19th and early 20th centuries.

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658 Arnett, "Doorways of New York," 100.

659 Arnett, "Doorways of New York," 103. Arnett quotes but does not cite John Ruskin's passages from his well-known works on architecture. The first quoted passage opens Ruskin's *The Stones of Venice, Volume the Second: The Sea Stories* (London: Smith, Elder, and Co., 1853), in which Ruskin ruminates on time and history as he observes architecture in Venice and contemplates the city's architectural decline over the centuries in light of Romanticism and cultural values of his own day. *The Stones of Venice* elaborated on ideas from Ruskin's *The Seven Lamps of Architecture* (London: Smith, Elder, and Co., 1849), the source for Arnett's second quoted portion in this passage. In it, Ruskin defines architecture as art, as opposed to building: "Let us … at once confine the name to that art which, taking up and admitting, as conditions of its working, the necessities and common uses of the building, impresses on its form certain characters venerable or beautiful, but otherwise unnecessary. …Architecture concerns itself only with those characters of an edifice which are above and beyond its common use." Architecture, which is art, adds "useless" artistic elements to a building; and art is a form of cultural sacrifice.

First espoused in the U.S. in the mid-19th century by Andrew Jackson Downing's publications on suburban house and garden design, and later developed on a larger scale by Frederick Law Olmstead in his urban park and parkway designs, these ideas resurfaced in California, informing Greene and Greene's Arts and Crafts bungalow aesthetic and Frank Lloyd Wright's Usonian ethic, to name two prominent examples.

Arnett's sub-section titled "The Door—And What Lies Within," makes clear that by 1902, Ruskin's ideas had been absorbed into popular culture in part, but the Romantic ideal has changed, so that for Arnett, artistic beauty in architecture was not merely the addition of "useless" but "pleasing" ornamental or historical details to a building. Arnett pointed to the beauty inherent in the useful; that is, for Arnett, the aesthetic value of utilitarian architectural structure defined the best architecture:

> Do not demand that the door shall tell of the luxury within. …You have the right to expect the old time hinge, strong because it is not hidden, welcome because it is beautiful; locks, bolts and nails that are not ashamed to be seen; doors that shall not be a source of the present generation alone. Be prepared to appreciate harmony of design even in iron; to note how stone and glass and bronze have beautified a necessity.
>
> And, after all, what do we care for entablatures or pilasters, architraves or corbels, merely as such? It is not the technical architecture of our doorways that interest us, but the idea of hospitality they typify, the associations that surround them … [T]he threshold was [once] of such import that the priest came to give it blessing. We retain the quaint custom of placing a horseshoe where was once the motto over the door; and I would give little for the man who does not tenderly kiss his bride and ask for a blessing on their future at the moment she first crosses the threshold of their home.[660]

Arnett's essay on doorway and hardware design hints at the full implications of what will become Modernist values regarding relationships between structure and architecture. The period discourse articulates the complexity of aesthetic conflict between and among engineering and architecture, structure and style, utility and beauty, and function and form after the 1893 Chicago World's Fair.

[660] Arnett, "Doorways of New York," 105.

STRUCTURAL ART AND THE ENGINEERING-VS-ARCHITECTURE CONUNDRUM

This concept, that structural elements of a building's "engineering" are the prime mover for and identical with the aesthetic design of a structure's "architecture," is the focus of David P. Billington's 1983 history of "structural art," *The Tower and the Bridge: The New Art of Structural Engineering.* Billington argues that certain exceptional public works and civil engineering structures distinguish themselves by way of their structural aesthetic. He reviews tower and bridge innovations resulting from new industrial materials as examples of artistic engineering. Billington insists on "the independence of structural art from architecture," separating the two fields of engineering and architecture, where "works of structure" are discrete from "works of architecture:"

> I have come to believe that there is a set of ideals for structural art that separates it from architecture or sculpture. Central to these ideals is the belief held by all the major engineers discussed in this book that they had considerable freedom of aesthetic choice in design without compromising the discipline of engineering. In short, the simple-minded idea that a structure designed to be efficient will automatically be beautiful is just as false as the fashionable notion that a beautiful structure demands the assistance of a non-engineering consultant on aesthetics… [T]he most beautiful works of structural art are primarily those created by engineers trained in engineering and not in architecture. Almost without exception it seems that the best works of structural art would have been compromised had there been architectural collaboration in the design of the forms… [T]he best designs in the strictest technical sense were often also the most beautiful ones.[661]

The origin of Billington's discussion is contemporary with the creation of industrial iron, and this in turn led to what I have discussed as a "form follows function" discourse in the rise of 20th century urban modernism. His ideas of urban development and civil engineering's public works go hand-in-hand:

> Civilization requires civic or city life, and the city life forms around civil works: for water, transportation, and shelter. The quality of the public city life depends, therefore, on the quality of such civil works as aqueducts, bridges, towers, terminals, and meeting halls: their efficiency of design, their economy of

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661 David P. Billington *The Tower and the Bridge: The New Art of Structural Engineering* (New York: Basic Books, 1983), xv-xvi. See Pierre Zucco's description of "this splendid example of the engineering art," in relation to PG&E's Spaulding-Drum hydropower development project in Northern California, cited in "What Eminent Engineers Say of Our Latest Achievement," *Pacific Service Magazine* 5, no. 8 (January 1914): 275.

construction and the visual appeal of their completed forms. At their best, these civil works function reliably, cost the public as little as possible, and, when sensitively designed, become works of art.[662]

Billington defines the quality structure, *par excellence,* as one whose design meets not only the engineering criteria of efficiency and economy, but also a third criterion, elegance, equal to the other two. Billington considers “elegance” to be a *principle of structural engineering* and not an additive element in the best structural art. He explains:

> …A work is better than another when it is at the same time more efficient, more economical, and more handsome. More efficient means stronger with less material, more economical means useful for less cost, and more handsome implies of lighter appearance, of a more integrated overall form, and of more visually sophisticated two-and three-dimensional aspects. These last judgments on appearance are necessarily less well defined.[663]

He summarizes: “The elements of the new art form were, then, efficiency (minimum materials), economy (minimum cost), and elegance (maximum aesthetic expression). These elements underlie modern civilized life.”[664]

> The disciplines of structural art are efficiency and economy, and its freedom lies in the potential if offers the individual designer for the expression of a personal style motivated by the conscious aesthetic search for engineering elegance. These three leading ideals of structural art—efficiency, economy, and elegance—…can be briefly described at the outset. First, because of the great cost of the new industrialized iron, the engineers of the nineteenth century had to find ways to use it as efficiently as possible. For example, in their bridges, they had to find forms that would carry heavier loads—the locomotive—than ever before with a minimum amount of metal. Thus, from the beginning of the new iron age, the first discipline put on the engineer was to use as few natural resources as possible. At the same time, theses engineers were called upon to build larger and larger structures—longer-span bridges, higher towers, and wider-spanning roofs—all with les material. They struggled to find the limits of structure, to make new forms that would be light and would show off their lightness. They began to stretch iron, then steel, then reinforced concrete, just as medieval designers had stretched stone into the skeletal Gothic cathedral. After conservation of natural

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662 Billington *Tower and the Bridge*, 6. Billington adds here, with no trace of ambivalence, “But the modern world is filled with examples of works that are faulty, excessively costly, and often ponderously ugly.”

663 Billington, *Tower and the Bridge,* 282 n. 18.

664 Billington, *Tower and the Bridge,* 6.

> resources, there arose the ideal of conservation of public resources. …The engineer had, therefore, always to work under the discipline of economy consistent with usefulness. What the growing general public demanded was more utility for less money. Thus arose the ideal of conservation of public resources. The great [structural art] came into being only because their designers learned how to build them for less money….Economy has always been a prerequisite to creativity in structural art. …Economy is a spur, not an obstacle, to creativity in structural art. …A third ideal must control the final design: the conscious aesthetic motivation of the engineer. A major goal of this book is to show the freedom that engineers actually have to express a personal style without compromising the disciplines of efficiency and economy.[665]

Billington focuses on towers and bridges, so waterworks are not in the purview of his study. But in focusing on works typically considered public works, or works of civil engineering, and on concrete's ability to extend the limits of bearing strength and carrying load by becoming thinner and thinner, his ideas are applicable to waterworks structures.[666]

Billington argues that cultural perceptions have historically conceived architects and engineers differently. Based on visual evidence in buildings of the importance of *beauty and style* in architecture, architects are attributed with aesthetic originality: the architect is a building artist. Based on the invisibility of the *scientific principles* that govern technological structures and processes, engineers are privileged with technological mastery: the engineer is a structural scientist. With the development of

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665 Billington, *Tower and the Bridge*, 5-6.

