DRAFT

ARCHAEOLOGICAL INVESTIGATIONS AT SITE 35TI90, TILLAMOOK, OREGON

By:

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and
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With contributions by:
Krey N. Easton
and
Frederick C. Anderson, M.A.

February 3, 2012

APPLIED ARCHAEOLOGICAL RESEARCH, INC., REPORT NO. 686

APPLIED ARCHAEOLOGICAL RESEARCH, INC.
Cultural Resource Management and Historic Preservation

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Findings: + (35TI90)
County: Tillamook
T/R/S: Section 25, T1S, R10W, WM
Quad/Date: Tillamook, OR (1985)
Project Type: Site Damage Assessment, Testing, Data Recovery, Monitoring
New Prehistoric 0 Historic 0 Isolate 0
Archaeological Permit Nos.: AP-964, -1055, -1191
Curation Location: Oregon State Museum of Natural and Cultural History under Accession Number 1739

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Prepared for
Kennedy/Jenks Consultants
Portland, OR 97201

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ABSTRACT

Between April 2007 and October 2009, Applied Archaeological Research, Inc. (AAR) conducted multiple phases of archaeological investigations at the part of site 35TI90 located in the area of potential effects related to the city of Tillamook's upgrade and expansion of its wastewater treatment plant (TWTP) located along the Trask River at the western edge of the city. Archaeological investigations described in this report include evaluative test excavations, a site damage assessment, three rounds of data recovery, investigations related to an inadvertent discovery, and archaeological monitoring.

The wastewater treatment plant upgrade and expansion project was partly funded by local bonds and partly by a federal department of Housing and Urban Development (HUD) grant. The use of HUD grants to partly fund the project required compliance with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing legislation, 36 CFR 800. AAR conducted the investigations to assist HUD and the city of Tillamook in meeting the requirements. All of the phases of work were performed under contract to Kennedy/Jenks Consultants, the consulting firm that provided engineering and environmental study services for the project.

Based on the results of the testing phase of investigation, site 35TI90 was recommended to be eligible for listing on the National Register of Historic Places (NRHP). Fieldwork showed that some parts of the site contained rich and dense cultural deposits, including features, that contributed to its NRHP eligibility, and that other parts contained sparse, non-contributory cultural deposits. The richest and densest cultural deposits were found within 20 meters or so of the Trask River. The density and richness of the cultural deposits declined with increased distance from the river. A part of the site was used for staging activities during the expansion and upgrade project. It was graded and rocked before it was investigated. Removed were cultural deposits that likely would have contributed to the site's NRHP eligibility but also cultural deposits that likely would not have been contributory.

In all, 27.5 m^2 of site area were exposed and 23.09 m^3 of sediment were excavated during all phases of investigation (excluding monitoring the trench spoil processed following the inadvertent discovery). The investigations resulted in the recovery of 12,340 pieces of lithic debitage, 369 stone artifacts (including 20 items classified as manuports), eight bone tools, 6,760 pieces of animal bone, and nearly 12,000 pieces of fire-cracked rock. Eight prehistoric cultural features or possible features were identified, two of which upon analysis were combined. In addition, 23 items that are or may be historical were recovered during the excavations and 66 similar items were collected during monitoring. Based on all of the recovered evidence, site 35TI90 is interpreted as having functioned as a base camp for fishing and hunting activities and for the manufacture of equipment that supported those activities.

Combined, the results of the investigations showed that parts of the site contain fairly thick cultural deposits that accumulated between ca. 1,300 and 250 years before the present. Abandonment of the site as suggested by radiocarbon dates and the lack of European trade goods aligns fairly well with the date of an earthquake and tsunami that occurred A.D. 1700. Once abandoned, the site does not seem to have been reused by the Tillamook. The site's historical component dates to the late nineteenth or early twentieth century and is not associated with its earlier occupation.

With this report and the placement of the artifacts, records, and associated materials at the Oregon State Museum of Natural and Cultural History, and one artifact (a zoomorphic-decorated object) with the Confederated Tribes of Grand Ronde, the city of Tillamook has fulfilled the requirements of Section 106 as they relate to TWTP expansion and upgrade project. The investigations described in this report were spatially limited to the area of potential effects for that project. Much of site 35TI90 remains, especially along the bank of the Trask River. The remaining part of the site should be protected and not disturbed. Any future developments at the TWTP should be should be reviewed for their potential to disturb the site.

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CHAPTER 1
INTRODUCTION

Project Description

This report describes the results of multiple phases of archaeological investigations conducted by Applied Archaeological Research, Inc. (AAR) at a part of site 35TI90 located in the area of potential effects (APE) related to the city of Tillamook's upgrade and expansion of its wastewater treatment plant (TWTP) located along the Trask River at the western edge of the city (Figure 1). Archaeological investigations described in this report include evaluative test excavations, a site damage assessment, three rounds of data recovery, investigations related to an inadvertent discovery, and archaeological monitoring. The sequence and timing of the various phases of investigations along with the numbers of the archaeological excavation permits issued by the Oregon State Historic Preservation Office (SHPO) under which they were performed are summarized in Table 1. The configuration of the TWTP is depicted on Figure 2 and the project APE, the areas where archaeological investigations were conducted, is depicted on Figure 3.

This report is preceded by one that presents an assessment of the archaeological sensitivity of the APE for the TWTP upgrade and expansion project area (Solimano and Roulette 2005) and another that described the results of an archaeological survey of the project area as it was defined in the spring of 2007, which led to the identification of site 35TI90 (Becker et al. 2007). In addition, during the three years of archaeological study described in this report, numerous letter reports and memoranda were prepared for the Oregon SHPO for compliance review (Becker and Roulette 2008a, 2008b; Heidrich 2008; Roulette 2007a, 2007b, 2007c, 2008, 2009).

The wastewater treatment plant upgrade and expansion project was partly funded by local bonds and partly by a federal department of Housing and Urban Development (HUD) grant. The use of HUD grants to partly fund the project required compliance with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing legislation, 36 CFR 800. AAR conducted the investigations to assist HUD and the city of Tillamook in meeting the requirements. All of the phases of work were performed under contract to Kennedy/Jenks Consultants, the consulting firm that provided engineering and environmental study services for the project.

All phases of fieldwork were under the direction of Thomas E. Becker, M.A., RPA. The following individuals participated in one or more field efforts: Fred Anderson, M.A., Christina Aucutt, B.A., Krey Easton, B.A., Jessica Hale, M.A., Curtis Heidrich, B.S., Melissa Lehman, B.A., Erica McCormick, M.Sc., RPA, Rob McCurdy, B.S., Janna Tuck, B.A., and Julie Wilt, M.A.

Post-fieldwork activities included inventorying and cataloging of all recovered materials and management of the collections through the analysis phase. These tasks were initiated by Christina Aucutt and were completed by Kendal McDonald, M.A., who also oversaw preparation of the collections for curation. Erica McCormick was responsible for the analysis of recovered artifacts and was assisted by Curtis Heidrich and Rob McCurdy. Krey Easton analyzed faunal remains assisted by Thomas Becker in the identification of shellfish remains. Aimee A. Finley, M.S., and Melissa L. Lehman, B.A., prepared the maps and graphics in the report. Ms. Lehman also contributed the artifact illustrations. Formatting and production of the report was under the direction of Ms. Finley. All aspects of the project were under the technical supervision of Bill R. Roulette, M.A., RPA, who served as the Principal Investigator.

Outside of AAR, Loren Davis, Ph.D., assisted by Steve Jenevin, conducted geoarchaeological investigations and modeling specific to determining the effects coseismic subsidence would have on the site 35TI90 area. The results of the investigations and modeling are integrated into this report. Obsidian sourcing was conducted by Northwest Research Obsidian Studies Laboratory in Corvallis, Oregon. Radiocarbon dating services were provided by Beta Analytic, Inc., of Miami, Florida.

