An Archaeological Assessment of the Eugene Millrace Diversion Dam and Intake for the I-5 Willamette River Bridge (#08329) Project, Lane County, Oregon

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Heritage Research Associates Report No. 314

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MANAGEMENT SUMMARY

A significant industrial archaeological site, consisting of the remains of the diversion dam and intake from the historic Eugene Millrace, occurs within the APE of the proposed I-5 replacement bridge over the Willamette River in Eugene and Springfield, Lane County, Oregon. The bridge replacement project may impact portions of this site that line the south river bank beneath the bridge. The Eugene Millrace Diversion Dam was determined National Register eligible in 2003, prompting the historical research and archaeological investigations described in this report.

Initial development of the Eugene Millrace in the mid-1850s relied upon natural fall to generate power for industrial and commercial development. Following damage from a series of floods, the millrace was expanded significantly in 1891 when a wing dam was built to divert more flow from the river. As water-powered industries gave way to electric power, industrial development along the millrace declined after 1910-1911, with the last water-powered industrial user on the millrace closing in 1928.

Eleven millrace features have been identified in or near the APE. Construction of the diversion dam, weir-intake bay, channel, log crib, and intake gate may have occurred as early as 1891. All of these features are conservatively estimated to date to before 1910. Downstream are channel remnants that probably date to 1910. Later, between 1949 and 1959, a conduit, pump house, and railroad overcrossing were constructed farther downstream by a fill gate that serves as the water entry for the modern millrace

A comparison of the features still present on the ground with those shown on a 1953 Oregon Department of Transportation sketch map prepared in conjunction with initial construction of I-5 indicates that a majority of the Eugene Millrace features are intact. Despite their location at the focus of previous interstate bridge construction, elements of the diversion dam and intake have remained, for the most part, in their original positions. Consequently, these elements retain a substantial degree of preservation in terms of all seven aspects of integrity (location, design, setting, materials, workmanship, feeling, and association) required by the National Register criteria.

Although millraces developed for power generation survive as landscape features in other Oregon communities, the Eugene Millrace is distinguished by the continued existence and integrity of the diversion dam and intake, arguably the most significant portion of any millrace operation. This site not only meets National Register Criteria A and C as determined in 2003, but also Criterion D for the information that study of the various walls, abutments, revetments, and in-stream concrete features associated with the diversion dam and intake can yield about the design and operation of the historic Eugene Millrace.

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1. INTRODUCTION

The remains of the Eugene Millrace have been identified within the project area of the proposed I-5 replacement bridge over the Willamette River in Eugene, Lane County, Oregon. The bridge replacement project may impact the portions of this site that line the south river bank beneath the bridge. The Eugene Millrace has been previously determined eligible for inclusion in the National Register of Historic Places based on its significance in history (as discussed below).

This document focuses on the physical remains of the Eugene Millrace and identifies the remnants as composing a significant industrial archaeological site. Industrial archaeology is "the systematic study of structures and artifacts as a means of enlarging our understanding of the industrial past" (Palmer and Neaverson 1998:1). The discipline of industrial archaeology has grown in recent years out of a "concern for the survival of field evidence" left behind by early industries in the face of modern development (Palmer and Neaverson 1998:15).

Previous archaeological investigations along the Eugene Millrace have focused on the downstream portion around the "Eugene Millrace Industrial District" near the millrace outlet south of Ferry Street Bridge (IRI 1992; Minor 1998). This report represents the first identification and assessment of archaeological remains from the millrace diversion dam at the upstream end of the millrace, arguably the most critical portion for understanding how the millrace provided power to the industrial district downstream.

As a result of research undertaken to identify the portions of the Eugene Millrace that remain within and adjacent to the I-5 project area, a more detailed chronology of millrace development at the upper, intake, portion of the millrace has been compiled. In the event that additional documentation for Section 106 compliance is required, this document contributes to further understanding of the surviving resources and provides guidance for any future interpretation of the site.

Location and Setting

The remains of the Eugene Millrace diversion dam and intake are located approximately at Willamette River Mile 184, about 2 miles below the confluence of the Coast Fork and Middle Fork of the Willamette River. The Willamette River Bridge extends over the top of the remains to the east side of Judkins Point, a prominent basalt hill that separates the City of Eugene from the community of Glenwood, which is now incorporated into the City of Springfield. The millrace remains below the bridge, now within the bridge

replacement project area, are located in the SE¼ of the SE¼ of Section 33, T17S, R3W, W. M. (Figure 1).

Area of Potential Effect (APE)

For the purpose of Section 106 compliance, the Area of Potential Effect (APE) for the proposed project in the area of the Eugene Millrace includes tax lots directly adjacent to I-5 between Franklin Boulevard and the Southern Pacific Railroad, and lots between Judkins Road and I-5 to the south of the railroad. The APE extends outside the existing right-of-way to allow for staging and access for bridge removal and construction activities (Figure 1).

Methods/Sources Consulted

The following presentation is based upon review of available printed and graphic materials that document the development of the upper portion of the Eugene Millrace, significantly informed by the post-World War II aerial photography of Judkins Point provided by the Oregon Department of Transportation (ODOT). The archives at the Eugene Water and Electric Board (EWEB), as well as the Lane County Historical Museum, the Springfield Museum, and the University of Oregon's Oregon Collection, were also consulted for materials pertaining to this portion of the millrace. None of the six historic maps (ranging in date from 1890 to 1931) on file at the Lane County Historical Museum, which contained the most relevant information for this study, show any details of the intake portion of the Eugene Millrace, and no engineering plans have yet been located for the millrace. The City of Eugene provided background material on the millrace from their files that had been obtained during earlier research efforts on downstream portions of the millrace.

This report reflects the combined efforts of three authors. George Kramer reviewed the history of the Eugene Millrace and developed a tentative construction sequence for the millrace features in the APE. Rick Minor and Kathryn Toepel oversaw documentation of the extant millrace features through mapping and photography and assessed their significance.