666 Modern aqueduct bridges abound that relate quite specifically to my study. One is the Sunol Aqueduct Bridge, a concrete arch bridge. Photographs published in *San Francisco Water* in reports on the Sunol Aqueduct's progress at various stages. See also Pacific Gas and Electric Company's "conduit arch spans" such as one over the Bear River, as they appear in Frederick S. Myrtle, "Mokelumne River Project Officially Placed in Service," *Pacific Service Magazine* 18, no. 5 (July 1931): 131-41, esp. 134-35 for photos of open conduit/canal bridges of arched design. See the frontispiece photograph of the same issue, showing an aerial perspective view of the way an open concrete canal/flume under construction on the Mokelumne Aqueduct relates to the landscape. Also note on 137 a photograph of the downstream face of a buttress style regulator dam, which may be an unusual example of a multiple arch buttress dam for PG&E. In another article, one can compare photographs of concrete arch bridges of aesthetic design in the Mokelumne River Project article with photographs of several other designs for utilitarian conduit bridges, canal crossings, and flume trestles, in an article later in the same issue of the PG&E magazine. See H. W. Haberkorn, "Enlarging Water Conduits on Our South Yuba-Bear River System," *Pacific Service Magazine* 18, no. 5 (July 1931): 150-55. There is unfortunately not space in this dissertation to include examples from every aqueduct bridge category and from every period.

industrial iron—and its offspring, steel and reinforced concrete—the modern material engineer was born, and a timeline began in which the properties of new materials required engineers to solve new scientific problems in structural space. Structures mark points on Billington's timeline, beginning with Telford's 1804 bridge, moving to Roebling's wire-cable suspension bridges, and examining innovative structures that use steel beam and reinforced concrete to contend with issues of height and load. Exemplary public works structures are those whose solutions attend simultaneously to engineering and aesthetics. "Structural artists" are engineers who express their artistry by means of their standard working means, by designing structures guided by scientific principles governing materials they work with and spaces their structures must stabilize for a given use. Civil engineers moved to create works of aesthetic originality—that is, to give visual expression to structural integrity—are structural artists. Like all artists, they work within their chosen artistic medium, in this case engineering public works structures.[667]

Billington is still clear on the point that the structural artist-engineer should remain separate from the architect in historical analysis and criteria for judgment of the value of their buildings, given that their different fields of training require different approaches to different types of structural and spatial problems. He rejects the companionship, but he does acknowledge the work of engineers who also trained in architecture and who are "expressing an artistic—poetic, if you like—vision of design." Still, he insists upon distinguishing designers who are principally engineers from those who are primarily architects in their relative position to and relationship with their objects: What separates structural artists from architects interested in structure as part of building aesthetics "is their insistence on efficiency and economy as the intellectual setting for their art."[668]

The materials and processes of modernist industrial technology worked against the historical narrative to which historical revival architectural styles by definition

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[667] Interestingly, Billington is explicit not only in differentiating works of structure from works of architecture. He also distinguishes structural art from sculpture, and he likens structural art to photography. Billington *Tower and the Bridge*, xv-xvi.
[668] Billington, *Tower and the Bridge,* 218.

adhered. This was a necessary change of garb: classical architecture's basic elements—column and plinth—were original, pure, simple, and patently structural elements. Over time, changes in technology and embellishment rendered them decorative rather than utilitarian, cultural value overrode structural use, and their material function transformed. The Sunol Temple was not a structural drum-with-roof supported by columns: it was a reinforced concrete structure whose underlying member of strength—rebar—was "dignified" by the neoclassical ornamentation that disguised it. **[Figures 69, 84, 122]**

Public works buildings provide a special case for structural modernism. During a transition period between the 1930s and the 1950s, water and power buildings signified doubly: not only did their materials reveal their inherent structural purpose, the building also became a symbol in itself, rendered transparent by the machinery of the transformational processes, the way in which the building, as "work," used, transformed, and transported its "product"—i.e., the relative weights and stresses it distributed, supported, and stabilized. The internal workings of industrial machinery and utilitarian processes became beautiful. Photography was in large part responsible for this change, an important point I do not have time to dwell on in this dissertation, but which my period image choices suggest. The idea of industrial beauty accompanied a rhetorical change in the labeling of such machinery and processes. The nouns "work" and "utility" took on a plural form applied to water's transformative power, literally and symbolically: "public works," "public utilities," provided services based on processes that transformed natural elements—for this study, water. Earlier architectural symbolism had been dressed in the garb of neoclassicism, what one might term classical revivalism, a trusted visual vocabulary, historically and culturally. The Arts and Crafts Movement, and California's Craftsman bungalow aesthetic, for example, were anchored to ideas related to Gothic Revival's Romantic investment in hand-crafted materials and visible structural elements. The rhetorical "dignity" neoclassical architecture had displayed and conferred upon waterworks buildings began to be overshadowed by underlying structures inherent in mechanical processes—not the water but the machinery, the "works"—that spun, funneled, siphoned, whirled, cascaded, propelled, transported, processed, and transformed that water. To rely on the modern "utility" was to rely upon the massive, intricate, sophisticated, and awe-inspiring machinery, the "works," that rushed the elusive, magic product to the city.

AMBIVALENCE AND THE MULTIPLE ARCH DAM: DEATH KNELL FOR STRUCTURAL AESTHETICS

The most prominent designer of multiple arch dams in American history, John S. Eastwood, was well-acquainted with the ways in which aesthetic elements of a dam were used against its design. When his Big Meadows Dam was already under construction in 1912, debate arose when Eastwood discovered persistent wetness in the bedrock foundation as he was preparing the areas which would ground the dam. At this time, engineers and board members discussed several possible ways to alleviate the problems this foundation situation presented, including pushing a massive load of earth against one side of the dam as an added safety buttress when it was complete. Eastwood's response to this suggestion is important to consider as it applies not only to that situation but also to the Mulholland Dam's alteration from exactly this procedure. "The dam is stable in itself," he countered, calling proposed earthfill bolsters unnecessary. He defined the proposed earthfill against the visible downstream face of the dam as "a rather expensive method of fooling the public" and called arguments in support of implementing these overly extreme measures "very far-fetched, and only intended to alarm the unwary and uninformed."[669] This seems to describe exactly what happened in the case of the Mulholland Dam.

Eastwood's Lake Hodges Dam, near San Diego, becomes my second example of aesthetic alteration in the guise of safety improvement after the 1928 LADWP dam disaster. **[Figures 241, 242]** This multiple arch dam is of particular interest as it presents wider implications for cultural values related to waterworks aesthetics, because multiple arch dams were targeted and successfully suppressed based largely upon their visual

669 John S. Eastwood to Mortimer Fleishhacker, February 14, 1913, quoted in Jackson, *Building the Ultimate Dam,* 127.

appearance. Before analyzing the historical suppression of this multiple arch dam, it is important to understand the type.[670]

A multiple arch dam is a series of contiguous, angled, thin-shell concrete barrel arches. **[Figures 241, 242, 245, 246, 247, 248]** Viewing the downstream face, a viewer sees what looks like a vertical running arcade of tall, close arches, not unlike a tall Roman aqueduct arcade. But these arches reveal themselves to be barrel vaults, with the barrels oriented on a sharp downward angle toward the ground on the upstream side of the dam, where the bedrock foundation anchors them. From the upstream face, or from above, a multiple arch dam is a series of scallops, created by the extrado surfaces of the contiguous barrel vaulting, which runs the full width of the dam, abutment to abutment. **[Figures 245, 246]** Under the weight of a full reservoir, which sits directly upon the continuous row of downward-angled barrel vaults, the dam remains solidly in place. Buttressing on the vertical downstream face usually features either protruding buttress supports attached to the legs of the arch and running into the ground, or arched struts braced horizontally between the legs of the arch, integrated into the overall design of each individual dam. Each crest scallop delineates one downward-angled barrel vault. The surfaces of the barrels distributes the water's weight along its own arch and from one