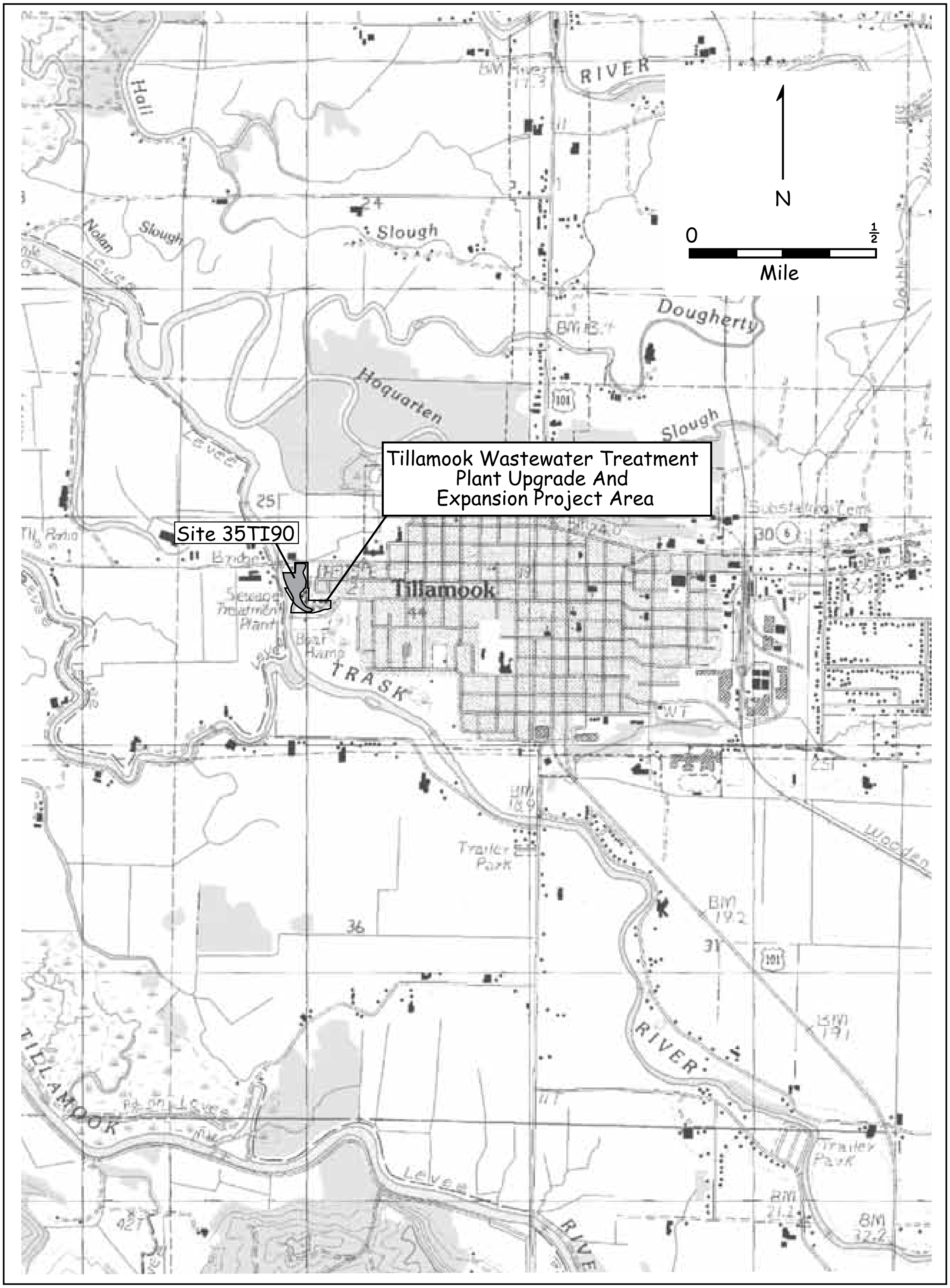

Figure 1. Location of the Tillamook Wastewater Treatment Plant upgrade and expansion project area containing site 35TI90 as depicted on the 1985 Tillamook, OR, 7.5-minute USGS topographic quadrangle.

Table 1. Summary of Archaeological Work for the TWTP Upgrade Project

Phase of Work	Permit #	Dates
Survey	964	April 2007
Testing/Site Damage Assessment	964	September 2007
Data Recovery	1055	November 2007
Supplemental Testing 1	1055	October 2008
Inadvertent Discovery	1191	July 2009
Supplemental Testing 2	1191	July 2009
Monitoring	-	September 2007 - October 2009

Site Area Description

Site 35TI90 is located in Section 25, Township 1 South, Range 10 West, Willamette Meridian, in the Tillamook sub-basin of the North Coast basin, in the North Coast Region of Oregon. It is located on the east (right) bank of the Trask River approximately 1.3 miles upstream from where the river empties into the southern end of Tillamook Bay. The south half of the site (South Area) encompasses the original TWTP (Figure 4). Its north half (North Area) is within the expansion and staging areas (Figure 5). The former is directly north of the original TWTP between it and 3rd Street where most of the new wastewater treatment facilities were constructed. The latter is west of the expansion area between it and the Trask River.

At present, the site area is relatively flat and its surface is between 10 and 14 feet (ft) above mean sea level (amsl). The most elevated part is to the north and the modern landsurface slopes gradually to the south. To a substantial degree, the site area appearance reflects filling and leveling of lands in the original TWTP. The pre-TWTP topography of the southern half of the site area is shown on a set of blueprints related to the original facility's construction in 1946. The blueprints include a site topographic map drawn in 1-foot contour lines. The topographic map shows that in addition to a general north to south elevation gradient, the south half of the site area contained two terraces: an upper terrace at an elevation of between 10 and 13 ft amsl, on which the original treatment plant was built, and a lower terrace that was between 6 and 7 ft amsl (Figure 6). A short slope with about a 10 percent grade connected the two terraces. The leading edge of the upper terrace featured a pronounced westward projecting nose. South of the nose the upper terrace trended sharply to the southeast. On its north side, the leading edge of the upper terrace ran north to south. The blueprint map also shows the topography along a part of the river bank. The bank is shown to slope steeply from the lower terrace to the river. At present, most of the topographic relief seen on the pre-construction map has been flattened by the addition of fill to the lower-lying parts of the plant site. There is a modest, very gradual slope between the grounds of the existing plant and the Trask River but there is little visible evidence for two distinct terraces. Also, the once sloping riverbank is now nearly vertical.

Maps prepared for the expansion and upgrade project are also drawn with topographic lines at 1-foot contours. The part of the site in the expansion and staging areas ranges in elevation between 10 and 14 ft amsl. With reference to the two terraces seen on the 1946 blueprint topographic map, the north half of the site is on the upper terrace.

In the site vicinity the Trask River exhibits a gradual but distinct northwestward-projecting bend (Figure 7). The site is located at the downstream end of the bend. An unnamed slough branches off of the west side of the river at the apex of the bend. The slough meanders across the floodplain before joining the Tillamook River near its mouth. At the site the river is narrow. It begins to widen downstream, closer to where it takes in Hoquarten Slough. Text on an 1887 General Land Office (GLO) map of Township 1 South, Range 10 West, Willamette Meridian, describes the Trask River in the vicinity

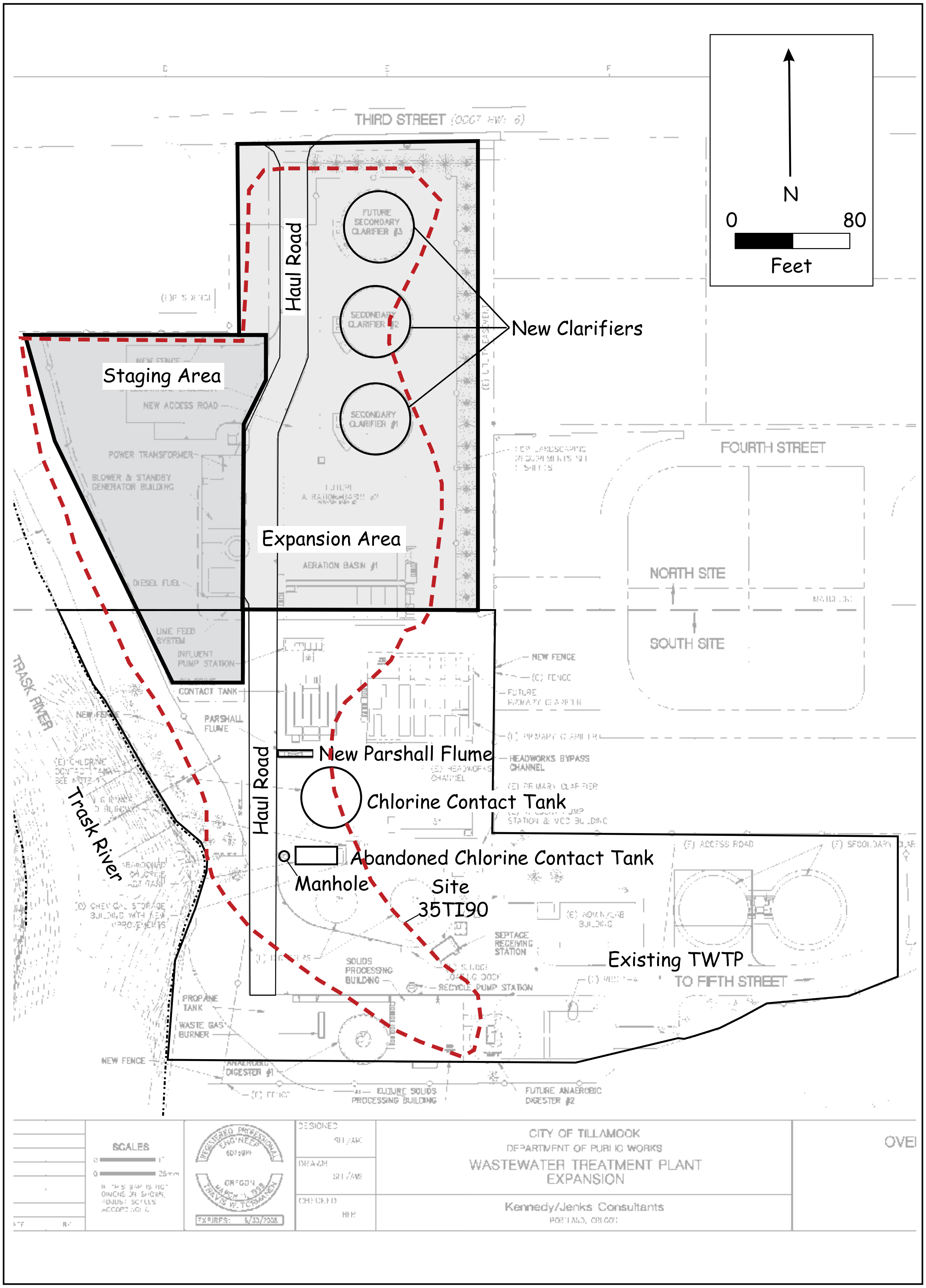

Figure 2. Configuration of the TWTP facility, expansion area, and staging area showing existing and newly constructed structures, buildings, and features mentioned in the report and the site 35TI90 boundary.