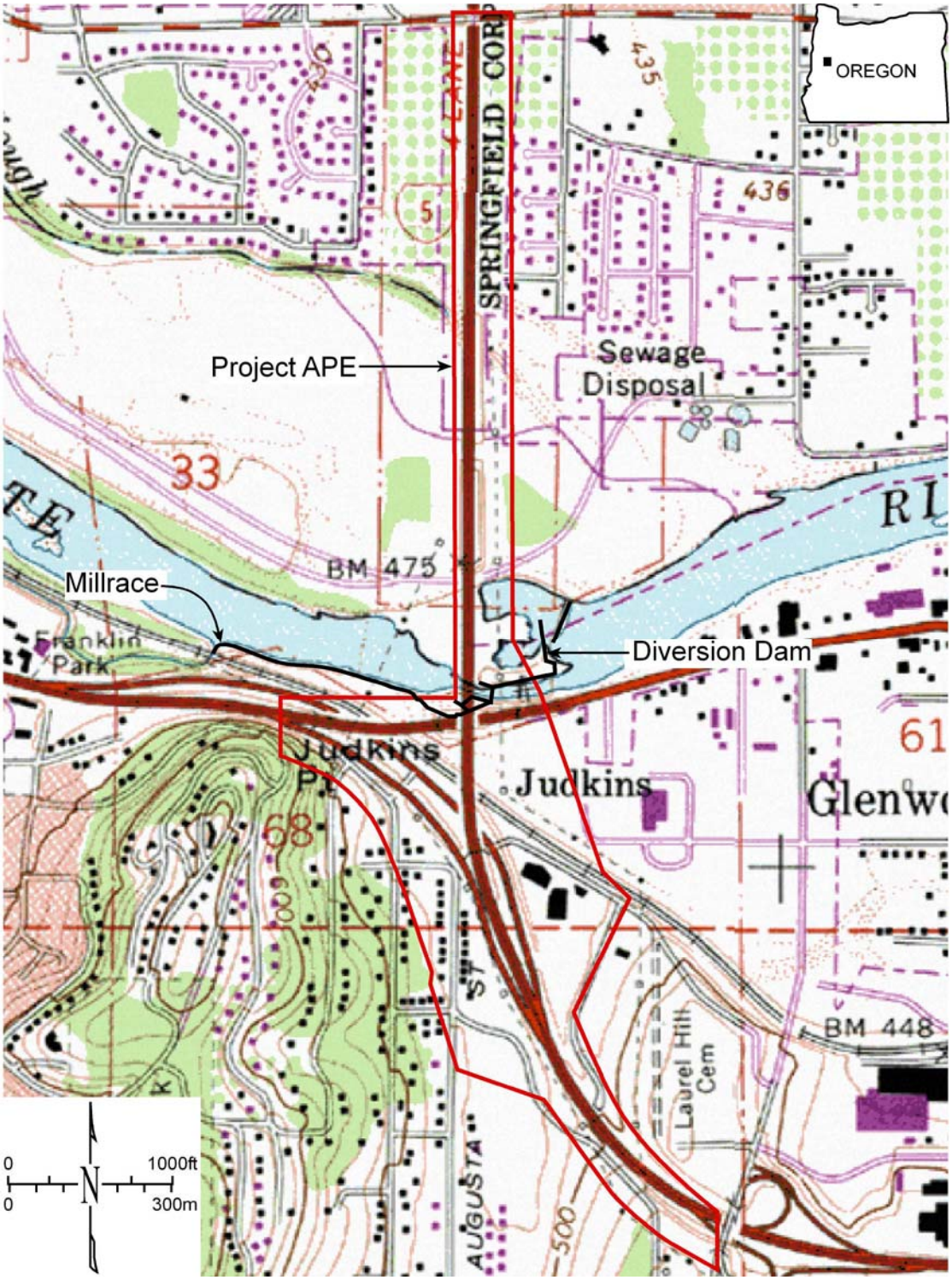

Figure 1. Location of the Eugene Millrace in relation to the APE for the I-5 Willamette River Bridge Project (USGS Eugene East 7.5′ quadrangle, 1986).

2. ASSESSMENT OF THE EUGENE MILLRACE

A Determination of Eligibility (DOE) document prepared for the proposed I-5 replacement bridge over the Willamette River at Judkins Point refers to the "potentially eligible Eugene Millrace Diversion Dam" (McMurry 2003:3).[1] Concurrence with the DOE by the State Historic Preservation Office (SHPO) provided the basis for the treatment of the dam (identified as Resource 1) in the I-5 Willamette River Bridge Draft Historic Resources Technical Report as "previously determined eligible" (ODOT 2006:11) and prompted the additional investigations presented in this report.

Careful reading of the DOE makes clear that the "Eugene Millrace Diversion Dam" was recognized as a major element within a larger grouping of "ruins" that lined this area of the Willamette Channel, including a series of concrete revetments that carried the water diverted by the dam, collectively forming the "intake" and upper end of the Eugene Millrace. Although the land-based remnants of the millrace system were not specifically cataloged, the determination of significance was based on association with the millrace's operation and role in Eugene's development. The evaluation of significance concludes, "While *these features* no longer serve their original purpose, they are significant for their association with the development of the millrace… *These features* are a significant part of this system and are potentially eligible for inclusion in the National Register of Historic Places as a part of a grouping that includes the remaining built features along the millrace's length" (McMurry 2003:5; emphasis added).

As indicated in the narrative description in the approved DOE request, the Eugene Millrace Diversion Dam essentially serves as a collective grouping of all the related millrace resources above the present intake, extending from the Diversion Dam in mid-channel westward approximately 0.5 mile to the present intake and pump house. Accordingly, it is assumed that the dam and all of the related features on the south bank have been previously determined eligible and will be subject to Section 106 evaluation in the event that there are any future impacts on these resources from the bridge replacement project.