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[670] The multiple-arch type is a thin-shell concrete buttress dam that takes the basic form of a series of arches. Viewed from downstream, the dam's face appears to be a flattened and buttressed arcade of barrel arches; from above, the dam takes the form of an arcade laid on its side, with a scallop of extrado curves facing upstream against the reservoir. The trick is that the "barrels" of the arches are angled so that they indeed come to lie on their sides; the barrels angled toward the reservoir create a continuously scalloped angular upstream dam surface upon which the weight of the reservoir water presses down. The multiple-arch dam design keeps the structure in place under multiple directional forces. Downward force keeps the dam stable on its foundation footings, while forces distributed along the arches stabilize the dam both internally among the arches, and laterally as a whole against its abutments. Due to its material economy, the form could be produced at significantly lower cost than other dams: thin-shell forms require much less concrete, and less time, to build. The design's elegant thin-shell concrete dam arches were laudable not only technically (the multiple-arch design was engineered for superior strength, especially under a full reservoir load), but also aesthetically. The requirements of its material economy created a work of "structural art," using Billington's criteria. From the point of view of "safety," its design elements would appear to conspire to keep the dam solidly grounded with the weight of a full reservoir behind it, even more than other dam designs theoretically do. In practice, it is apparently the case that the dam is structurally "safe," to judge from Donald C. Jackson's thorough and incisive study. Jackson specifically cites no multiple-arch dam failure. He cites one example of a dam failure in which a solid masonry gravity dam base was topped with a multiple-arch dam crest; the masonry dam base failed, taking the upper multiple-arch portion with it. See Jackson, *Building the Ultimate Dam,* 232-35.

arch to its neighbors, so that the load as a whole is shared by all the elements along the scalloped barrel arches, and ultimately distributed into the underlying foundations and adjacent abutments. A multiple arch dam relies on this collective and interactive series of structural properties and on the water's weight—not on the dam's own weight—for stability. This transfer of load holds true for any arch dam—usually and historically, arch dams are one single curve. The multiple arch dam is different in that the structural design incorporates several contiguous barrel arches, so that in plan its crest appears as an arcade on its side, with the scalloped upstream face of barrel arch extrados positioned so that the barrels are run at an angle down into the ground. This leaves the constant angle of the scalloped surface of contiguous extrado surfaces of the barrel vaults, with that angular surface of vaulting exposed to the weight of the water mass, which then presses down upon that scalloped face, helping to keep the structure securely in place.

Donald C. Jackson points out that multiple arch and buttress dam design offers a system of combined strategies that involve water's weight and gravity's force in its coefficients of stability. A multiple arch dam keeps the reservoir in place differently from a gravity dam. A dam incorporating a single arch curve holds back water by redistributing load and stress into the ground, through the foundation and embankments. By dramatic contrast, a dam scalloped into multiple arches multiplies the arch effect, distributing load internally within the dam, from one arch to another, along the entire surface of the barrel vaults, as well as transferring load into the ground and abutments. Eastwood once described this strategy to be as a man might support himself in a doorway by bracing his arms against the two sides of the doorframe, rather than holding onto the door. Whereas the gravity dam must work to counter and contain the reservoir's weight and the forces that want to push it forward, the multiple arch design enlists water's weight and gravity's force pressing down upon the angled barred arches in its combined strategy to stay in place.

Paramount in dam design is the need to counter the dam engineer's nightmare, *uplift*. This is the ability of a reservoir's water mass, under great downward pressure and in the way of water's amorphous physical quality, to find infinitesimal weaknesses around the dam foundations. Water may infiltrate imperceptibly, but once it builds sufficiently, all at once either the entire dam slides downstream, or the earth beneath the dam liquefies and the reservoir water rushes in, lifting the dam up away from the earth and snapping it to pieces, as occurred with the St. Francis Dam. With gravity dams, it is the sheer weight of the dam's solid mass itself, upon sound foundations, that keeps the dam in place and holds back the reservoir. By dramatic contrast, the structure of the multiple arch dam is designed to utilize the weight of the reservoir water mass to stabilize it by pressing down on it. The gravity dam fears water and the push of gravity; the multiple arch dam invites them to collaborate.

In cross-section, a multiple arch dam presents a similar shape and size of profile and footprint to a gravity dam. An interesting difference in the profile and footprint is its orientation: they are essentially mirror images of one another, with the concrete gravity dam having a slightly battered, nearly vertical upstream face and an angled downstream face, creating a modified right triangle, with the angled mass of material facing downstream. A multiple arch dam has a vertical downstream face, sometimes with buttresses to support it, and an angled upstream face whose barrel arches angle downward into the reservoir. Aside from this mirror-image orientation, the radical differences between the two dam profiles lie in the quantity of material, the structural design properties, and the *nature* of the footprint they place on the ground. A gravity dam is a solid mass of concrete, pyramidal in cross-section. This is easy to see in the broken but solid concrete ruins of the St. Francis Dam. **[Figures 236, 237]** A gravity dam relies primarily on a single concept—its own weight—to hold a reservoir in place. A multiple arch dam, however, is essentially hollow. **[Figure 246]** It relies on the combined properties of thin-shell, reinforced concrete in concert with various load distribution strategies provided by barrels, arches, and buttresses.

In contrast to solid gravity dams in the massive tradition, multiple arch dams—what Eastwood originally called dams of "arched buttressed concrete"—rely on properties of thin-shelled reinforced concrete and of the arch for stability and should be categorized within a tradition of materially-efficient structural dams. The structural approach keeps the amount of material, and therefore cost and construction time, to a minimum. Jackson paraphrases Eastwood's explication of the clear structural merits of multiple arch over massive gravity dam design, specifically related to "uplift" from water seepage between dam and foundation.

> Because of their widely spaced buttresses, [Eastwood] contended, his multiple arch designs obviated problems with uplift pressures and consequently were better equipped to resist sliding. He also argued that the included upstream face of his design was superior to a vertical upstream face because it allowed loads to be 'distributed evenly over the entire base of the dam.' With a vertically faced gravity dam such balanced loading cannot be ensured. Eastwood also noted that his design allowed for a 'lighter base loading than can be obtained in any other type,' because of the great length of the buttresses (almost 150 feet in the deepest part of the dam).[671]

To defend the thin-shell, reinforced concrete arches in the design, he explained, with what Jackson calls "unassailable…validity," that "perfect arch action can only be obtained by the infinitely thin arch and the arch action will diminish from the infinitely thin arch to no arch action whatever when the arch becomes infinitely thick." The "infinitely thick" dam arch would describe a massive gravity arch dam like the famed Hoover Dam on the Colorado River, each of which curves into a single massive arch, intrado facing downstream, but which still relies largely on its own weight to keep it on the ground with a full reservoir pushing from behind it.[672]

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671 John S. Eastwood, "Statements Regarding the Stability and Safety of the Eastwood Multiple Arch Dam and Three Reasons for the Use of This Design at the Big Meadows Site of the Great Western Power Company," n.d., ca. September 1912, JSE18, Water Resources Center Archives, University of California, Berkeley (WRCA, now the Water Resources Collection and Archives, University of California, Riverside), quoted in Jackson, *Building the Ultimate Dam*¸ 122. For more on Eastwood's engineering and the technical development of the multiple arch dam, see Chapter 8: "Theory and Practice in Dam Design" in Jackson, 169-192; and for a very specific technical analysis of one Eastwood dam, see the section titled "Mountain Dell Dam: A Case Study" in Jackson, 176- 181. For contextual placement of multiple arch dams within dam history, see Chapter 2: "Dams: A Technical and Historical Review" in Jackson, 13-40. For a general technical and developmental dam history, see Kollgaard and Chadwick, eds., *Development of Dam Engineering*, esp. 219-670 for concrete arch and buttress dams.

672 "Unassailable…validity" in Jackson, *Building the Ultimate Dam,* 123; "Perfect arch…," in John S. Eastwood, "The Eastwood Multiple Arch Dam: An Outline and Description of the Structure, Methods and Purposes of Design," September 20, 1912**,** John S. Eastwood Papers 18, WRCA, quoted in Jackson, *Building the Ultimate Dam,* 123.

All things being equal, and had American dam history played out differently, multiple arch dam designs might have rendered the gravity dam obsolete. As Eastwood explains above, the multiple arch design essentially eliminates the uplift threat that plagues gravity dams, and it does so in such stable way that the multiple arch dam should have presented itself as the obviously preferred design. Since an arch dam does not rely on bulk, it uses exponentially less material than a gravity dam, and is therefore much less expensive to build, for a host of reasons related to the quantity of concrete each consumes. From an engineering point of view, it is an efficient and economical dam. From the point of view of aesthetics, its *material* efficiency and economy makes it an arresting-looking work of structural art. At this point the comparison fails to remain equal.