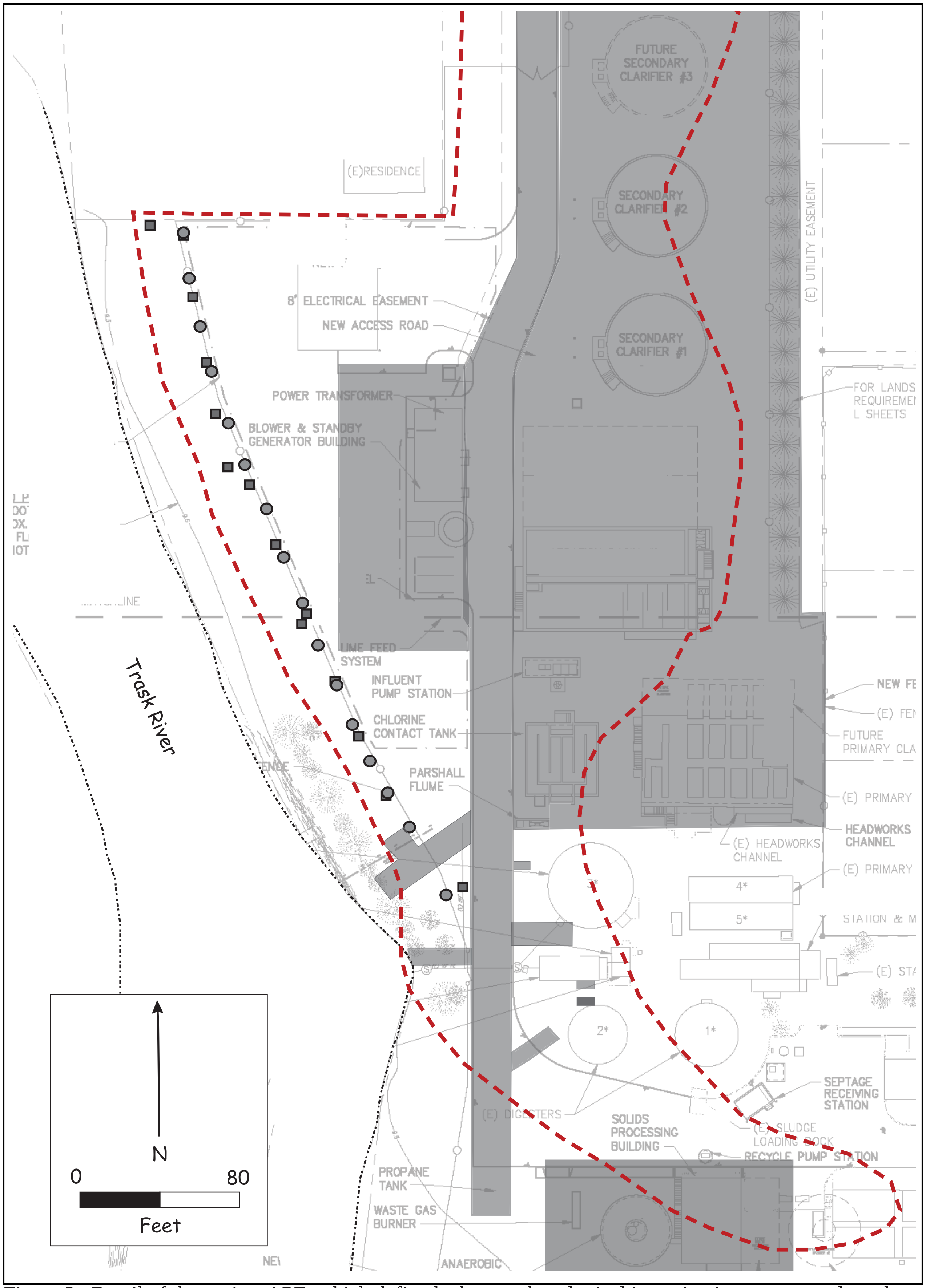

Figure 3. Detail of the project APE, which defined where archaeological investigations were conducted.

Figure 4. Overview of the South Area, facing southeast from the edge of the Trask River, with an existing chlorine contact tank and digester visible in the background.

Figure 5. Overview of the North Area, facing northwest, prior to development of the staging and expansion areas. The Trask River is beyond the treeline in the background.

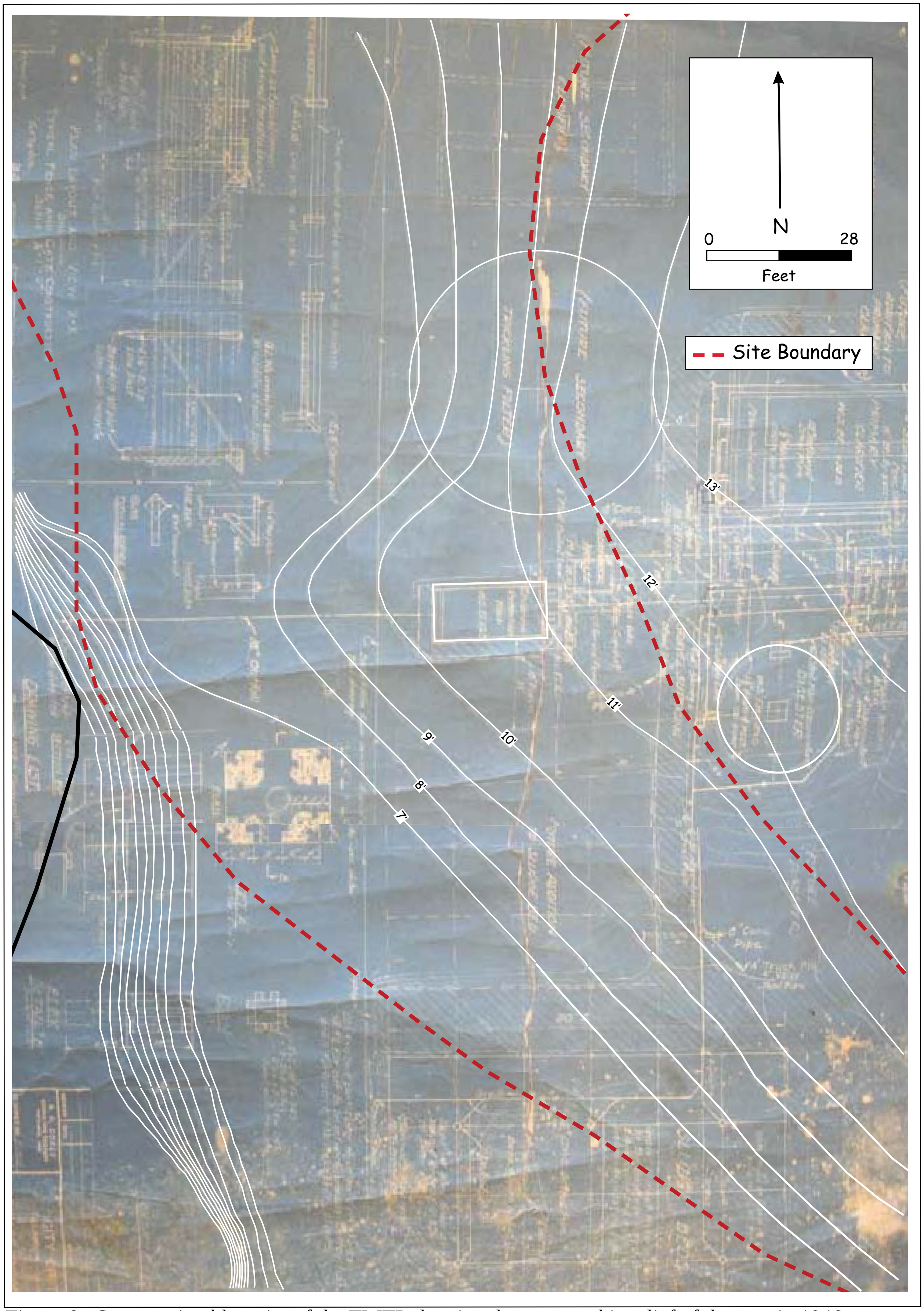

Figure 6. Construction blueprint of the TWTP showing the topographic relief of the area in 1946.

Figure 7. Overview of the site vicinity, facing north, showing the bend in the Trask River. The TWTP is just visible at frame right.

of the project area at that time as "narrow, shallow, and obstructed by drift" (Coulton et al. 1996: Figure 25).

An 1858 GLO map of Township 1 South, Range 10 West, Willamette Meridian, depicts the area containing the site as marshy (Figure 8). Field notes from the GLO survey in 1857 describe the site area as wooded tidelands. Trees observed by the surveyors included spruce, hemlock, cedar, maple, and alder. Undergrowth included crabapple, maple, hazel, salmonberry, huckleberry, and briars. Elderberry, salal, bearberry, thimbleberry, and other plants were noted in the adjacent floodplains and tidal marshes (Coulton et al. 1996). The plants the surveyors observed and described in their notes are consistent with those that comprise the native climax vegetation stage for the area (Franklin and Dyrness 1973:59).

An aerial photograph of the site vicinity taken in 1939 before the original TWTP was constructed (Figure 9) shows the area as an open grassy field. The photograph shows several drainage ways that appear to coalesce to form a single drainage that entered the Trask River in the southwest corner of the facility.

At the time of the fieldwork, the northern part of the site had been stripped of vegetation but before that it contained thick pasture grass (Becker et al. 2007:4, Figure 4). Elsewhere in the site area, the undeveloped parts of the TWTP were covered in grass with a few trees at the riverbank.