Although the Eugene Millrace was evaluated as a standing historic structure in 2003, it may more appropriately meet the definition of an industrial archaeological site. The upstream portion of the Eugene Millrace, including the diversion dam and the intake revetments, no longer serves its original purpose, but the remnants are clearly visible for

[1] An archaeological survey for the I-5 Willamette Bridge Replacement Project was undertaken by the University of Oregon (Connolly et al. 2003). This survey included excavation of three shovel probes on the south bank of the river: one in the vicinity of the millrace diversion dam remains and two north of Franklin Boulevard. No cultural materials were recovered in these three probes, and no mention was made of the millrace diversion dam remains beneath the bridge.

interpretation and for understanding further the workings of this industrial feature. As defined in *National Register Bulletin* 36, an archaeological property is

> …the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains. It is the physical evidence of the past and its patterning that is the archeologist's data base.
>
> …[For a historical archeological property, an] integrated historical and archeological investigation will generally produce more information about a particular historic property (or activities associated with that property) than would have been gleaned through the separate study of either the archeological remains or the historical record alone. (Townsend et al. 1993:2-3)

As with other standing structures, the integrity of a historical archaeological site is a critical factor in determining significance. Industrial archaeological sites in particular are often subject to the effects of demolition or modification of the historical fabric, which may obscure to some extent the degree of integrity still present (e.g., Patton 2001:17). However, integrity for archaeological sites, including historical archaeological sites, is determined in a more relative fashion than is often applied to the assessment of other types of historical sites:

> Because of the complexity of the archeological record, however, integrity is a relative measure and its definition depends upon the historic context of the archeological property…. the definition of archeological integrity varies from property to property. For properties eligible under Criterion D, integrity requirements relate directly to the types of research questions defined within the archeologist's research design. In general, archeological integrity may be demonstrated by the presence of spatial patterning of surface artifacts or features that represent differential uses or activities…. (Townsend et al. 1993:14)

As is demonstrated below, this industrial archaeological site not only meets National Register Criteria A and C, as determined in 2003, but also Criterion D for the information it can still yield about the design and operation of the historic Eugene Millrace.

3. HISTORY OF THE EUGENE MILLRACE

Millrace Industrial Development

Initial development of the Eugene Millrace occurred in the mid-1850s, when two disconnected natural channels, portions of which were dry in normal water flow, were connected in the middle via a "ditch." In its earliest form, the millrace relied entirely upon natural fall to create a continuous waterway from Judkins Point to downtown. "As Eugene City grew, the importance of the millrace grew also. The industrial and commercial life of the energetic little pioneer town centered on it banks" (Tweedell 1949:6). Water-powered mills of a variety of forms developed along the millrace and collectively served an important economic role in Eugene's nineteenth century development.

The millrace went through several ownerships during the nineteenth century. In 1877, the waterway was purchased by a group of industrialists led by William Edris and A. S. Patterson. This group made significant improvements to the millrace, including deepening and widening the channel and, apparently, expanding a timber crib dam at the intake that had been built by earlier developers (Tweedell 1949:6).[2]

The millrace was repeatedly impacted by floods and changes in the Willamette River channel, with major events in 1874, 1877, and 1881. A major flood in 1890 "seriously damaged the intake of the Millrace" (Eugene *Daily Guard*, 1 January 1913, as cited in Jones 1981:8). This flood "tore out the rock walls of the intake channel and changed the river's course" (Rees 1975:28). In 1891, Edris (having bought out Patterson's interests) sold the millrace to George Midgley and Frank Chambers. They expanded the millrace significantly and built a wing dam in the river to divert more flow into the race (Rees 1975:28). This structure was needed because the 1890 flood had "scoured the river channel" and deepened it by five or six feet (Tweedell 1949:12).

By 1910, the dam and the deepened millrace became controversial, with property owners adjacent to the race claiming that they were being regularly flooded as the result of these changes to the natural grade of the channel. Chambers, still the owner and operator of the Eugene Millrace, faced legal challenges demanding the removal of the wing dam to restore natural flow. In early 1911, a large group of property owners along the upper part of the millrace filed suit, demanding the destruction of the wing dam extending into the river at the head of the race.

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[2] The deed of transfer to Edris-Patterson et al., dated August 2, 1877, refers to the right to "sufficient dirt and stone lying adjacent to the dams for the purpose of keeping them in repair."

According to the group's petition, "the dam started at the curve of the river above the gravel bar across from 'Coney Island' and followed down the reef of rocks in the middle of the river to a 'crib' across from the intake at the island. From the crib to the island was a temporary structure which was removed to let log drives pass" (Tweedell 1949:12, quoting from a petition to Major J. F. McIndoe). *Based upon this description, the existing concrete dam in mid-channel near Judkins Point, as well as the associated in-stream features on the south bank, are assumed to have been in place by 1910.* This date is significantly earlier than stated in the Determination of Eligibility request, which roughly dated the diversion dam as circa 1920.[3]

While Chambers was successful in defending his operation of the millrace legally, plans to further deepen the channel to provide for hydropower generation do not appear to have materialized. As a result, the years 1910-1911 were the beginning of the end of millrace industrial development, as water-powered industries quickly gave way to electric power. The last water-powered industrial user on the millrace, the Fruit Growers Association's operation of the Eugene Ice and Storage Company, closed in 1928 following a flood that again breached the intake (Jones 1981:20; Rees 1975:31). In 1932, the Eugene Power Company commissioned an engineering study about the possibility of rebuilding and expanding the dam and millrace system for electric production, but nothing appears to have come of this effort (Russell 1932).

Providing motive power for more than seventy years, the Eugene Millrace allowed the development of significant industry in Eugene and played an important role in the city's transformation from a small pioneer settlement into one of Oregon's major population centers. Frank Chambers, onetime owner/operator of the millrace, told Bob Tweedell that "[the millrace] had quite a bit to do with developing the town and enabling Eugene to overtake Springfield, which was at one time the larger town" (Tweedell 1949:10).

Post-Industrial Millrace Development

With the end of industrial uses of the millrace in 1928, the waterway appears to have been largely viewed as a recreational amenity for University of Oregon students and others, continuing a tradition that had begun shortly after the turn of the twentieth century. "As the millrace lessened in industrial importance, it gained in recreational importance" (Rees 1975:31). While undocumented, some modification apparently occurred after 1928 that allowed water to enter the millrace channel, probably through a concrete wall intake west of the Diversion Dam and the Coney Island intake.

In 1938, the University purchased the property north of the millrace and east of the Anchorage, a boat house that stood near today's UO Physical Plant. Interest in the millrace, spurred on by students, focused upon retention of the millrace as a landscape feature lining the northern edge of the campus. Ambitious development plans included an

[3] It is entirely possible, indeed likely, that the existing dam was constructed in 1891, following damage to the intake by the 1890 flood. No references to any improvement or modification to the intake between 1891 and 1910 were located.

outdoor amphitheater and a park. The Oregon State Highway Department, in coordination with the City of Eugene, considered the potential for relocating Franklin Boulevard (the Pacific Highway/US Hwy 99) and the Southern Pacific Railroad tracks to enhance the millrace features. Because of World War II, these plans were delayed and then, in 1942, another major flood damaged the intake, shutting off water flow and leaving the millrace dry.