One dam on the Hetch Hetchy system was a forgotten architectural monument of a very different kind, which was eventually eclipsed by ongoing controversies over the later damming of Yosemite National Park's Hetch Hetchy Valley. The 1918 Lake Eleanor Dam, a multiple-arch dam on San Francisco's Hetch Hetchy system, is considered today to be a peripheral aspect of the Hetch Hetchy system. **[Figure 248]** From its high-elevation location, its water fed steep penstocks for hydropower generation downstream.[673] The dam's multiple arch design is striking: an example in a dam of David Billington's "structural art." The idea of a structural aesthetic governs structures whose aesthetic, or sense of the beauty and balance of its design, from a visual point of view, is determined by its internal, or engineered, structure, the nature of its building materials and its engineering design, and not by the architectural style chosen for its surface appearance alone. In architecture governed by the modern idea of a structural aesthetic, the exterior shape and form of a structure, and any artistic qualities that make it attractive or beautiful, are identical with its internal, engineering design. In other words, a structural

[673] Other initial phases of power generation required for the Hetch Hetchy dam and aqueduct infrastructure, maintenance, and construction—before a drop of water could be delivered through the aqueduct— included the completion of the first phase of the O'Shaughnessy Dam and its system in 1923, and the 1924 completion of the Moccasin Creek Powerhouse system. Subsequent phases of expansion and construction continued for the next decade, leading to the aqueduct's completion, and the ceremonial and architectural dedications discussed in this study, in 1934. See Hanson, *San Francisco Water & Power,* 31-36.

aesthetic does not separate interior from exterior; no architectural design can be "applied" to the structure's "surface": visible surface elements are identical with internal structural elements. An arch in such a waterworks structure, for example, is by definition a working, structural arch; the arch is not applied as a decorative or purely visual statement. By contrast, historical revival architectural approach to waterworks creates an exterior that associates itself with architectural styles that identify cultural ideas or values that a viewer can associate with *other kinds of buildings* for which an arch is a standard—banks, churches, universities, commercial buildings, residences, ancient aqueduct—and applies those value-laden elements to the exterior surface so that the waterworks structure looks like a building that has high cultural and historical value. The structural aesthetic is different from the historical revival aesthetic: internal structure, building materials, and structural engineering design are identical with one another; surface appearance is not separate from the internal structure of the architecture. In fact, with the structural aesthetic, terms are reversed from those of the historical revival aesthetic: internal structure determines external form, to the point where we can discuss a certain transparency—sometimes suggestive, sometimes associative, sometimes literal and real transparency—between exterior and interior. Exterior surfaces reveal internal structures. This structural aesthetic eventually comes to define a principal ethic of 20th century modernism in architecture and design, and has an especially important role for the architecture of public works.

The Lake Eleanor Dam's multiple arch dam style is an early example of this structural aesthetic: its structural engineering and its visual attractiveness both rely, explicitly and in equal measure, on the arch. Like the round temple, for which the circle and the column comprise both support and visual effect, the arch is a staple architectural referent in western culture.

The Lake Eleanor Dam was one of a handful of multiple arch dams that John Eastwood did *not* design. He was the most prominent multiple arch dam engineer in the world, and his design innovations focused on radically reducing the high expense of dam construction through maximizing efficiency, economy, and stability—which translates into the concept of safety. As I have mentioned, dam engineering historian Donald C. Jackson's *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* rigorously analyzes the debates that resulted in the rejection and/or alteration of Eastwood's multiple arch dam designs. Jackson has exhausted the primary research archives on the question of multiple arch dam engineering, construction, and controversy, in the context of Eastwood's dams, and for this reason I lean heavily on Jackson's evidence and analysis: he has plumbed an array of extensive archives on this single point of high relevance to my study, and I am indebted to him for the wealth of evidence without which the depth of my critical analysis would not be possible. One of the factors Jackson discusses is precisely my point of investigation here, the suppression of Eastwood's dam designs based on their appearance, when their appearance was a dual indicator of both engineering prowess and aesthetic success. Thin-shell concrete arches and buttresses are the structural elements that ground the design's strength and stability, *and* the features that make the dam style the work of "structural art." These elements of the structure were precisely the elements critics targeted as reasons to reject it, citing their *visual* features, and skirting or ignoring their contribution to the dam's *structural* integrity.

After the St. Francis Dam failed, new safety regulations passed, placing all dam construction under new scrutiny, but a special board, the Multiple Arch Safety Commission, was formed specifically to review multiple arch dam design. In 1936, the review process singled out the Lake Hodges Dam for bolstering, based on the nagging problem of what appeared to be normal temperature cracks in the buttresses when the dam was new. The dam had functioned without leaks or problems for over a decade of maximum use—it was even topped by flood waters and heavy debris just before its construction was completed, with no damage or adverse effects—but critics pressed for altering the dam regardless of its performance record. The argument instead focused on the dam's visual appearance. One of the principal critics denigrated Eastwood's focus on "the beauties of the multiple arch dam," and objected based on an assessment that "the psychology of these airy arches and the lace curtain effect of [Eastwood's] stiffening props is not well suited to inspire public confidence."[674] From the abrupt halt to the 1912 Big Meadows Dam construction to the 1936 "rehabilitation" to the Lake Hodges Dam, critics denigrated Eastwood's designs on "startlingly unscientific" grounds. Using visual terms, their repeated disparagement pummeled the defining features of the thin-shell concrete arch-and-buttress system of multiple arch dam design; they targeted the very attributes that signaled the multiple arch dam's structural strengths. "Undesirable features" singled out rhetorically as "defects" that appeared "unsurpassed in frailty," including descriptions of inherently strong arch and buttress elements in such phrases as "thin," "slender," "airy," and "lace curtain effect." The most dedicated critic objected to the "psychology" of the design, which he believed would lead to "popular apprehensions and misapprehensions."[675] Jackson finds nothing in the local period press that indicates public fear based on the multiple arch Big Meadows Dam; nonetheless, it was abruptly abandoned under construction in 1912 and replaced in 1929 with an earthen dam. Public and professional outcry rose after the 1928 St. Francis Dam gravity dam failed, and stricter oversight laws were enacted in 1929, just as had occurred in 1911 after the Austin Dam, a gravity dam, failed by sliding, and in 1917 after the Lower Otay Dam, an earthen structure, had washed out in a major flood. But in general, as regards gravity dams, even after the St. Francis failure, Jackson finds: "Generally, the disaster was treated as a freak accident that did not reflect on the suitability of gravity dams in any larger sense," and the dam failure was blamed primarily on foundation defect, with evidence for "uplift" contributing to the failure, as well. By contrast, the response to the Italian multiple arch

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674 Freeman to Davis, September 26, 1912, quoted in Jackson, *Building the Ultimate Dam*¸ 123. Jackson points out that Freeman, one of the biggest critics of Eastwood and the multiple arch dam, had a good deal of influence in the dam engineering field. He was called on to consult and to testify on many dam projects. He was also decidedly in favor of dams in the massive tradition, and as an engineer-builder, he only constructed gravity dams.

675 "rehabilitation" from "Editorial: Unsafe Dam Design," *Engineering News-Record* 117 (November 5, 1936): 656, quoted in Jackson, *Building the Ultimate Dam,* 237; "startlingly…," in Jackson, 124; "undesirable…," "defects," and "slender" in H. W. Dennis, G. A. Elliott, and Walter L. Huber to Edward Hyatt, State Engineer, September 15, 1932, Folder #630, Huber Papers, WRCA, quoted in Jackson, 242; "unsurpassed…," "Editorial," *Engineering News-Record,* 1936, quoted in Jackson, 237; "thin," "airy," "lace…," "psychology," "popular…," in John R. Freeman to Arthur P. Davis, September 26, 1912, Box 63, Freeman Papers, MIT, quoted in Jackson, 123-24.

dam that slid off its improper masonry base had been immediately blamed on the multiple arch design.