Project History

In 2005 AAR conducted a literature and records review focused on the proposed TWTP upgrade and expansion project area (Solimano and Roulette 2005). Based on the review it was determined that unrecorded archaeological resources were likely to be present at the project area and it was recommended that a cultural resources survey be conducted in advance of the proposed project (Solimano and Roulette

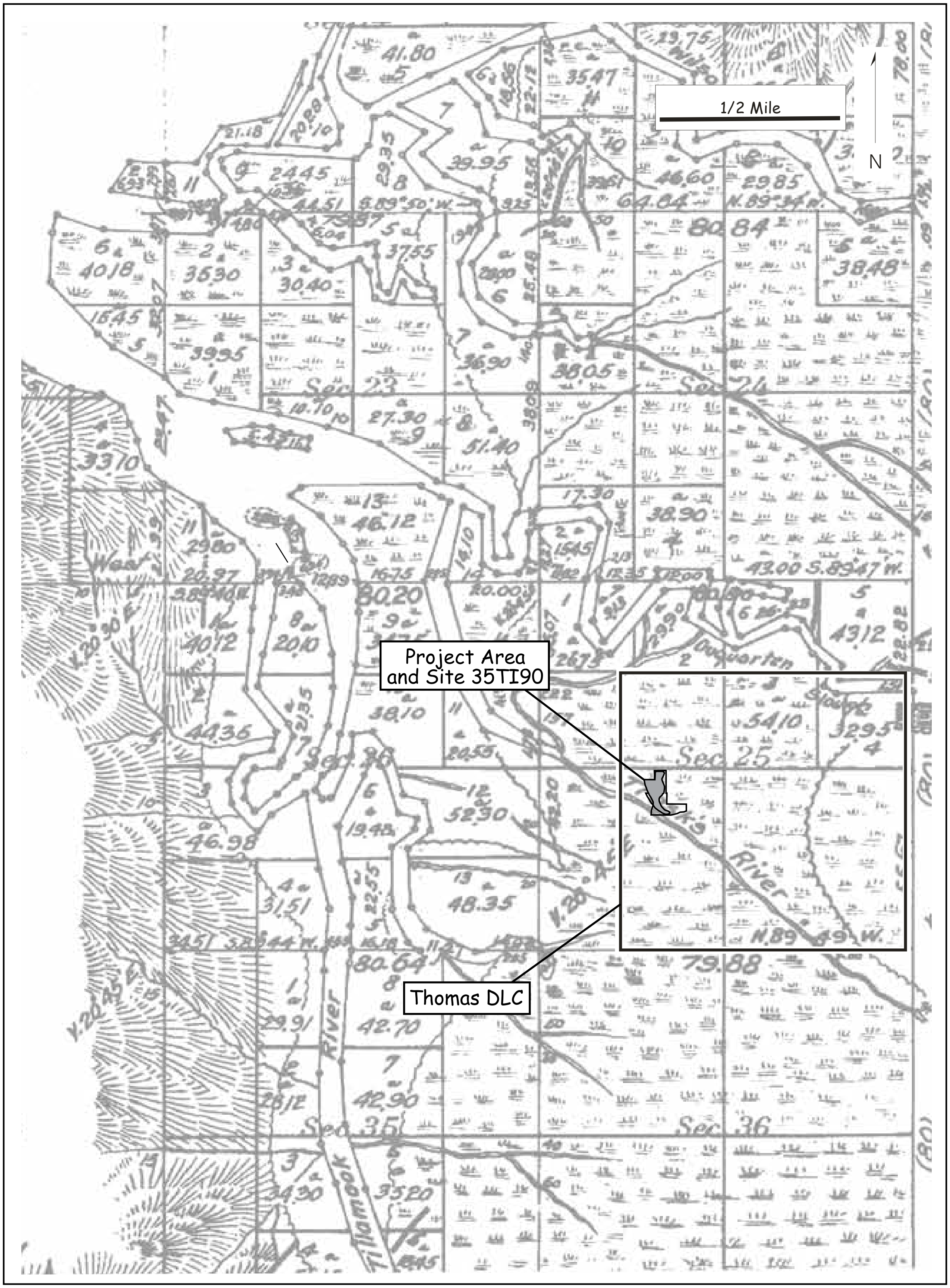

Figure 8. Location of the project area and site 35TI90 in relation to the Thomas DLC as depicted on the 1858 GLO map.

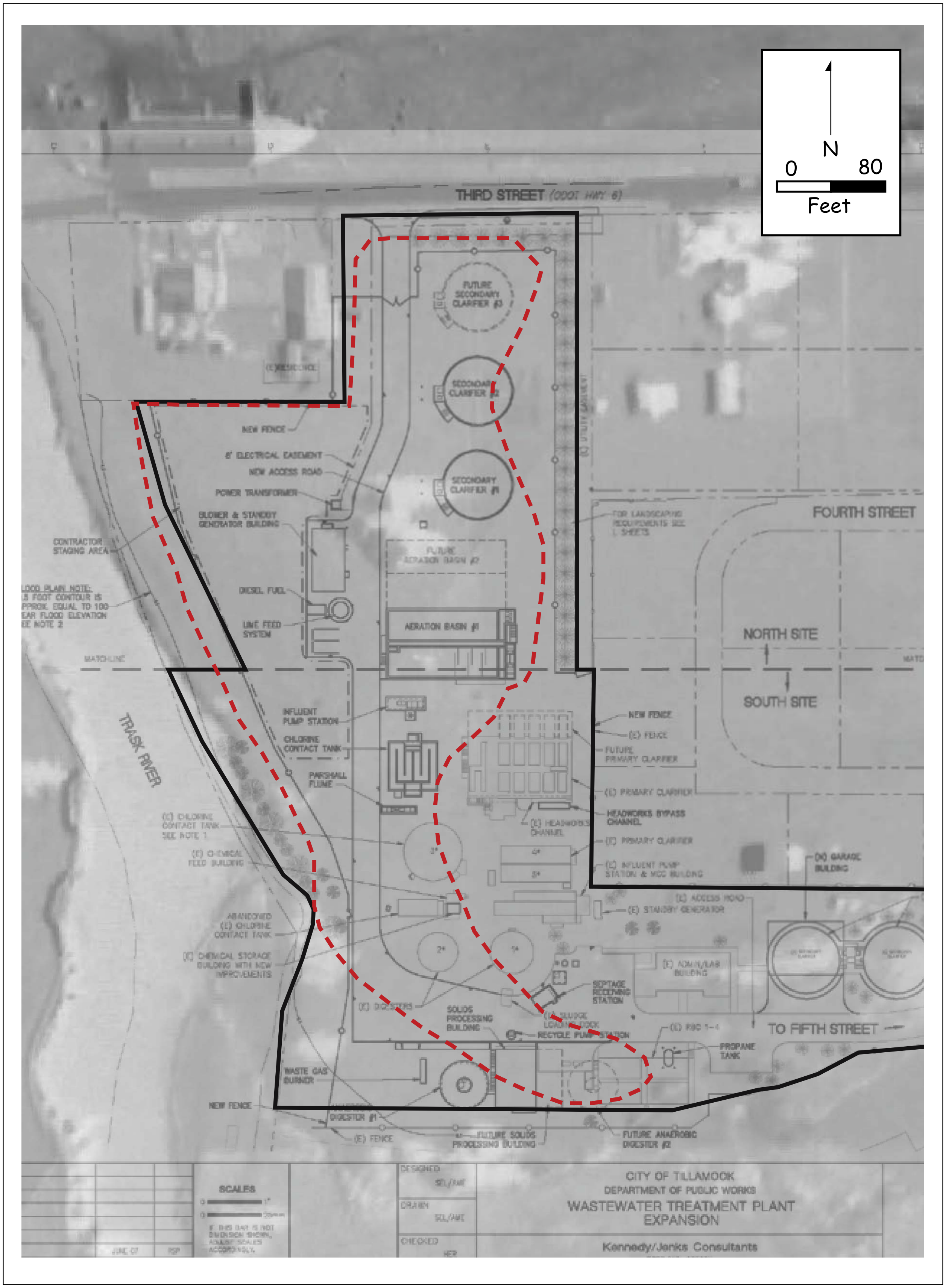

Figure 9. Location of the project area and site 35TI90 in relation to a plan map of the treatment plant overlaid on an aerial photograph showing local conditions in 1939.

2005:15). The survey was conducted in April 2007 under Oregon Archaeological Excavation Permit No. AP-964 (Becker et al. 2007). The project area at that time included the grounds of the existing TWTP and the expansion area but not the staging area. As part of the survey 14 shovel test pits (STPs) were excavated, eight of which yielded 48 pieces of lithic debitage, one projectile point, 20 pieces of fire-cracked rock (FCR), 13 pieces of animal bone, and 396 historical or probable historical artifacts. In addition to the artifacts found in probes, FCR was noted on the ground surface in two areas.

The debitage primarily consisted of chert, jasper, and chalcedony (which were collectively characterized as cryptocrystalline silicates [CCS]). The projectile point was of CCS. It has a converging stem, a rounded base, and was formed by minimal flaking. The faunal material was calcined and highly fragmentary. Most of the material appeared to represent small to medium mammals. Two fragments were pieces of fish vertebrae. One small fragment was from a shellfish.

The cultural material was recorded and assigned site number 35TI90. Historical artifacts were found throughout the northern half of the site in the expansion area but were most common in its northern part that was nearest 3rd Street. Prehistoric artifacts co-occurred with historic-era materials in three STPs excavated in the expansion area and in one STP placed in an undeveloped part of the TWTP. In the latter, artifacts were found beneath 1.4 meters (m) of fill. Excavations in four other STPs excavated within the original TWTP could not penetrate fill. Based on the results of the survey, at a minimum and counting both historical and prehistoric cultural components, the site was determined to be 150 m long and about 40 m wide.

At the time of the survey only lands owned at the time by the city of Tillamook were available to be investigated. The approximately 2-acre private inholding referred to as the staging area could not be examined. At the time of the survey it was a grass-covered field. The staging area was assessed as having a very high potential to contain archaeological deposits and AAR recommended that it should be investigated prior to any project-related ground-disturbing activity (Becker et al. 2007:28).

Before that could happen, the staging area was stripped of vegetation, graded, rocked, and contractors had moved trailers into it (Figure 10). Part of the expansion area had also been graded and rocked and excavations for clarifier basins had largely been completed (the clarifier basins were largely outside the eastern boundary of the site as it was defined based on the initial survey). The activity at the site was brought to the attention of the Oregon SHPO, which placed a stop work order on the project.

The investigations conducted subsequent to the stop work order are described in this report. Initially the fieldwork included specific tasks required to have the stop work order lifted and focused on specific areas where construction activity was to occur. Later phases of investigation likewise were spatially limited to the project APE. After the initial testing and site damage assessment, all other phases of fieldwork took place within a construction site. Despite the disjointed approach and limitations placed on where fieldwork could be conducted, when combined the investigations were extensive and a great deal was learned about the site. In all, the various phases of fieldwork included the excavation of 27.5 square meters (m2) of site area in the form of 35 small excavation units measuring 50 centimeters (cm) on a side (referred to as quarter test unit or QTUs), 17 units measuring 1 m on a side, and two units measuring 1 x .5 m. Three of the 1-x-1-m units were excavated as part of the test phase and are referred to as test units (abbreviated TU) all of the other larger units were excavated during three rounds of data recovery and are referred to as excavation units or EUs. The 1-x-.5-m units were excavated as part of the investigations following an inadvertent discovery (see below) and are also referred to as EUs.