"In 1945, at the war's end, the plans for relocation of the highway and railroad tracks were resumed, but plans for the millrace were left hanging because it was still dry" (Rees 1975:34). In 1947-1948, in connection with the construction of a new Ferry Street Bridge and the realignment of US Highway 99, the City of Eugene, following a special bond election, purchased the millrace from its former owners.[4]

Some reports document that the millrace intake was repaired to charge a 42-inch-diameter pipe that returned water to the millrace in 1949. This does not appear to refer to the concrete-encased pipe that presently extends along the south side of the bike path east of the railroad overpass and is an EWEB water supply line (Mike McCann, EWEB, personal communication 2007). The reported pipe feature is not apparent in a 1951 ODOT aerial photograph (Figure 2), but was clearly in place by 1955 (Figure 3). The pipe apparently relied upon some unidentified in-stream intake feature west of the 1910-era diversion dam (Tweedell 1949:36, see also *Eugene Register Guard,* 17 September 1952).[5] Although refilling the millrace, water flow from the pipe was limited. "Both the pipe used to patch the intake channel and the pipe under the new highway were too small to accommodate an adequate flow" (Rees 1975:35).

As with the pipeline discussed above, there is some discrepancy about whether the existing electric pumps were initially installed in connection with the pipeline, or were added later to address the limited flow. According to Tweedell, the pumps were a part of the 1948 engineering plan presented to the city by John Cunningham, a consulting engineer from Portland. "Two pumps were to be installed, providing a water flow of 15 cubic feet per second. Both pumps would operate during the summer, but only the smaller would be used during the winter" (Tweedell 1949:40).

However, immediately following the City Council's approval of this project, aided by the financial support of the Millrace Protection Association, a particular property owner near the intake began to infill the portion of the millrace crossing his property, resulting in the so-called "Battle of the Millrace" (Tweedell 1949:42). This may have halted any other development or progress to charge the millrace. At any rate, aerial photographs do document that the pipeline, without any pumps, existed and ran through an open bay of the railroad overpass as late as 1955.

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[4] This also appears to have been the date of the relocation of the Southern Pacific Railroad line north of Franklin Boulevard.

[5] ODOT aerial photos as late as 1958 clearly show this pipe continuing through the railroad overpass.

Figure 2. Aerial photograph of the millrace intake in 1951 showing the millrace flowing beneath the railroad overpass west of the project (ODOT JP4-3-51).

Figure 3. Aerial photograph showing the project area in 1955 (ODOT JP7-12-55).

Other reports imply that the University students, frustrated by the tepid stagnant water in the race in the early 1950s, hired their own engineering firm to investigate options to improve flow. "Students hired an engineering firm to investigate the possibility of increasing the flow of the race, and, upon the advice of the report, convinced the University and the City to install pumps to increase the race's flow" (Rees 1975:37).[6] Rees further states that in 1949 the Oregon Highway Department "buried a portion of the millrace in a 30″ pipe, effectively limiting its flow to 25 cfs," although it is not clear if this refers to a portion of the lower race rather than the conduit just west of the intake (Rees 1975:37).

Clearly, based on the existing configuration of the millrace, where the abandoned concrete-lined pipe runs into a pump/gatehouse immediately north of the railroad overpass, the conversion of the race to piped/pumped water intake occurred in two phases. No reference to the current steel-pipe intake or its date of construction was located, and available aerial photographs indicate the existing pump house was not constructed until after 1958. The same source shows the pump house in place by 1960 (Figure 4), and it is assumed that the present intake in the channel was built in connection with its construction.

Figure 4. Aerial photograph taken in 1960 showing bridge construction activities in the millrace area, as well as intake relocation and pump house near railroad overpass (ODOT JP8-5-60).

[6] Rees' bibliography cites both the 1948 Cunningham report (as referred to by Tweedell) as well as a subsequent study by Corning, Howland, Hayes, and Merrifield (CH2M) dated 1955.

According to the most recent documentation on the functioning of the millrace, the University of Oregon appears to own the intake to the millrace and presumably is responsible for the operations of the pumps. "The U of O has a water right to pump water from the Willamette River just below Judkins Point near the I-5 Bridge into the Eugene Millrace, which is referred to as 'charging' the Millrace. There are two alternating pumps rated at 12 million gallons per day at this location" (U of O Central Power Station, Permit Evaluation Report, c. 2006).

Tentative Construction Sequence

With the exception of the in-stream three-headed steel intake and the University of Oregon operated pumps and pump house, no millrace resources located north and east of the railroad overpass are functional elements today. While inexact, the following timeline attempts to catalog what appear to be the dates of construction and, where appropriate, abandonment/damage associated with the millrace resources in or near the APE for the I-5 bridge (Figure 5).