All of this was taking place in a culture that came to value sheer mass over structural design. As early as 1912, the growing federal Reclamation Service, which quickly increased in waterworks prominence over time, particularly in dam building, had adopted a preference for dams in the massive tradition in comparison with buttress-style dams:

> We [the Reclamation Service] have been included to adhere to the older, more conservative type of solid dam, largely perhaps because of the desire not only to have the works substantial but to have them appear so and recognized by the public as in accordance with established practice…Plans for the construction of storage works, while they must be prepared with regard to reasonable economy, must be [undertaken] with a view to being not merely safe but looking safe. People must not merely be told that they are substantial, but when the plain citizen visits the works he must see for himself that there is every indication of the permanency and stability of a great storage dam…he must feel, to the very innermost recesses of his consciousness, that the structure is beyond question.[676]

The result of the selection of the Lake Hodges Dam for post-St.-Francis-failure response was to install heavily reinforced vertical panels between every other pair of buttresses on the downstream face of the dam. **[Figure 241, 242]**

> The extent to which these massive frames increased the strength and stability of the dam may be debatable. But they certainly altered the appearance of the downstream face, making the structure seem cluttered and (more importantly) massive. …[T]he central (albeit conjectural) point was that multiple arch dams were essentially unsafe—despite the dams' exemplary safety record, despite the fact that some were actually built with artificial expansion joints to take the place of natural hairline cracks, and despite their ability to conserve material and eliminate the hazards of hydrostatic uplift. Multiple arch dams, especially the

[676] F. H. Newell to A. H. Dimock, April 16, 1912, NA RG 115, Entry 3, Box 287: "Discussion Related to Dams," National Archives, Washington, D.C.; and F. H. Newell, "Irrigation: An Informal Discussion," *Transactions of the American Society of Civil Engineers* 62 (1909): 13, quoted in Jackson, *Building the Ultimate Dam*, 189-90.

> radically thin structures championed by Eastwood, simply did not conform to what dams were expected to look like….[677]

Not only are these buttresses structurally redundant, they kill the dam's inherent structural aesthetic. The ability to apprehend that aesthetic visually, by looking at the downstream face, is no longer available. Among other aesthetic travesties, the buttresses interrupt the rhythmic interplay between negative and positive space, between curved and straight lines; they disintegrate the balance of tensions between contained and compressed space; and they repeatedly truncate both lateral and vertical flow of these spatial elements, forcing staccato stops where Eastwood's aesthetic magnanimity had given open, guided visual movement. It is now impossible to apprehend the visual elements that permit a viewer to understand the multiple-arch form, or to experience the structural sublime it engages, to apprehend this dam design's full aesthetic extent. It is a rare kinesthetic sense to enter into the expansive but compressed space beneath the intrados, into an unimaginable yet real marvel: a massive body of water, unnaturally suspended, hovering conceptually, pressing down, held, upon the air.

OUTCOMES

I discuss this specific dam and the loss of its aesthetic effects in relation to a pattern of post-St.-Francis-failure alterations made in the name of "dam safety," but based primarily on objections to visual aesthetic expressions. Analysis of the specific ways in which the multiple arch dam type was discussed and criticized in a selection of

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[677] Jackson, *Building the Ultimate Dam,* 244-45. I have already quoted and examined Freeman's decidedly unscientific comment regarding the cultural and visual effect of a large gravity dam, a comment that fails to take into account site appropriateness of engineering principles or of economy. Engineer R. G. Clifford in 1913 explained the reasoning for using expansion/contraction joints in an arch dam such as Lake Spaulding Dam, which PG&E was in the process of building. "The shrinkage of concrete as it cools off and dries out is very considerable, amounting to one-half an inch or more in each 100 feet. While the water is against the dam this is largely prevented by the pressure of the arch, but when empty there is not enough tensile strength in the concrete to prevent it cracking. If these vertical cracks in the dam should diverge away from the reservoir a very distinct weakness would develop in the dam, it being conceivable that such a section might be dislodged when the water pressure was applied. The contraction joints are artificial radial lines of weakness spaced 80 feet apart to anticipate the effects of contraction, the resulting blocks resembling the stones in an arch except that interlocking is provided in our case." See Clifford, "Common Sense Engineering Principles," 225.

instances reveals a persistent suppression of multiple arch dam aesthetics, even when the style's exemplary structural qualities, by another set of standards, would have made it an ideal of efficiency, economy, and aesthetics. In the history of multiple arch dams, there is only one known failure, the 1923 Gleno Dam in Northern Italy.[678] This, too, resulted from an engineering error: the decision to change the dam type from a masonry gravity dam to a multiple arch dam after construction had begun, and without redrawing the entire design to account for the changed element. In this case, a stone masonry base nearly 60 feet tall and nearly 80 feet deep was complete when the owner decided to top this base with a multiple arch structure. This decision doomed the dam: since the multiple arch dam was not anchored into an earth foundation but essentially set on top of a level, man-made foundation, the arch-and-buttress technology was rendered useless. Stress essentially cracked the dam in half vertically shortly after the reservoir was first filled, and the dam was pushed right off the masonry foundation. Critics in the United States used this failure as evidence against the otherwise highly reliable multiple arch design. Eastwood declared it "no more like one of my dams than is a gravity dam."[679] Jackson concurs: "To label the catastrophe a multiple arch dam failure was a gross distortion."[680]

At a time when the federal Bureau of Reclamation was beginning the era of massive, enormously expensive dams, Eastwood had invented a design, which, in expense and engineering, presented a superior exercise of the efficiency and economy tenets of civil engineering structures. In addition to maximizing efficiency and economy in time, materials, and cost, Eastwood's designs also were exemplary models of Billington's requirement of elegance for a work of structural art. In denying mass, Eastwood had to rely single-mindedly on structural engineering (and not excessive material, as is the case with a gravity dam) to solve problems of stability and strength, and to maximize economy—in money, time, and safety risk.

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678 Jackson, *Building the Ultimate Dam,* 232-33.
679 John S. Eastwood to Ed Fletcher, April 3, 1924, John S. Eastwood Papers 4, WRCA, quoted in Jackson, *Building the Ultimate Dam*, 232-33.
680 Jackson, *Building the Ultimate Dam*, 232.

Jackson's evidence leads him to argue that Eastwood's inventiveness, represented in his slogan "Bulk Does Not Mean Strength," should have been an impetus for widespread adoption of multiple arch dam technology. He cites several instances in which the dam type was cause for relief among small municipalities or irrigation districts needing dams, but who did not have access to leviathan dam-building budgets, as did large cities and government agencies. Eastwood's economical dams were viable for such clients, but projects were stalled in review and approval processes conducted by outside experts and agencies. Jackson analyzes engineering debates behind multiple arch and buttress dam designs and finds that in the main Eastwood's multiple arch dams were rejected on visual terms, not because of technical flaws. The most vociferous and persuasive critics, who were also proponents, and some builders of massive gravity dams, argued from a premise of safety risk. The conundrum is that multiple arch dam engineering presented evidence that soundly opposed these critics' objections, that is, this dam type presented a "safer" dam. Critics Jackson cites bypassed, downplayed, ignored, or denied structural analyses that proved the design to be of unusual and innovative strength and stability, grounding their criticisms on appearance.

In the case of the Lake Hodges Dam, an existing Eastwood multiple arch dam was needlessly "rehabilitated" (etymologically, given a new uniform, or re-dressed), to its aesthetic discredit. In another, the Big Meadows Dam, from an earlier period, construction was stopped after it had made significant progress, and the uncompleted multiple arch structure was replaced with a solid hydraulic fill dam in the massive tradition—as opposed to a materially efficient structural dam like Eastwood's.[681] In many other cases, plans to build multiple arch or radial arch dams were halted or rejected where they would seem to have been acceptable, even warranted. In addition to the loss or destructive alteration of these dams, the waterworks engineering and civic leadership communities lost a valuable opportunity to educate themselves, and the water-buying public, by investing in the aesthetic tenets of innovative engineering for waterworks.

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681 Also see "typical" cover illustration of a Spanish-Mission style intake behind a dam in a reservoir: *Pacific Service Magazine* 18, no. 10 (October 1932): cover illustration, with caption reading "Bucks diversion dam and reservoir, Bucks Creek Power Development."

In the final analysis, so-called improvements ("buttressing" and "rehabilitation") were visual addenda, whose function was to satisfy aesthetic ambivalence. The experts who argued against proven structural integrity did so on a presumption that it was in the public's best interest to make these particular dams "safer." Historically, in the wake of any dam failure, heightened consciousness of safety measures follows, and the wake is wide, as dam failures receive broad media coverage and trigger heightened public awareness. Arguments employed by experts who persuaded decision-makers to "strengthen" these dams were crafted almost exclusively in visual terms. From the point of view of aesthetics, what were called improvements served only to demean the structure's aesthetic integrity, lowering its cultural value precipitously. Contrary to the initiating assumptions of weakness in the structure, changes made in the name of structural safety seem clearly to have had questionable structural value. In both cases, alterations were expensive—in money, time, public perception, and technological integrity. The "erasure" of the Mulholland Dam in Hollywood and the Lake Hodges Dam in San Diego had an amplified cultural effect, by turning the technical failure of the St. Francis Dam into a cultural disaster by devaluing waterworks aesthetics.