To establish the chronology of the project and the circumstances that propelled it along for two-plus years, the following section includes a brief summary of each phase of the fieldwork. Table 2 presents a summary of the number and type of excavations and other activities performed as part of each phase. The areas investigated in each phase are shown in Figures 11-13. It is the intent to limit

Figure 10. Overview of the North Area, facing west, showing the development in the staging area that led to the stop work order.

Table 2. Units Excavated During Each Phase of Fieldwork at Site 35TI90

Phase of Work	Dates	Excavated Units	Volume	Area
Testing/Site Damage Assessment	September 2007	QTU 1- 20; TU 1-3	6.765 m3	7.75 m2
Data Recovery	November 2007	EU 4-18	12.15 m3	15m2
Data Recovery	October 2008	QTU 21-24	.85 m3	1m2
Inadvertent Discovery	July 2009	EU 19-20	1.0 m3	1m2
Data Recovery	July 2009	QTU 25-35	2.325 m3	2.75 m2
Monitoring	September 2007 - October 2009	-	-	-

discussion to separate phases of investigation as much as possible and to instead, focus on the results of the project separate from the various stops and starts and compliance issues.

Evaluative Testing

Evaluative testing was combined with a site damage assessment. Both phases were performed under Oregon Archaeological Excavation Permit No. AP-964 (see Figure 11). Initially, the efforts focused on three sections of the upgrade and expansion project area where construction activity most urgently needed to resume. They were designated Areas 1, 2, and 3. Area 1 was partly in the graded and rocked staging area and extended east into the expansion area that also had been graded but not rocked. It was 35 m long and 7.5 m wide and included where excavations for an aeration basin were ongoing and also where a section of trench for the primary utility line was to be excavated. The trench was to be about 1.5 m wide and to run the length of the expanded facility from 3rd Street in the north to its southern end. It was located just off the west side of the existing TWTP access road which was to be upgraded to serve

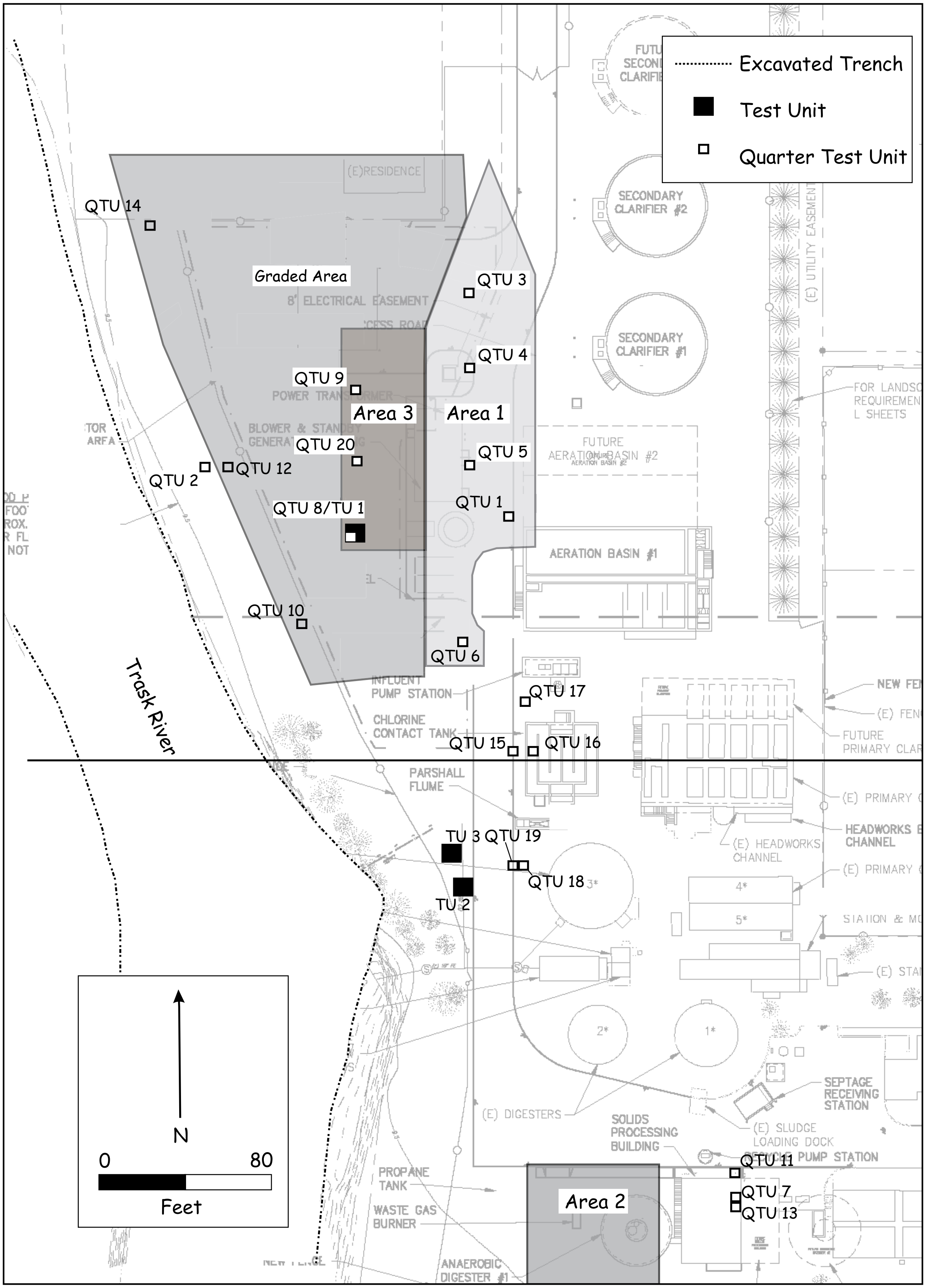

Figure 11. Detail showing extent of investigations during evaluative testing.

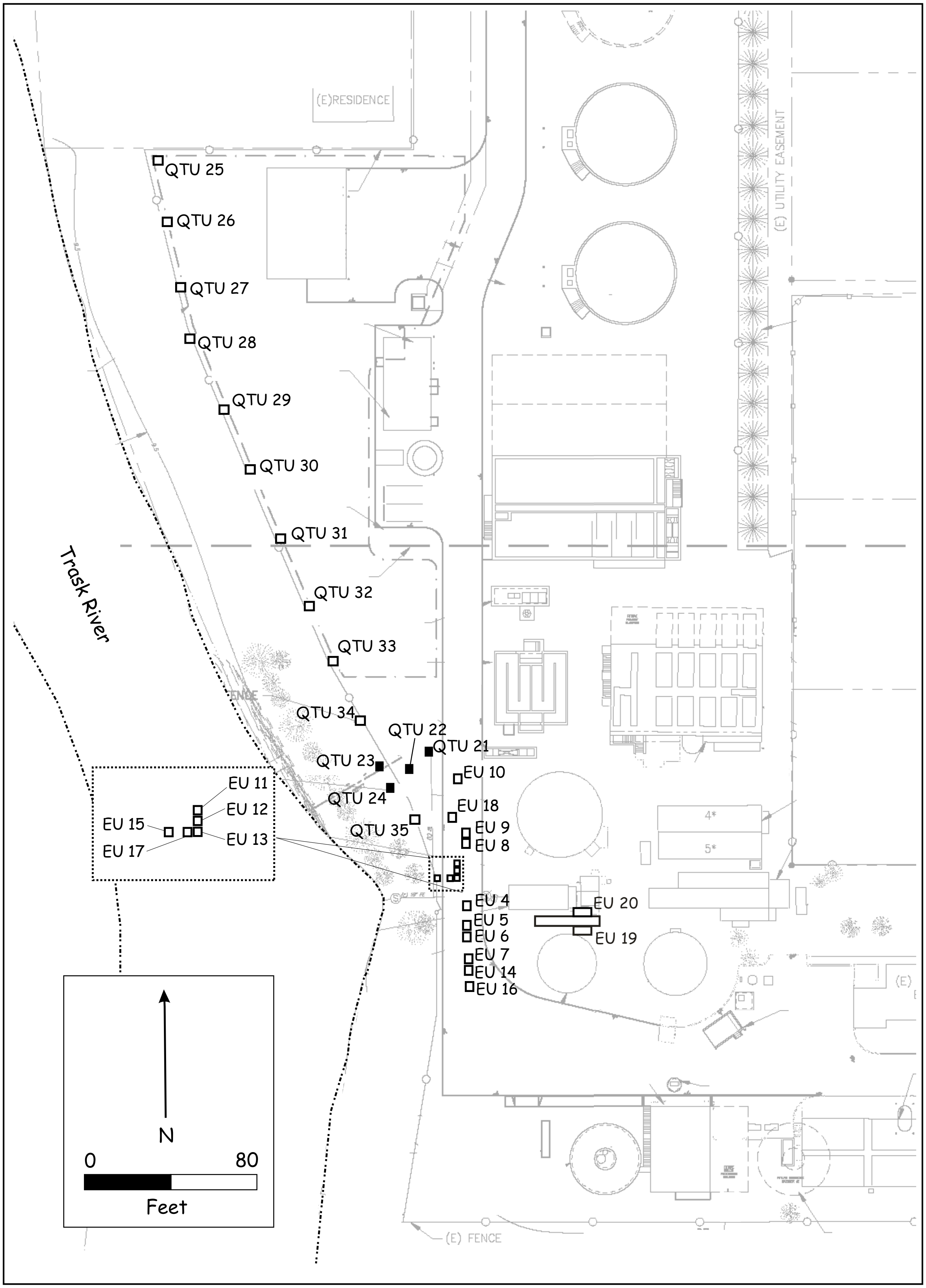

Figure 12. Detail showing extent of investigations during the three rounds of data recovery excavations and the location of the inadvertent discovery.