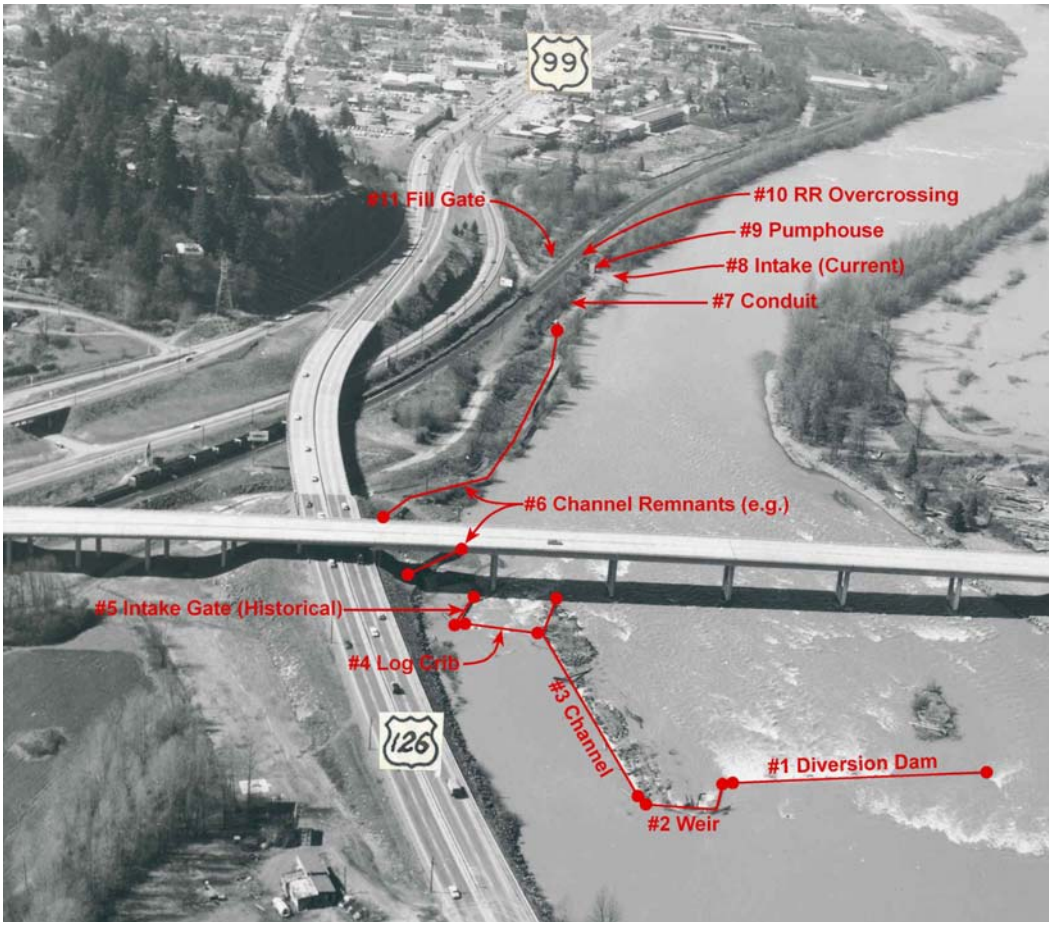

Figure 5. Location of Eugene Millrace features superimposed on 1962 aerial photograph (ODOT 164-14) (see Figure 12 for detail of features within the I-5 corridor).

1. Diversion dam (pre-1910): This dam is located mid-channel, east of the temporary detour bridges and includes in-stream concrete buttress elements formerly associated with timber cribs or flashboards. Construction may have occurred as early as 1891; it was then damaged and abandoned following the 1928 flood.

2. Weir/intake bay (pre-1910): Located atop "Coney Island," at south Willamette Channel east of temporary detour bridges, this roughly trapezoidal "bay" extends upriver from the primary dam line and served some undetermined purpose to direct water into the main millrace channel. This feature is assumed to have been part of previous dam construction and then damaged in the 1928 flood.

3. Channel (pre-1910): These remnant concrete walls line the bedrock of "Coney Island" east and beneath the temporary detour bridges and serve as the head of the millrace proper. Historical photographs compared with modern aerials (e.g., GoogleMap) indicate that this system originally created a fairly uniform 100-foot-wide channel that extended from the "weir" to the assumed "log crib." While not documented, intake modifications undertaken post-1928 likely occurred in this area. These remains are assumed to have been part of previous dam construction, damaged in the 1928 flood, and repaired or altered to provide flow through 1942.

4. Log crib (pre-1910): Extending south from the channel at a downstream angle, this feature appears to be the "log crib" that functioned as a removal gate for log rafts (see Tweedell 1949:12). This feature is assumed to have been part of previous dam construction, damaged in the 1928 flood, and possibly modified to provide flow through 1942 (Figure 6).

5. Intake gate (pre-1910): As modified following floods, this element almost certainly funneled water into the channel after 1928 and through 1942. An angled concrete wall constricts the water and directs the water flow into the millrace proper, just downstream from the log crib (Figure 6). This element had a downstream extension, perhaps for strength, that *may* be the buttressed wall exhibiting modern graffiti that is visible from the bike path (Figures 7 and 8).

6. Channel remnants (c. 1910): Continuing to the west (downstream), various concrete walls likely relate to the 1910 improvements to the channel and the increase in "head" pre-1910. Large portions of this wall appear to be damaged or missing from repeated flooding. Based on historical data, they may have been repaired and provided some function after the 1928 flooding until 1942 when another flood caused the millrace to go "dry." Aerial photographs as late as 1955 show this channel to be largely intact and carrying water flow into the millrace system (Figures 2 and 3). Substantial sections of the concrete revetments are still within the project area (Figures 7-9).

7. Conduit (c. 1949): Water flowing through a pipeline "charged" the millrace following acquisition by the City of Eugene, but the pipe's use may have been short lived, as it was not a successful effort. The present pipe, clearly built after 1951 based on ODOT aerials, is a water pipe for EWEB but appears to occupy the location of the millrace pipe that

Figure 6. View to north from south shore of revetments and features associated with the intake gate (#5) and log crib (#4) beneath original I-5 bridge (left) and detour bridge (right).

Figure 7. View to southeast looking toward the original I-5 bridge (in background) showing large revetment marking former millrace channel.

reportedly augmented the flow through the overpass (see Figure 3). The relationship between the conduit and the channel remains unclear.

8. Intake (c. 1959): This later steel pipe intake was installed below the waterline and is now marked by warning signs. This is the current source of water to the Eugene Millrace and is assumed to have been installed concurrently with the present pump system.

9. Pump house (c. 1955, 1959): Concrete headbox, a portion of which was probably built in connection with the conduit and then subsequently modified with installation of pumps. This system is believed to be owned and operated by the University of Oregon.

10. Railroad overcrossing (c. 1949): This concrete culvert provides two bike/pedestrian paths beneath the elevated railroad grade and is assumed to be related to the 1949 relocation of the rail line in connection with Oregon State Highway Department highway improvements to Franklin Blvd. Field inspection indicates that this feature originally had four bays, based on physical patches, and additionally had three “gates” on the north face,

Figure 8. Reverse view of revetment shown in Figure 7 with I-5 bridge visible in upper corner.

Figure 9. View to northeast of revetment from west side of detour bridge.

as evidenced by surviving capstan wheels and through-port for the lift rod. The two gates on the east have been filled, one of which serves as the chase for the steel conduit that now fills the race below the pumps. ODOT Aerial Image JP4-3-51 (Figure 2) clearly shows the millrace once flowed through this feature.

11. Fill gate (post-1955): A small, steel grate protects the end of the steel conduit and serves as the water entry into the modern millrace. This feature is located immediately south of the railroad line and just west of the bike path as it crosses through the over-crossing. Physical evidence indicates that this feature originally had some sort of gate system at the north-facing elevation and has been subsequently modified.