David Billington's tenets for structural art work is a way to define *structure* apart from *architecture* in theory, and it works "to a man," that is, within the purview of the single engineer-artist's work of originality, particularly of course once those works are built. But when the place of origin for the work of civil engineering shifts to a civic body empowered to choose and pay for waterworks design, a critical cultural situation becomes clearer. If the committees, boards, councils, administrators, politicians and bureaucrats charged with the decisions to build waterworks structures are not clear on whether they value art—that is, if they do not know whether and how structural beauty matters—they may fall back on arguments that default to aesthetic ambivalence. In the examples I have discussed, this position's default is a *status quo* which symbolizes safety. Based on two ingrained cultural conditions at the time of the post-St. Francis disaster debates and decisions regarding the multiple arch dam—first, the cultural propensity to conceive of engineers as structural scientists, and not as artists; and second, the prevailing massive tradition—civic leaders were unable to permit a work of art to qualify as a structural masterpiece. It was too new an idea, and as such presented too great a risk. This ambivalence was characterized by doubt of a kind that led to an inability to act with certainty in the face of two poorly understood options—literally, both are veiled. In the case of the multiple arch dam, the design's aesthetic and technical stability cast further doubt on Eastwood's claims of structural superiority in critics who centered predetermined positions on bulk as a traditional attribute of stability. For these critics, aesthetic difference was one variable too many to consider. Many thin-shell concrete arch dams were famous and many remained unquestioned. Aesthetics was rejected as a point for consideration.

Presenting a vocal position in opposition to the structural aesthetics of multiple arch design, John R. Freeman, a prominent period dam engineer, ignored the multiple arch dam's structural attributes in order to attack its appearance. His remark in favor of the massive tradition over the structural aesthetic is revealing: "It does not pay to carry economy to excess in dam building and there is nothing quite so satisfying as a big solid mass of concrete." A series of multiple negatives, mixed figurations, and contradictions in terms, the bellicose rhetoric signals ambivalence. Taken literally, the first sentence in the compound, "It does not pay to carry economy to excess in dam building" is confusing: we can assume Freeman means to imply both fiscal and material economy, but he figures the statement in social and political terms as well. Ultimately he negates the value of being economical. To be economical "to excess" would seem to mean to strive for extreme economy and efficiency, a rule-of-thumb standard for structural engineering, as I have discussed. Freeman's comment, however, counters this tenet, literally indicating that to engineer a dam most efficiently, that is, with the minimum material possible, and at the lowest cost economically, is not expedient, politically or socially. He does not touch on engineering value of an economically designed dam. In truth, the most efficient and economical dam structure rejects Freeman's terms: an economically-designed dam in fact opposes "excess" and it *does* 'pay'—in pecuniary terms—because it saves money by using materials economically—and its design is what permits this situation. So, Freeman argues in favor of dams that feature excess in money and materials: he advocates for big, expensive dams, his "big lump of concrete." Freeman's rhetorical approach promotes the massive dam tradition over the threat economy's elegance poses to the visual stereotype that mass indicates safety.

Freeman was not beyond designing a concrete dam to "look" aesthetically pleasing in the visual trend of the period, however, even if it still was a "lump of concrete." In 1911, Freeman had submitted a concrete gravity dam design for the Calaveras Dam to the Spring Valley Water Company, which I discussed earlier in this dissertation. In light of Freeman's vociferous objections to aesthetic dam design, his neoclassical, historical-revival styling of the downstream face in his Calaveras Dam project drawings is of interest. **[Figure 250]** In addition, the project's aesthetic is quite unusual among built dam structures, presenting a series of stylized pilasters standing the full height of the downstream face. Stairways up and along the face of the concrete dam indicate scale.[682] William Bourn and Spring Valley called not on Freeman but upon William Mulholland, Los Angeles Aqueduct builder and L.A. City Engineer, to design and build the Calaveras Dam. In 1914 dam construction started, but in 1918 the dam failed during final stages of construction. In 1923 reconstruction began, and the new earth, hydraulic fill, and rock Calaveras Dam was complete in 1925.[683]

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682 The image I include here is a similar design proposal of Freeman's for the Hetch Hetchy Dam from the following year. Reproduced from Freeman, *On the Proposed Use of a Portion of the Hetch Hetchy*. The original blueprint drawings of the Calaveras Dam design proposal, submitted by John R. Freeman, Consulting Engineer, Providence, RI, and signed off by Spring Valley Water Company Chief Engineer Herman Schussler, April 13, 1911, are held in Engineering Archives, SFPUC, Millbrae, CA. See Freeman drawings E-131 to E-143, especially the perspective drawing of the downstream face, E-135, where the full-height column details are labeled "pilasters."

683 Theodore Scowden had recommended long before, in his 1875 report on the city water supply, that the City buy "a Calaveras site, on a branch of Alameda Creek in Alameda and Santa Clara Counties, as the beginning of a future municipal water supply. The City was unable to act quickly and the Spring Valley Water Company effectively blocked this threat of competition by promptly purchasing the land and water rights for itself. …Construction of the earth and rock fill type dam did not start for another 38 years, until 1913. A series of misfortunes and engineering errors culminated in a failure of the partially completed dam on March 24, 1918, when the upstream face of the dam sloughed off and the water gate tower collapsed." The dam was rebuilt by O'Shaughnessy to a height of 215 feet, making it the tallest earth fill dam in the world in 1925. See Hanson, *San Francisco Water & Power,* 16.

Failures of dams in the massive tradition runs contrary to the way Eastwood's multiple arch dam—and Billington's "structural art" in general—would have it. Dams "pay" socially and economically when they serve the public good by being efficient and economical. However, "in lieu of offering viable engineering arguments," Jackson observes, "critics denigrated the design largely because of its visual appearance; the nontechnical public was assumed incapable of appreciating theoretical vindications of the design."[684] In his analysis, Jackson appears to have grounded the same conundrum I have identified, my "aesthetic ambiguity," and, extrapolating from his analysis of the St. Francis failure aftermath, one might characterize aesthetic ambiguity with the following behavior among the critics who moved to suppress the multiple arch dam. First, they are both drawn to and repulsed by beauty. Second, their position reveals divisive gender-identification of structural appearance, where beauty is gendered female and viewed as weak; mass is gendered male and perceived as strong, or stable. Third, something must look traditional to be assessed as better, stronger, and longer lasting. Fourth, unfamiliar looking innovations should not be trusted. Last, when all of the previous terms are in place, appearance trumps performance, and one's associations about visual aspects are more important as evidence than scientific or engineering facts.

How do ideas of safety come to characterize ambiguity regarding dam design? On the surface, and in the literal terms in which these design conflicts were framed, the argument for mass over elegance might seem self-evident, so readily did the argument that equated bulk with safety win over the more complex one that favored an aesthetic that equated beauty with strength. But, of course, it's not that easy. Leo Marx traces a complex cultural ambivalence in American values, related to the one I am discussing, to

684 Jackson, *Building the Ultimate Dam,* 131. In a subsequent study, Jackson grants dams in the massive tradition a viable place in the national economics, although I find his argument regarding aesthetics still holds. The vast dam projects of the New Deal Era from the 1920s to the 1940s were large-scale sources for labor and manufacturing. See David P. Billington and Donald C. Jackson**,** *Big Dams of the New Deal Era: A Confluence of Engineering and Politics* (Norman, OK: University of Oklahoma Press, 2006), 4, 5, 156. Also see Eliza L. Martin, "Martin on Billington and Jackson, 'Big Dams of the New Deal Era: A Confluence of Engineering and Politics,'" H-Net: Humanities and Social Sciences Online, June 2008, accessed March 7, 2015, https://networks.h-net.org/node/15526/reviews/15624/martin-billington-and-jackson-big-dams-new-deal-era-confluence.

be rooted in conflicts inherent in the long-held and leading ethic of the American pastoral ideal as it applied to industrial growth. Leo Marx holds the image of technology in the garden to be "a cardinal metaphor of contradiction" holding the center of "a complex, distinctively American form of romantic pastoralism" that appeared in art and literature in a pervasive image of the locomotive in the landscape.[685]

> The sudden appearance of the machine in the garden is an arresting, endlessly evocative image. It causes the instantaneous clash of opposed states of mind: a strong urge to believe in the rural myth along with an awareness of industrialization as counterforce to the myth.[686]

In an analysis of ways in which Thomas Jefferson's writing and career exemplify the American pastoral as foundational to American cultural values into and through the 19th century, Marx discovers "deep ambiguities" within the construction of the clash of "polarities" inherent in the pastoral ideal.[687] Jefferson's articulateness, his extensive writing, and his prominence permit Marx to infer from the statesman's writing a central paradox: lifelong conflict between rural retreat and civic duty "expresses decisive contradictions in our culture and in ourselves." Dialogue between two opposing terms, being dialectical, inherently faces an "unknown history" of "ever-changing circumstances," does not yield a "fixed image of society," and requires continual adjustment and redefinition. Just as Jefferson was unable to work out the difference between the two to his own satisfaction—"during his eight-year term as President of the United States, Jefferson's policies had the effect of creating precisely the kind of society he did not want"—for American society in general deeply ingrained qualities of the pastoral ideal created a long-standing cultural illusion of perpetual paradise, part unspoiled nature and part cultivated garden. Jefferson conceded placing "the manufacturer by the side of the agriculturalist," but the underlying conflict remained, captive to the unresolved push of circumstance against preference.