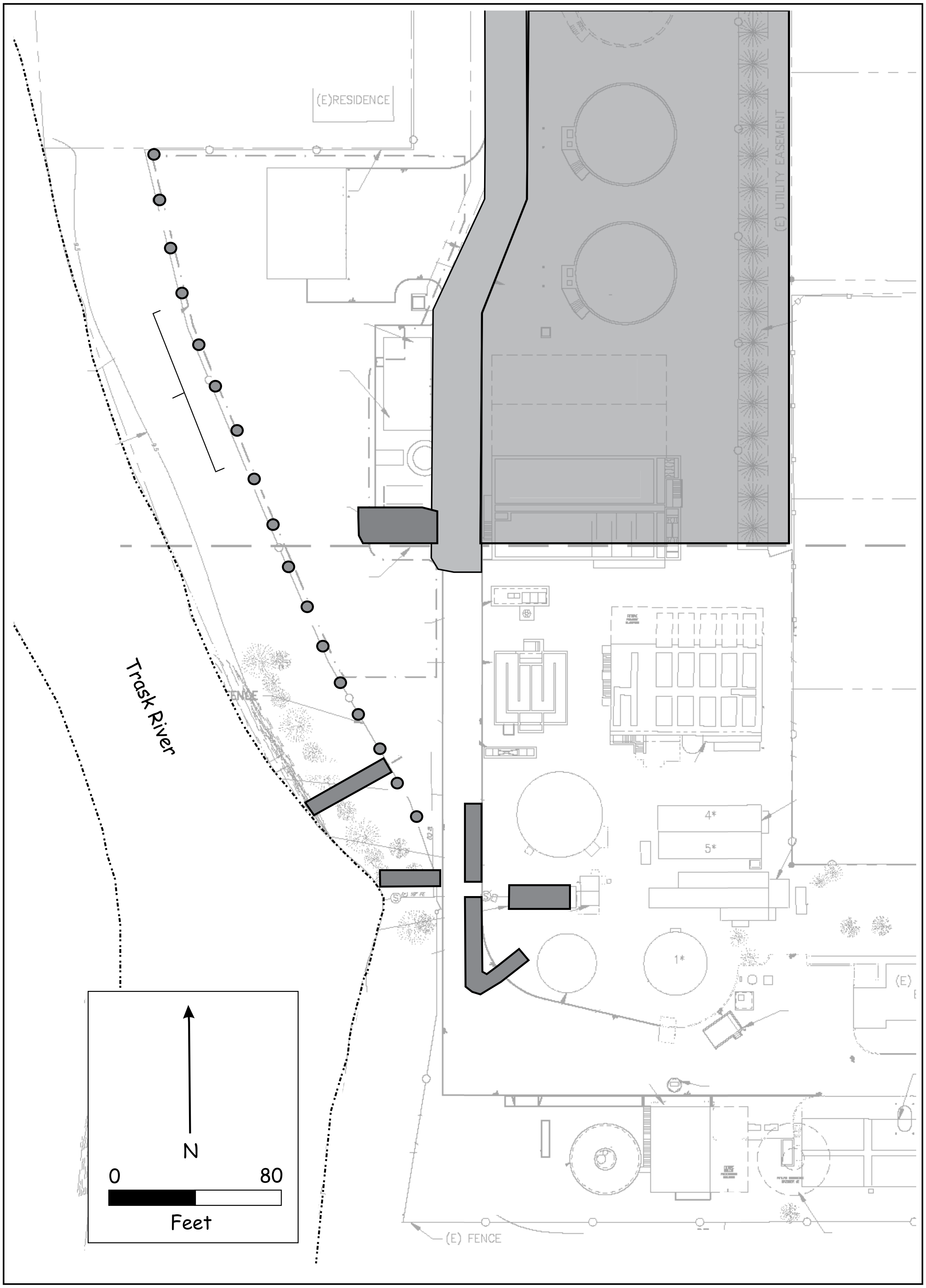

Figure 13. Detail showing the areas monitoried during constrcution (shaded gray).

as the main construction haul road during the expansion and upgrade project. Area 2 was defined as a 9-x-9-m area in the southwestern part of the original facility where an anaerobic digester and a waste gas burner were to be constructed. This area had been used for disposal of sludge and was investigated using backhoe trenches (Figure 14). Area 3 was in the staging area and was where a Blower and Standby generator building and where a diesel fuel tank and line feed system structure were to be installed. It measured about 14 x 7.5 m and had been graded and rocked. Its eastern edge abutted the west side of Area 1.

Five QTUs were excavated in Area 1. They were between 20 and 30 m from the riverbank. They contained few artifacts; no more than four per unit. The backhoe trenches excavated in Area 2 extended to 3 m below surface and did not reach the base of the fill and sludge. Three QTUs were excavated in Area 3 and one of the QTUs was converted into a TU. The units were aligned north to south to expose a cross section of the area. The southernmost unit, QTU 8/TU 1, contained dense archaeological deposits and a cultural feature identified as a probable hearth. The other two QTUs contained minimal cultural material.

The testing phase also included the excavation of units in other areas where project-related disturbance were anticipated. QTUs 7, 11, and 13 were excavated adjacent to Area 2 at the southern end of the existing facility where a Solids Processing Building was to be constructed. A complete pestle was found in one of them but overall the three QTUs contained few artifacts. QTU 17 was excavated in the footprint of where a Chlorine Contact Tank was to be constructed. It contained a trace amount of FCR and small bits of calcined animal bone but no artifacts. Two QTUs (QTUs 15 and 16) were excavated where a Parshall Flume would be constructed. One contained trace amounts of FCR and burned animal bone and the other contained the same types and quantities of archaeological material plus one artifact.

QTUs 18 and 19 and TUs 2 and 3 were excavated between the original TWTP and the Trask River where a trench was to be excavated to install a new outfall pipe. The QTUs were excavated near the east end of the proposed trench location near an abandoned Chlorine Contact Tank within the footprint of the existing plant. They contained moderately dense cultural deposits. The TUs were placed toward the west end of the trench closer to the Trask River. This area overlapped with the route of the main utility trench/haul road. The upper 60 cm or so in the TUs consisted of fill. Once recognized, it was removed by a backhoe before beginning hand excavations in the units. Below the fill were intact cultural deposits that contained the equivalent of 1,000-plus artifacts per cubic meter (m3).

Additional QTUs were excavated in the north half of the site to assess the damage caused to it by grading (Figure 15). The site damage assessment involved a comparison of soil profiles, artifact frequency, and artifact diversity in QTUs placed in the graded staging area and adjoining ungraded areas. QTU 2 was excavated in an ungraded area and the three other QTUs were placed in the staging area. A comparison of soil profiles between the two areas showed that between 10 and 50 cm of sediment had been removed when the staging area was graded. QTU 2, placed in the ungraded part of the site, yielded the equivalent of 2,025 artifacts/m3, while the three QTUs placed in the graded area contained the equivalent of between 120 to 540 artifacts/m3. This suggested that, everything else being equal, the sediment scraped from the staging area likely contained abundant artifacts. Artifact types were generally consistent between all of the QTUs.

Based on the results of the testing (and site damage assessment), site 35TI90 was determined to be larger than it appeared following the survey. The combined survey and testing results showed that the site was long and narrow extending north to south about 190 m from near 3rd Street at the north end of the expansion area to the southern edge of the existing plant. Along most of its length it is narrow extending only about 40 to 50 m inland from the east bank of the Trask River. It is 70 m wide at its north end but there its eastern edge is defined by survey phase STPs that contained only historic-era artifacts. The densest and richest (in terms of diversity of cultural material) part of the site was noted to be closest

Figure 14. Detail of the sludge encountered in the Area 2 trenches.

Figure 15. Overview of excavations in Area 3. Note the top of the red barn just visible at frame right, is also visible in Figure 5 prior to construction.

to the river. Prehistoric cultural material became sparser in a rapid and consistent fashion with increased distance from the river. Its northern part appeared to have been severely damaged by grading.

Based on the results of evaluative testing, AAR recommended that the site was eligible for listing on the National Register of Historic Places (NRHP). Not all parts of the site were considered to contribute to its significance. Parts of the site, such as in Area 1 and where the Solids Processing Building, Chlorine Contact Tank, and Parshall Flume were eventually constructed, which within the project area were most distant from the river, contained low-density artifact deposits or incidental amounts of archaeological material. Parts of the site closest to the river like where the new outfall pipe would be located contained dense to very dense artifact deposits.

AAR recommended that project-related activities could resume in the non-contributory parts of the site. The Oregon SHPO agreed with AAR's recommendations and allowed the expansion and upgrade project to resume but required that an archaeologist monitor all earthmoving in the non-contributing parts of the site.