4. ARCHAEOLOGICAL DOCUMENTATION

Although the significance of the Eugene Millrace, particularly downstream from the project area within the early industrial center of Eugene, has long been recognized, the upper portion of the millrace in the vicinity of the project APE has received little attention. As a result of the construction of I-5, ravaging from periodic flooding, and the somewhat fractured and disassociated appearance of the millrace remnants along the south bank of the Willamette River at Judkins Point, it has been assumed that this portion of the millrace has been extensively disturbed and has lost its integrity. To supplement the cultural resource investigations that have been carried out to date for this project, a reconnaissance was undertaken to document the current condition of the millrace remnants.

In conjunction with archival research that focused on identifying millrace features within the APE, archaeologists conducted limited field documentation of these features. An intensive pedestrian survey at intervals of 10 m or less was conducted within the APE to identify features and artifacts that may be associated with the millrace and its use. On the basis of the survey, it was concluded that the major elements of the millrace are above ground and that there was very limited potential for subsurface archaeological deposits associated with the millrace. As a result, no subsurface probing was conducted.

Instead, the extant concrete features were mapped in the project APE beneath and adjacent to the I-5 bridge alignment within the existing right-of-way on the south bank of the river. The archaeological team first located all existing concrete water-management features within the existing right-of-way, then they used a laser transit to accurately record those locations. Some millrace concrete features are located in the river and were not accessible by land; it was not deemed prudent to attempt to traverse the deep, swift water of the former millrace channel, and these features were not mapped by transit. Instead, the locations of these inaccessible concrete features were estimated by referring to aerial photographs and a 1953 sketch map of the millrace. In addition, the concrete revetments were photographed (Figures 6-9).

A comparison of the features still present on the ground with the alignments shown on a 1953 ODOT sketch map of the area prepared in conjunction with the initial construction of I-5 indicates that a majority of the Eugene Millrace features are still present and are, in fact, quite intact (Figure 10). Exceptions include the southern portion of the millrace in the APE, which is no longer visible as it was buried under fill during the relocation of Franklin Boulevard. The revetments as they appeared before they were buried by roadway fill are shown in Figure 11 (cf. Figure 12). In addition, a portion of the millrace was apparently removed during construction of a powerline tower base (Figure 12). The powerline was constructed sometime after the initial construction of I-5. Toward the west

end of the APE, two major breaks in the millrace revetments appear to be attributable to the building of access roads related to I-5 construction, as indicated in the 1960 aerial photograph (Figure 4; enlarged in Figure 13). Considering that extensive construction efforts for both the original I-5 bridge and the detour bridge occurred virtually on top of the Eugene Millrace intake features, its current integrity is remarkable.

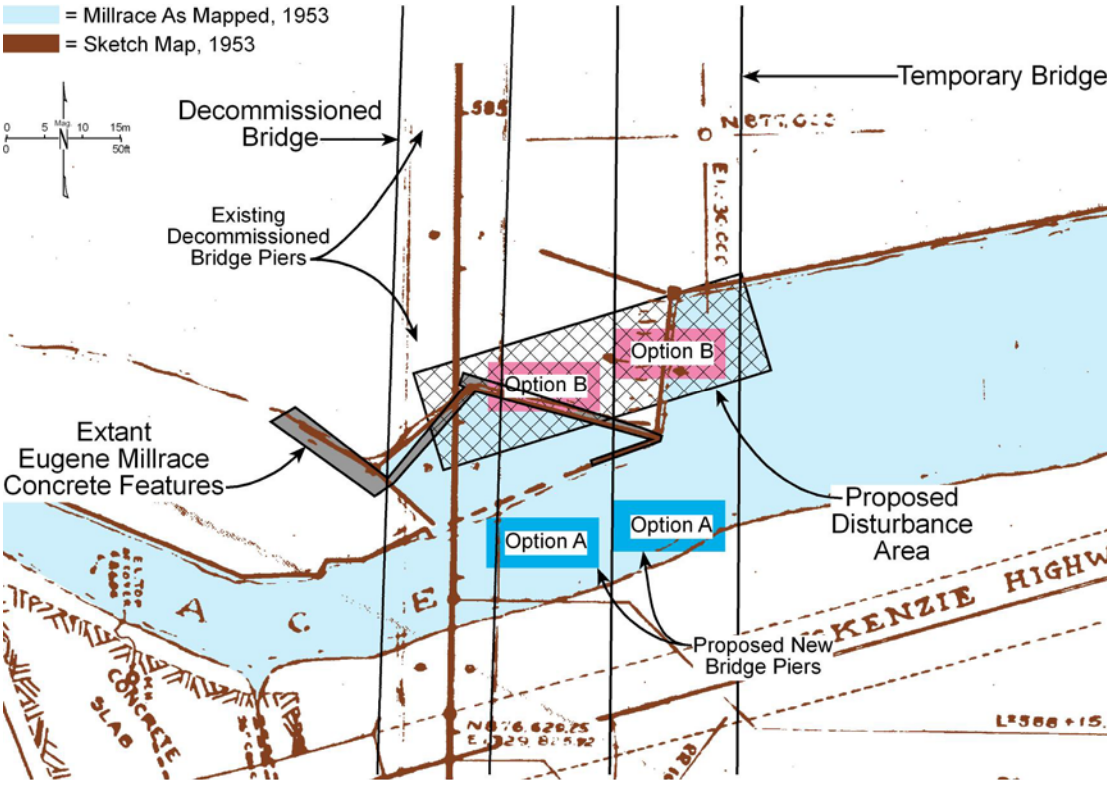

Figure 10. ODOT sketch map made in 1953 showing millrace features, millrace channel, and extant revetments.