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685 Marx, *Machine in the Garden*, 229.
686 Marx, *Machine in the Garden*, 229.
687 Marx, *Machine in the Garden*, 135. In the remainder of this paragraph, I quote and paraphrase from Marx's analysis of Jefferson's core ambivalence, 133-44.

Landscape painting from the period represents this illusion clearly, especially in romantic paintings which depict technology—usually the locomotive, emphasizes Marx—in the landscape. Marx cites a George Innes painting from 1855, *The Lackawanna Valley*, a commission from the Lackawanna Railroad Company that initially "repelled" the painter. Innes' internal dialectic process resolved his reluctance to paint "anything as devoid of visual charm as a repair shop, a roundhouse, or a smoking locomotive," and he produced an otherwise-typical romantic landscape that incorporated the long curve of railroad track and the train's cloud-like plume of exhaust as if they were organic to the natural scene: "It is a striking representation of the idea that machine technology is a proper part of the landscape….Instead of causing disharmony, the train is a unifying device." But Marx insists that in reality the locomotive—and industrial technology in general—hardly had the effect of being an organic part of the landscape as a whole; instead, it fomented conflict with the arcadian quality of the pastoral ideal, and artists went to great pains to absolve technology's resistance to traditional arcadian beauty in their images. "In [its] sentimental guise the pastoral ideal remained of service long after the machine's appearance in the landscape. It enabled the nation to continue defining its purpose as the pursuit of rural happiness while devoting itself to productivity, wealth, and power," and at the same time to remain in a state of internal conflict, unaware of "the meaning inherent in the contradiction."[688]

Marx provides a picture of long-held American beliefs of a kind that led aesthetic ambivalence to cloud clarity of thinking about dam design in the 1920s and 1930s. The case of the St. Francis Dam failure and resulting aesthetic changes to dams provides a telling example of ways in which competing values result in ambivalence that affects design. Dams, being large-scale structures in the open landscape, create sites that combine long-held American notions of beautiful, pastoral, picturesque, and sublime. Yet, dams incite the terror within the sublime, raising conflicts regarding the unknown limits of technology—its power, nature's power, the power of human invention. And,

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688 All quotations in this paragraph from Marx, *Machine in the Garden*, 220-21, and image of the Innes painting, in Marx, pl. 2.

perhaps at base was working a terror of not knowing the full political process that brings the large dams into being. There is not space in this dissertation to discuss the ambivalences inherent in the marriage of capitalism and democracy and their processes, though it is certainly implied in my discussion, and amply discussed by historians elsewhere. Aesthetic ambivalence within this pastoral ideal is most clearly seen in waterworks architecture in times when cultural stress rises and heightens embedded and unresolved tensions within those conflicts. Perhaps the figure *par excellence* to represent this situation was the Mulholland Dam in Hollywood—and it was erased.

A RESOLUTION, OR RESOLVE

Aesthetic ambivalence came to a head for waterworks engineering in a different way during the early 1930s, when the architectural design for the colossal Hoover Dam on the Colorado River remained unresolved.[689] Unable to devise a proper aesthetic solution to the problem of style for this dam of unprecedented mass, scale, and visual impact in the landscape, design engineers called in prominent Southern California architect Gordon Kaufmann to resolve the form-to-function conundrum. Kaufmann's work was highly visible in Los Angeles and elsewhere; his downtown Los Angeles *Times* newspaper headquarters, a celebrated Art Deco icon in its time, was under construction. Prior to Kaufmann's hire, dam engineers had been unable to force any of several "applied" historical revival designs to succeed—and they finally threw up their hands while grappling unsuccessfully with a Gothic Revival attempt. Kaufmann's modern, Art Deco design for the Hoover Dam—Boulder Dam at the time—honored the structure's function, its mass, and the potential theatricality of its scale and setting. Kaufmann retained the dam's dominant and design-squelching feature, the smooth utilitarian expanse of its monolithic, curved-arch concrete face, which highlighted its function by

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[689] I do not discuss here the seven-state Colorado River Compact to create the water system on the Colorado River, signed in 1922. Damming and diverting Colorado River water was originally initiated much earlier by California water planners and could be discussed as a "California" project, even though it was a Federal building project. It involved seven states, and California's watershed contributed nothing at all to the Colorado River. Nonetheless, the Compact gave California the largest share of Colorado River water.

emphasizing its height, size, scale, and building material relative to the vertical rock canyon surrounding it. **[Figure 251]** The Art-Deco design strategy, whose theatrical overstatements, grounded in verticality, matched and enhanced structure and scale in the dam itself, also functioned to unify the dam with its oversized appurtenances—hydropower facilities, pumping structures, intake towers, outlet gates, spillway. Kaufmann brought monolithic mass into human-scale balance at the crest of the dam, with the architecture of the roadway curve, figural sculpture, and narrative mosaics and friezes, all located where visitors met and communed with the colossus whose footings straddled the massive canyon, but whose surface and height seemed suspended as though a curtain hung to close off the great canyon's space. With this successful design, Kaufmann dispelled aesthetic ambivalence with resolve, creating a unified design program whose artistic form honored structural function. Kaufmann's holistic approach, which applied a single design scheme to the entire compound of structures that made up the massive Hoover project, and which attended both to structure and to surface as integrated elements, was a novel approach to dam design. This was not a historical revival dam; it was a product of its own time and place, and of its own, and proper, form. This was most pronounced given the unprecedented size, scale, and global visibility of the federal government's first major Bureau of Reclamation project.

At the same time, Kaufmann's work on the Hoover Dam brought him to the attention of the new Tennessee Valley Authority: the TVA hired him as its first consulting architect for the five-dam system's initial design planning.[690] The entire federally-owned TVA came to be grounded in an integrated modernist design program guided by a central architect's office: modernist architect Roland Wank succeeded Kaufmann's consultancy, becoming the TVA's lead architect. Although neither the Hoover Dam nor the TVA falls within the direct purview of my study, I cite their architect-led designs as cases where explicit acknowledgement of the need for the "marriage" of aesthetic and utilitarian design overcame, or rather pre-empted, the

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[690] After Kaufmann's consultancy, Roland Wank became the first chief TVA architect, followed in 1937 by Albert Kahn. See Walter L. Creese, *TVA's Public Planning: The Vision, The Reality* (Knoxville, TN: University of Tennessee Press, 1990), 6, 213, 368 n. 67.

conflicted design indecision that aesthetic ambivalence wrought. These two grand-scale projects consciously sought the specific expertise of a central architect—the Hoover Dam by default when engineers admitted aesthetic defeat; the TVA by design, with an aesthetic program embedded from the start. As this dissertation has clearly illustrated, the practice of seeking aesthetic design expertise from an architect was common practice in the design of most American waterworks. This is not to deny engineers their place in the aesthetic design process: Eastwood's multiple-arch dam is a case in point. It achieves engineering's ideal aim for efficiency and economy, a true example of modernism's form-follows-function edict; its requisite *elegance* factor makes it a solid instance of *structural art* for American waterworks. Billington's clear parameters and Sullivan's pert tenet together button up an ample modern aesthetic philosophy that regards with high cultural value the visual character of materials and forms inherent in the economy of urban structures.

Now, just add water.