Data Recovery

Because the parts of the site that contributed to its significance could not be avoided or protected in place, data recovery excavations were undertaken to mitigate the adverse effects that the expansion and upgrade project would have on site 35TI90. Between 2007 and 2009, three rounds of data recovery excavations were conducted, each in response to specific developments impacting specific parts of the site. The first round was conducted in November 2007 under Excavation Permit No. AP-1055. The permit was expedited so that the construction project could resume. It focused on the southern part of the site between the original TWTP and the Trask River. It included the excavation of 15 EUs in the linear route of the main utility trench and an area slightly to the west where the existing outfall pipe was to be removed and a new one installed along with associated manhole structures (see Figure 12). The EUs were placed in the vicinity of testing phase TUs 2 and 3 in which intact archaeological deposits containing abundant cultural material had been identified. The 15 EUs represented an approximately 5.4 percent sample of the part of the site where cultural deposits contributing to the NRHP eligibility of the site were located. Eight EUs (EUs 4-9, 14, and 16) were placed in a north-to-south row over a distance of about 25 m. They formed a discontinuous trench (referred to herein as Trench 1) composed of EUs that adjoined to form 1-x-2-m blocks and others excavated singularly (Figure 16). Five other EUs (EUs 10-13 and 18) were placed in a row a few meters westward from the first one. They were distributed over a distance of about 18 m and formed a second discontinuous trench (referred to herein as Trench 2). In this row EUs 11, 12, and 13 were adjoining and formed a 1-x-3-m block (Figure 17). Testing phase TU 2 was directly in line with the block and extended its length to 4 m. The other EUs in the row, EU 10 and EU 18 were excavated singularly farther to the north. EUs 15 and 17 were aligned east and west with EU 13 to form a short trench (referred to herein as Trench 3) perpendicular to the north-and-south oriented trenches (Figure 18). The entire area where the units were placed was mantled with fill of varying thickness. Artifact recovery in the units was highly variable but generally high with the richest and most dense cultural deposits in units comprising Trenches 2 and 3 and the south half of Trench 1.

In the fall of 2008 a new location for the outfall pipe was selected. The new route was 18 m long. It connected to a manhole at its east end that was about 20 m north of the original outfall pipe route and extended to the Trask River at a 45-degree angle. At its west end it was only 10 m north of where the original route intersected the riverbank. The trench to be excavated for the outflow line was to be 5 m wide. The data recovery was conducted under Permit AP-1055 and included the excavation of four QTUs in the area to be disturbed by installation of the pipe. The amount of excavation was deemed adequate because little of the new route passed through the part of the site that contained cultural deposits that contributed to its NRHP eligibility and because the part that did was very close to the north end of Trench 1. Of the four units, QTU 21 was disturbed throughout and contained very little cultural material. The other three units contained intact cultural deposits. QTUs 23 and 24, located closest to the river,

Figure 16. Excavations underway in Trench 1 during the first round of data recovery in November 2007. EU 7 is in the foreground. Sediment seen in the sidewall trench is fill. View is north.

Figure 17. Overview of Trench 1 and Trench 2 with the Trask River in the background. View is southwest.

Figure 18. Overview of the intersection of Trench 2 with Trench 3, which extends beyond the silt fence.

contained substantially richer deposits than did QTU 22, located further to the east. With the exception of a possible oil lamp fragment, the character of the archaeological deposits was redundant with the materials recovered the previous year in Trenches 1, 2, and 3.

A third round of data recovery was initiated in the summer of 2009 by plans to erect a security fence around the perimeter of the expanded and upgraded facility. Fence construction was to include placement of support posts at a 10-m interval. To mitigate the adverse effects related to this activity, AAR excavated 11 QTUs close to where the support posts would be installed. The area investigated extended along the length of the west edge of the staging area and southward beyond it where Trenches 1, 2, and 3 were excavated. Although the fence extended southward from that point, it passed through an area that previous investigations had shown to be mantled with thick sludge and fill deposits or that contained no or minimal archaeological deposits. Nine of the QTUs were excavated in the staging area. They contained artifact types and frequencies on par with other QTUs excavated in that part of the site during the testing and site damage assessment phases. Two of the QTUs were placed south of the staging area. One, QTU 35, the southernmost QTU, contained only fill. The other one contained a moderate amount of cultural material.

Inadvertent Discovery

Additional investigations were conducted in July 2009 after a zoomorphic-decorated stone object was recovered by the construction crew excavating a trench within the existing TWTP. The trench was excavated in a fully developed part of the plant between a digester and a chlorine contact tank about 10 m east of the known extent of site 35TI90 (Figure 19). The construction manager recognized the artifact as potentially important and stopped work in the vicinity of the find. He also kept separate the spoil from the trench where the object was found.

Figure 19. Overview of the heavily developed area where the inadvertent discovery was made.

As a highly stylized object, the artifact was recognized as possibly representing a funerary inclusion. A meeting was held at the work site to review its find location and to plan for its appropriate handling and treatment. The meeting was attended by representatives of the Oregon SHPO, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz, the city of Tillamook, and AAR.

The artifact was identified as an object of cultural patrimony and the representative of the Confederated Tribes of Grand Ronde indicated that the tribes would retain it after it had been properly documented. AAR was permitted to take possession of it and to transport it to the AAR laboratory in Portland, Oregon.

To investigate the location that the artifact was found, two units measuring 1 m by 50 cm were excavated off of the sides of the backhoe trench in which it was found. Sediments appeared intact and contained sparse cultural material that did not include any artifacts similar to the zoomorphic-decorated object. In addition, approximately 5 m3 of sediment from the trench that had been stockpiled was screened resulting in the recovery of five pieces of debitage.

Monitoring

AAR monitored mechanical and sometimes manual excavations off-and-on between September 2007 and October 2009. At all times, monitoring included a consistent set of techniques designed to identify cultural features or artifact concentrations if they were exposed but not necessarily every artifact that might be present. Excavations were continuously and carefully observed and vertical and horizontal exposures were scrutinized as they were created by the removal of sediment. In most instances, when excavations involved heavy equipment, lifts were between 10 and 15 cm thick. Spoil piles from excavations was also examined.

Overall, little cultural material was observed during monitoring. This can be attributed to the fact that much of the area where monitored construction activity took place was east of the site and in areas that had previously been disturbed and contained fill or some mixture of fill and disturbed native sediment.

All construction activity conducted in the first 20 days after the stop work order was lifted was monitored. During that period most of the activity was focused on Area 1 and specifically excavations for clarifiers, an aeration basin, and the northern part of the main utility trench. All of these activities were either outside of the site boundary or in the part of the site that contained the historical component, which previously had been interpreted as consisting of dumped objects that do not represent in situ deposits that did not contribute to the NRHP eligibility of site 35TI90 (Becker et al. 2007:27). During monitoring, 53 historical or possibly historical items were collected from that part of the site. The objects were consistent in function and character with those found during the initial survey.

Because little cultural material was noted during the initial period of monitoring, AAR recommended that monitoring be discontinued in parts of the expansion and upgrade project area shown during the survey to not contain archaeological deposits or to contain disturbed or sparse archaeological deposits. The Oregon SHPO concurred with the recommendation and subsequent monitoring focused on construction activities where archaeological deposits had been shown to be present (based on the results of the phases of investigation that had been completed at the time monitoring was conducted). These included excavations in Area 3, trenching for the installation of the outfall pipe (the original route), and trenching within the existing plant when the trench routes were in proximity to where important cultural deposits had been found. Later that list of areas was amended to include the second outfall pipe location and where post holes were excavated for the security fence.

Monitored excavations in Area 3 were limited to an area measuring 3 x 6 m and extended to a depth of 60 cm below the ground. Excavated sediments consisted mostly of coarse gravel fill with some intact sediment. No cultural material was noted.

An approximately 22-m-long trench was excavated within the grounds of the existing plant next to the abandoned Chlorine Contact Tank. The trench was oriented north to south and was roughly 1.5 m wide and 1.2 to 1.5 m deep. The top 40 cm consisted of gravely fill that capped an intact soil profile consisting of a layer of dark brown silty loam and a basal layer of concreted rounded gravel and sand. No artifacts were observed during excavation or during the inspection of trench sidewalls or side-cast trench spoil.

Trenching for the placement of the first new outfall pipe was monitored. The original proposed route followed the route of the existing outfall pipe. The original plan was to have the new outfall line parallel the existing one which was to be decommissioned. The route started in the east at an existing manhole structure located west of the abandoned Chlorine Contact Tank. It exited the structure extending to the south, made a 90-degree turn to the west and extended about 12 m to the Trask River. The trench excavated for the new installation was 2 m wide and between 2 and 3 m deep. It terminated 2 m east of the riverbank. The sediment profile exposed in the trench indicated that the excavations were wholly within an existing trench for the original outfall pipe. The profile included a layer of fill, about 1 m thick, that capped a deposit of angular riprap rocks grading between cobble and boulder in size. Relative to the current ground surface, the riprap was most deeply buried near the river and rose in elevation to the east. Below the riprap was a layer of concreted sandy gravels. No artifacts or other evidence for archaeological deposits was observed during earthmoving activities. If archaeological deposits had been present in this area previously, they were most likely destroyed during the construction of the existing outflow pipe, or during grading activities prior to the laying down of riprap.

In the fall of 2008 the location of the outfall line was revised and trenching for the new line was monitored in September 2009. As noted above, the new route was 18 m long. At its east end it connected to a manhole structure west of a new Parshall Flume structure. From there it extended 18 m at a 45-degree angle to the Trask River. For most of its length it was 5 m wide. It was wider at its east end where it tied into the manhole structure. At its east end it was 3.5 m deep; it was 2 m deep at its midpoint, and only 1.25 m deep where it truncated the riverbank. Excavations at the river's edge had been completed by the time a monitor arrived at the site. Approximately 6 m of the trench had been excavated. Excavation of the remaining 12 m of the trench was monitored.

At its east end, sediments in the trench consisted of approximately 1.5 m of fill over a layer of dark stained sediment that based on the results of the previous testing and data recovery investigations was known to be the main cultural deposit at the site (see below). The deposits were about 60 cm thick and directly overlay a layer of highly oxidized sand and gravel that extended to the base of the trench. At a point about 8 m from the river bank a layer of yellowish brown silt clay loam was observed to cap the layer of dark-colored sediment.

Despite cutting through the main cultural deposit in the south part of the site, trenching did not expose many artifacts. The most common items observed were pieces of FCR. Approximately 10 m east of the riverbank, a patch of small shell fragments was observed in the north trench wall near the top of the layer of dark-colored sediment at its contact with the overlying fill. The patch of shell fragments was designated Feature 8 and is described in Chapter 7 of the report.