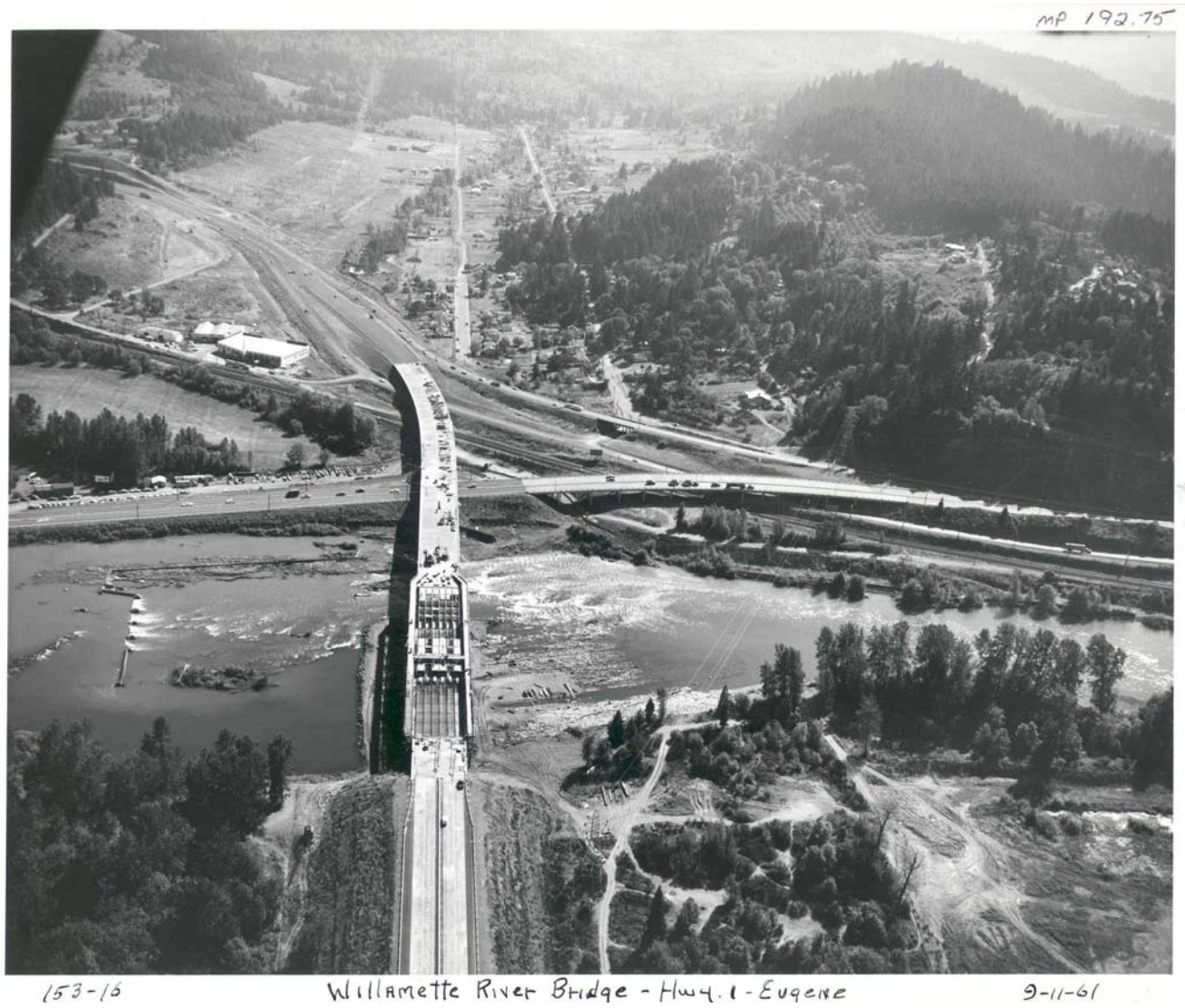

Figure 11. Vew to south showing construction of I-5 in 1961. Millrace revetmentsare visible both east and west of the I-5 bridge on the far side of the river at the base of the fill for Franklin Blvd (ODOT 153-15, 9-11-61).

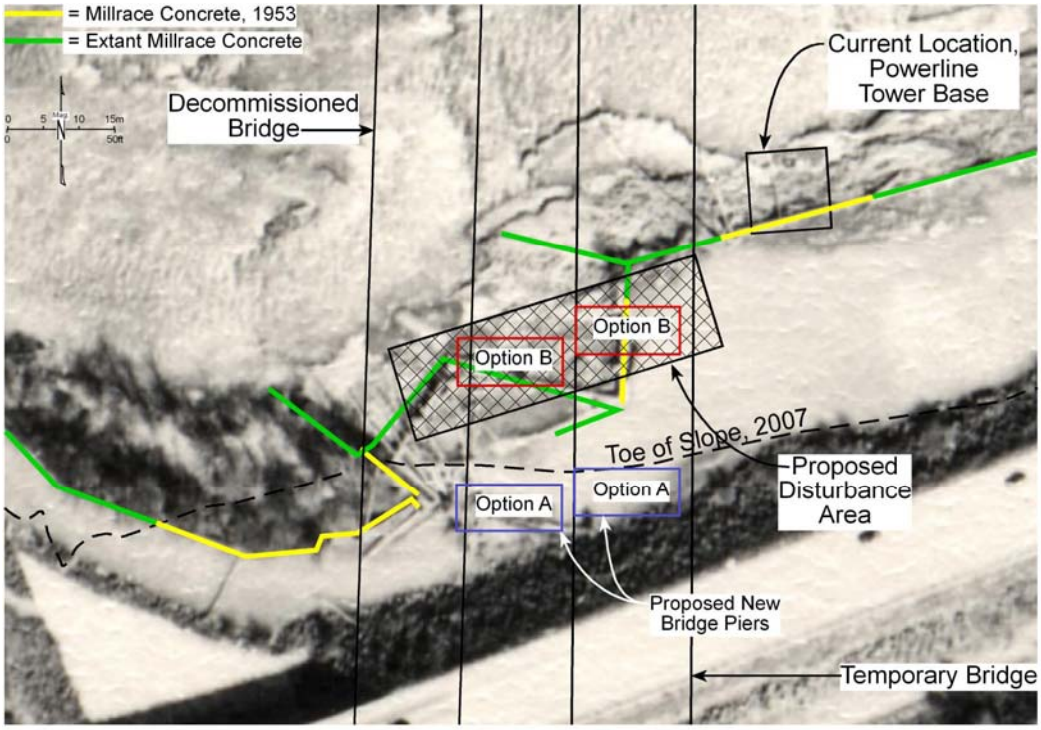

Figure 12. Millrace features from 1953 ODOT sketch map superimposed on 1951 aerial photograph base showing revetments that have been buried or removed by powerline construction (ODOT JP4-3-51).