CONCLUSIONS

I return to the epigraph with which I began this dissertation, by Henry Nash Smith, a historian who had significant influence on cultural thinking about the American West. Nash proposes: "History cannot happen—that is, [people] cannot engage in purposive group behavior—without images which simultaneously express collective desires and impose coherence on the infinitely numerous and infinitely varied data of experience." Part of Nash's point of view solidly grounds a twentieth-century attraction to structuralism, a view that appeals to a sense of order and balance by seeking to comprehend culture through commonalities, even universalities, in internal human motivations and social organization. This type of structuralism relies on symbols and images common to a given cultural group as internal signposts for meaning. It grounds human history in similarity and commonality. This is appealing for the tension-relieving balancing act narrative denouement provides. Here, history is story: beginning, middle and end provide viable lessons that make sense within the schema into which the narrative figures structure themselves, or, stated perhaps more precisely, within the situations in which the author-historian places and directs those figures in the crafted historical narrative. Without these, said Smith, "history cannot happen."[691]

Leo Marx then pointed out ways in which incongruity or disjuncture in the mythic narrative Smith identified—which Marx called the pastoral ideal—disrupted accepted historical narratives related to ideas of landscape. The problem Marx the difficulty Americans had through their historians in reformulating the historical narrative to reflect, even embrace, industrial technology's rupture of traditional ideas of landscape. For Marx, landscape ideals were so foundational in American identity formation, that the disruptive image of industry (in the form of a steam engine slicing through the lands of the American West) posed a cultural problem, a resistance to incorporating an apparently incoherent, foreign, image into the accepted standard narrative. In other words, how does a culture that identifies with a certain kind of defining narrative deal with conflicting

[691] Henry Nash Smith, *Virgin Land*, ix.

terms within it that result in an ambivalence that resists conceptual change? Marx's openness to tolerating such ambivalence, and to accepting terms that do not concord with familiar ways of perceiving history and identity are characteristics that suggest a poststructuralist approach. Marx understands the accepted cultural narrative but is able to step outside it; when he does, it becomes clear that the pieces do not fall together into a neatly-composed narrative. The doubt that arises with the rupture creates a series of questions that require new relationships with the old material. Marx suggested that a dialogue among the new and apparently disjunctive terms was the way to exit the closed circle of the traditional narrative.

Taken together, these two historians encompass a mid-twentieth-century snapshot of the history and culture of the American West; both express a need for a historiographical repositioning and cultural conceptual restructuring of the ways in which a culture conceives and tells its history. The two thinkers reflect a transition point in their own (also my own) mid-20th-century American culture, a position that represents a fulcrum, a toggling in thinking between structural and poststructural modes of analysis. If the waterworks structures I study span a fabrication history of 1800 to 1939, then this particular generation of thinkers poses frames of analysis quite pertinent, in their day, to the quandaries inherent in the formal problems of modernism arising in the time period—about 1939—with which I end this dissertation. These issues affect my analysis of the waterworks designs I present. My identification with Marx's "cardinal metaphor of contradiction"—the machine in the garden—signaled a deep historical cultural ambivalence, and this is one an area of my own study that will bear ongoing examination.

In this cultural view, force and counterforce coexist, but not in the mythic-literary balance that Nash's identified narrative more neatly ties up. Marx's very different perpective imagines a fulcrum that supports a see-sawing offset of imbalance, arresting and endless, in the clash of opposites. In Nash, the desire to rest in structural balance and sense rubs up against Marx's awareness of counterforces that resist balance, meaning, and sense: in fact, these aggressively interrupt.[692] Marx's contribution is the attempt to wrestle with irreconcilable incongruities in the concrete evidence of everyday life, against Nash's recognition of a persistent desire to regulate or balance incongruity with underlying images that "impose" a structural historical narrative. Both literary historians recognize that the comfort a structural armature offers is that of making sense, offering "coherence" for "infinitely varied data of experience." Marx is different in that he explicitly tackles defining a problem that impedes coherence, comprehension, or meaning. His key image, the machine in the garden, upsets and undermines the traditional identity-forming narrative. Marx explicitly names the discordance of two irreconcilable terms working at an unconscious level, and proposes ways in which the conflicting ideals of landscape and technology coexist (even as they push against each other) to create a characteristically American inner conflict, a cultural ambivalence.

The area of study I identify in this art historical dissertation is an extension of this problem. Waterworks systems present a type of image in which the machine and the garden exist together. Architectural design of waterworks finds a way to wrap the two together into a culturally legible, recognized aesthetic form. It has been my work in this dissertation to unearth and present a formerly unwritten history of architectural forms urban waterworks have taken during 19th-century urbanization in the United States. I begin to pose questions that address contexts for changes in cultural values regarding the pastoral and other landscape ideals, as these apply to water and related land use issues in the American West, but ultimately in California. These theoretical investigations require further investigation, for example, into the development of critical theory and of architecture with the relocation of Frankfurt School thinkers and of modernist architects to California. This will require further study of ways in which such values developed in the greater Los Angeles area, and in the larger purview of Southern California.

The persistent myth of difference, near rivalry, between Southern and Northern California, as this pertains to water and water systems development needs to be more closely examined through continued analysis of aesthetic aspects of waterworks there as

[692] Quotes in this paragraph, Marx, *Machine in the Garden*, 229.

well. My single sampling from Southern California in this dissertation is the closing case study of the Hollywood and Lake Hodges dams. This in itself constitutes a disjunctive departure from the main narrative of my own study. It is a pertinent disjuncture. I use its large scale to emphasize my opening onto the issues I present above. Bbecause it deals with giant waterworks structures affected in large-scale aesthetic ways by a formidable water disaster, it serves to dramatize in visual terms what otherwise would remain a nuanced point about the cultural ambivalence I focus on. I will expect to find other ways to examine this cultural ambivalence toward design.

For the most part, the architectural design of waterworks structures between 1860 and 1939 is unambivalent. Engineers and civic and business leaders relied upon the aesthetic vision of architects to give visual form to waterworks structures, as I have soundly established. To one degree or another, as I have shown, waterworks designs conformed to the architectural design standards for their time and place, from 1800 forward. I show this to be the case up until the Pulgas Water Temple's construction in 1939 for the city of San Francisco. The Pulgas Temple was not the only works structure funded as a Public Works Administration project, and this is an area of interest as this study moves forward. The values inherent in the Tennessee Valley Authority architectural vision, following on the heels of the massive design conundrum presented by the Hoover Dam, will help to articulate ways in which national ideals arising from New Deal works projects and the gargantuan water projects of federal and Army Corps reclamation affected thinking about aesthetics for water systems development in California. And, conversely, one will look to ways in which California's own renowned hydraulic systems influenced the wider world of water collection and conveyance from the 1940s forward.

Formally, and not surprisingly to an art historian, dams, aqueduct canals, and waterworks buildings begin to demonstrate what we might call a minimalist aesthetic, until by the end of the 20th century they begin to disappear as they take on the quality of low, horizontal relief in design, and as more major works constructions are literally placed underground. Waterworks sites may become less visually attractive by one architectural standard, but by another that includes the way they present themselves in the landscape, waterworks grow as tourist destinations. Architectural design just after mid-century begins to lend its aesthetic to visitor centers and viewing structures. This entails elements of landscape architecture history that I will continue to explore. Around the turn of the 21st century, water museums begin to develop at waterworks sites, and a trend of conservation and creative reuse begins with the renovation of historic waterworks buildings into water museums, and water and environmental education centers. The latter is active and ongoing today, a vivid demonstration of the high cultural value waterworks architecture displays.

Finally, I will give attention to methodological questions regarding my own field's relationship to utilitarian works buildings as proper objects for art historical study. For anyone working in ancient periods, where archaeological ruins are principal sources of evidence, large-scale infrastructure is an accepted and common area for art historical study. I have completed initial studies of water-related architecture and imagery for Republican Rome and for pre-Columbian Mesoamerica. By stark contrast, finding art historical materials or another art historian who works on waterworks architectural history is not as readily available. I am often asked "how" my topic fits into 19th and 20th century modern art history, while I am lauded for similar projects for ancient, pre-modern, and even Renaissance period waterworks. This will bear further investigation, as well, into art historical values that inform ideas of use and beauty, work and leisure, production and display, utility and aesthetics. As I have pointed out, to examine ambivalent stances toward aesthetics in utilitarian waterworks structures may help as much as iconographical analysis of ornament, form, style, or landscape setting to expose veiled ways in which cultural values direct interpretation of visual aspects of waterworks. It is my aim to add this discussion to existing scholarly debate, for, as we enter a millennium fraught with global concerns about water and the environment, the methods of aesthetic analysis emerge as tools to help reveal values embedded in cultural objects that define urban space and a culture of water in California and the American West.

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