Figure 13. Enlargement of 1960 aerial photograph showing avoidance of millrace intake features within the I-5 construction corridor and the breaching of the millrace revetments to the west to allow construction access (ODOT JP8-5-60).

5. SUMMARY AND RECOMMENDATIONS

Most existing research on the Eugene Millrace has focused on its earliest development period along its lower portion, the industrial uses that were supported by waterpower, and the various controversies in the post-World War II era to retain the feature as a recreation/landscape element. Lack of specific documentation, along with imprecise language to describe elements of the system damaged by floods, have impeded a clear understanding of the system, particularly as it relates to the upper intake area below the Willamette River Bridge that is the focus of this study. Archaeological documentation undertaken during this study suggests, however, that much can be learned from the features that remain in the intake portion of the former millrace.

Resource Assessment

Based upon available information, it appears that the existing wing dam and related features east of the current bridge location were in place by 1910. These features likely relate to the reconstruction and expansion of the millrace following the 1891 flood. The decline in reliance on waterpower and the failing prospects for the millrace system make it highly unlikely an entirely new system would have been developed in 1920, as some reports have indicated.

As a result, the majority of concrete elements within the project area are dated circa 1910, but are assumed to be older. With the exception of the conduit and pumping system, all subsequent work to channel walls, intake weirs, and cribs was almost certainly limited to repair or reconstruction following flood damage. Aerial images show that even as late as 1955 the millrace channel east of the overpass remained a functional waterway. The present pump and intake system, built circa 1959, is located directly north of the railroad overpass downstream.

The extant features of the Eugene Millrace diversion dam and intake are more than 100 years old and clearly meet the definition of an industrial archaeological site as the term is now applied by professionals in historic preservation (e.g., Patton 2001; Starbuck 1994; Townsend et al. 1993). Despite its location at the focus of interstate bridge construction over the past 45 years, the archaeological investigations confirm that elements of the diversion dam and intake have remained, for the most part, in their original positions. Consequently, these elements reflect a substantial degree of preservation in terms of all seven aspects of integrity (location, design, setting, materials, workmanship, feeling, and association), as required by the National Register criteria (Townsend 1993:17).

The Eugene Millrace is an outstanding example of a resource type that was a common feature relating to power generation in early Oregon communities. Relatively few of these features remain. The Eugene Millrace diversion dam and intake is the first such feature to be documented in Oregon as an industrial archaeological resource. While millraces survive as landscape and drainage features in a number of communities today, the Eugene Millrace is distinguished by the continued existence and integrity of the diversion dam and intake, arguably the most significant portion of any millrace operation.

Future Management

Although there is considerable documentation available on the Eugene Millrace in general, very little information exists on the construction and functioning of the upstream (intake) portion of the millrace. Local archives have been searched, and no engineering records or reports, drawings, or photographs have yet been found to explain the hydrologic operation of the millrace or the particulars of its zigzag configuration at the intake. It is likely that hydrological engineers can reconstruct much of the workings of the millrace by inspecting the features that remain. It is also possible that longtime, local residents may retain memories or photographs of the millrace from its earlier days prior to construction of the I-5 bridge.

As is clear from this document, much of the specific history of the diversion dam and upper portions of the Eugene Millrace remains unclear, with most information on the project's design and post-World War II development coming from available aerial photographs of the site that document its features at approximately two-year intervals between 1951 and 1962. Clearly, the various walls, abutments, revetments, and in-stream concrete features located west of the diversion dam and east of the railroad overpass/intake all relate to the development of the millrace as a key industrial feature in Eugene between the mid-1850s and 1928, satisfying the determination of National Register eligibility through that association. In the absence of engineering reports and other records for this industrial archaeological site, the integrity of the remaining features provides a basis from which the hydrologic engineering and operation of the millrace can be reconstructed.

In the context of the proposed replacement of the I-5 bridges, activities relating to both construction of the new bridges and demolition of the existing bridges will occur within the boundaries of the Eugene Millrace and associated features. Project design has not yet been finalized, and the extent to which the millrace features will be affected has not yet been formally determined. Two design options for placement of bridge piers are presently under consideration, each of which will have different degrees of direct impact on the Eugene Millrace and its features. Pier Location Option A would be located on the south bank of the river in an area of fill placed during relocation of Franklin Blvd circa 1960 and would avoid constructed elements of the millrace that are presently visible. Pier Location Option B, however, would result in pier placements directly atop some of the constructed features of the millrace and would cause their destruction (refer to Figure 2).

Because of the nature and significance of the Eugene Millrace, a number of management options are available for the protection, study, and interpretation of this resource:

1. Placement of proposed bridge piers should be made, if feasible, to avoid constructed elements of the millrace to reduce diminishment of the integrity of the resource and to maximize protection of millrace features for public interpretation. Placement of the piers is dependent on a number of factors, including bridge design and habitat considerations. Another source of potential impact is the demolition and removal of the existing bridges, as well as the transport of equipment and materials, through the Eugene Millrace site. Previous construction in the area of the millrace has been accomplished with remarkably limited impacts (Figure 13). If direct impacts to the built features of the millrace cannot be avoided, mitigation is recommended.

2. Mitigation measures for future study and interpretation may include, as appropriate, a hydrological engineering review of the millrace intake area to gain insight as to how the millrace was designed and functioned. Measured drawings and/or large-format photography is another standard method for documenting archaeological industrial sites that may be applied to the millrace:

> Unlike the more traditional subfields of archeology, in which digging is central to the recovery of data, industrial archeologists rarely dig and instead prepare extremely precise measured drawings and large format photographs of standing structures and ruins (Starbuck 1994:15).

Mitigation should also include a public education component, which could include interpretive signage and/or a public workshop (including a solicitation for information from local informants who might have memories or early photographs of this portion of the millrace).

3. The development and implementation of a protection plan for the millrace, identifying avoidance and minimization measures utilizing areas of previous disturbance, is recommended for the construction phase of the bridge replacement project. The objective of the plan would be to minimize the impacts of the construction and demolition activities on the millrace features. In addition to construction, activities that may affect the millrace during this project include demolition, erecting and removal of construction platforms, access roads, off-road vehicular impacts, or other activities. Use of an archaeological monitor during construction is recommended to ensure implementation of the protection plan.

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APPENDIX:

ARCHAEOLOGICAL SITE FORM
FOR THE EUGENE MILLRACE INTAKE AND DIVERSION DAM