The existing outflow pipe and an associated manhole structure were removed in October 2009. All earthmoving related to the activity was monitored. An area approximately 6 m north to south and 7.5 m east to west was excavated to a maximum depth of 4.5 m deep. The excavations appear to have been wholly confined to the footprint of the area disturbed during the original installation of the trench and manhole structure. Fill in the excavated area consisted of mixed sediments, cobbles, and boulders. During the same period a manhole structure on the north side of the existing trench was removed.

Also, in October 2009, excavations related to the installation of the security fence were monitored (Figure 20). In most places a screw-type auger with a bit approximately 30 cm in diameter which was mounted on a small utility vehicle was used to drill holes for the fence posts. The holes were located close to where QTUs had previously been excavated but because of compaction issues, the QTUs could not be used for fence post installation. After the holes were mechanically excavated a manually-operated posthole digger was used to clear them of loose sediment. Overall, the holes were approximately 1 m deep. Lithic artifacts were observed in fill removed from two of the post holes. Four others contained FCR and one contained a small piece of calcined bone.

Conventions

In this report, measurements for common distances, areas, elevations are provided in feet or inches. Measurements for prehistoric objects (artifacts, site dimensions, sizes of excavation units and depths, thickness of sedimentological units, etc.), or observations of an archaeological nature are in metric units. By convention, commas are used between the thousands place and the hundreds place for numbers but not calendar dates or years before the present (B.P.). Unless specified otherwise, radiocarbon dates included in the text are uncorrected radiocarbon ages. Because many sources consulted as part of AAR's study do not state whether radiocarbon dates included in them are calibrated or uncalibrated, they are assumed to be uncalibrated unless specific otherwise. Dates B.P. that are known to have been calibrated (cal) are so indicated by use of the abbreviation cal before the B.P. When calendar dates are provided they are counted backward from 1950. They are reported as B.C. (before the Common Era), or A.D. (Anno Domini).

Figure 20. View of excavations for the installation of the security fence in the North Area.

Organization of the Report

Following this introductory section, the remainder of the report is organized into seven chapters and several appendices. Chapter 2 presents a description of past and present environment and ecology for the study area. Chapter 3 presents context statements for regional ethnography and history. Chapter 4 provides the context for interpreting site 35TI90 in terms of regional settlement and landuse models and discusses prior archaeological research around Tillamook Bay and adjoining areas along the northern Oregon coast. Chapter 5 presents the research design for the project. Chapter 6 describes the field and laboratory methods used in this study. Chapter 7 presents the results of archaeological investigations at site 35TI90. Chapter 8 presents a summary and discussion of the results of the investigations. Chapter 9 relates the findings from site 35TI90 to regional archaeology. Chapter 10 presents the conclusions of the project. Chapter 11 lists the references cited. The text is followed by appendices that include an updated site record form (Appendix A), artifact catalogs (Appendix B), the report from the consulting geoarchaeologist (Appendix C) and those from the obsidian sourcing (Appendix D) and radiocarbon dating laboratories (Appendix E).

CHAPTER 2
ENVIRONMENTAL OVERVIEW

Site 35TI90 is located on the Trask River a little more than a mile from where the river empties into the southeastern corner of Tillamook Bay. Its location is at the western edge of Tillamook valley and is separated from the Pacific littoral by Cape Meares, a prominent headland that rises to 1,422 ft amsl. Tillamook Bay is a large, shallow basin that features a complex network of tide flats, bars, sloughs and marshes (Nelson et al. 1998:1-2). The Trask is one of four rivers that drain into its southern end. The others include the Tillamook, Wilson, and Kilchis rivers. The Miami River enters the bay at its northern end. Sediments deposited by northward flowing long shore currents have created a large spit across the mouth of the bay, with an opening at the north end through which the bay fills and drains with the tides. Named Bayocean Spit, it is a large but transient landform that has been pierced several times during the mid to late Holocene (Woodward et al. 1990) and as recently as the mid-1950s (Komar et al. 2004:6-8; Nelson et al. 1998:1-4). To the north and south, the bay is enclosed by low, steep hills with narrow beaches. To the east and south, the bay is bounded by a large floodplain created by the tributaries.

Geomorphology and Geology

Tillamook Bay is located along the western margin of the Coast Range, which extends from the Coquille River north into southern Washington (Franklin and Dyrness 1973). The Oregon Coast Range is bounded to the west by the continental shelf, on the east by the Puget Trough and on the south by the Klamath Mountains. The range is comprised generally of uplifted and folded interbedded seafloor sandstones and mudstones that date to the Eocene, Oligocene, and Miocene epochs. These lithified sediments are laced with similarly aged basalt from lava flows that erupted onto the seafloor or which were covered by flows that occurred after their rise above sea level (Alt and Hyndman 1978; Lund 1974; Orr et al. 1992; Schlicker et al. 1972). The geological formations underlying the Tillamook Bay area are composed mainly of Oligocene- and Miocene-age sedimentary rock (Pearson 2002). These formations are overlain by Pleistocene and Holocene alluvium (Komar 1997; Schlicker et al. 1972).

Tillamook Bay is a drowned river estuary that began forming about 9000 B.P. when the Holocene rise in sea levels began to flood the lower section of the five rivers in the area (Komar 1997; McManus et al. 1998). The estuary likely reached its current form as sea levels stabilized about 6000 B.P. when northerly longshore currents began to deposit drift sand, forming the Bayocean Spit (Nelson et. al 1998). The bay was divided until sometime between approximately 2,000-5,000 years ago, into two parts by a ridge that extended northwest from near Bay City. The Miami River flowed into the northern bay, and the Kilchis, Wilson, Trask, and Tillamook flowed into the southern bay (Glenn 1978; Peterson and Darienzo 1989). The modern bay is connected to the ocean by a natural channel on the northern end of the spit west of the town of Garibaldi. According to Komar (1997), the primary sedimentary input in estuaries is riverine with 80 percent of the sediment coming from the Wilson, Trask, and Tillamook river drainages. The mixing of riverine and marine sediments in the estuary is complex since the sediment-transport process fluctuates with the ocean tides, the seasonal fluctuations of water through the drainage system, and in accordance with particular circulation patterns throughout the system (Komar 1997).

The estuary is notable as an efficient sediment trap for both terrestrial and marine sediments (Charland and Reckendorf 1998:5-2). Prior to about 6,000 years ago sediment accumulation in the bay was rapid, between ca. 3 and 6 ft per 100 years, but the rate slowed considerably to about 8 inches per 100 years as sea level stabilized (Komar 1997:19-20). Near the mouths of the Trask, Tillamook, and Wilson rivers, Holocene-age deposits are up to 100 ft thick, but are generally shallower towards the north end of the bay (Komar 1997:18). Sedimentation patterns within the bay have been altered significantly over the last 200 years by the modification of river channels, several large forest fires, timber harvesting, agricultural activity within the alluvial plain, and the construction of two jetties (Komar 1997; Komar et al. 2004; Pearson 2002). The morphology of the bay was altered by a major influx of marine sediments into the bay as a result of a breach of the Bayocean Spit between 1951 and 1956, changing the control of tidal flow within the bay until a dike was constructed to close the breach (Coulton et al. 1996; Komar et al. 2004). The Tillamook alluvial plain periodically experiences large scale flooding due to heavy rain, melting snow, high tides, and strong winds that drive the high ocean tides ashore (Pearson 2002). These floods have the potential to top the banks of the Trask River at the site, especially its lower-lying parts. At least nineteen large-scale floods have occurred in the Tillamook Bay since the late 1890s (Coulton et al. 1996).

Most geomorphic studies of Tillamook Bay have examined the history of sedimentation in the bay as a way to address the effects of modern land use on sedimentation rates. These studies have not generally considered the rate of aggradation at the river mouths. It is likely that Holocene-era filling of the bay began when the tributary mouths were much farther south and east than present. During the early Holocene when sedimentation rates were higher, deltas at the mouths of the rivers flowing into it likely aggregated quickly, coalescing from separate finger-like landforms into more expansive landforms that over time stabilized into habitable land as opposed to tide flats or shallow water. The rate of aggradation related to delta building, in conjunction with earthquake uplift/subsidence data, could be used to determine when the part of the landform on which the project area is located was first available for use by native peoples. While such data are not available, it seems likely that the site area was habitable no earlier than about 5,000 years ago, when sea levels stabilized.

The morphology of the bay is also influenced by its proximity to the Cascadia Subduction Zone (CSZ) which is a region off of the west coast of North America where the Pacific plate, comprised of the Juan de Fuca and Gorda plates, subduct beneath the North America plate (Muhs et al. 1992; Verdonck 2006). At the center of the CSZ is a reverse fault that parallels the coastline from British Columbia, Canada, to Northern California. Subduction of the Pacific plate imposes considerable strain on the edge of the American plate as the edge of the continent becomes “locked” to the Pacific plate causing it to fold, warp, and move along fault lines (Verdonck 2006; Orr et al. 1992:189; Verdonck 2006; West and McCrumb 1988). Variables in the structural geology cause some regions along the coast to experience steady rates of uplift as the continental crust flexes, while other regions sink gradually or drop abruptly with the release of crustal pressures. This release of pressure is often associated with great thrust earthquakes of a magnitude 8.8 Richter or higher (Atwater 1992; Darienzo and Peterson 1990). The sudden drop of the continental shelf has both long-term and short-term effects on the coastal landscape and the people inhabiting them. One immediately potential effect is the on-shore rush of large waves, or tsunamis, formed by the sudden displacement of the seafloor (Atwater 1992; Darienzo and Peterson 1990; Kelsey et al.2006). As observed from the tsunamis that followed the large Sumatra-Andaman earthquake of December 26, 2004, these waves can have a devastating effect on coastal communities and landscapes.

The reoccurrence of large earthquakes and subduction events has been documented in several locations along the Oregon coast, including Bradley Lake where coseismic subduction events averaged one per 500 years (Kelsey et al. 2006). These tectonic events have shaped and configured the coastline through differential subsidence, uplift, sedimentation, and erosion. In the periods between coseismic subduction events, a relatively stable estuarine environment may reform as the uplift of the coast resumes, rivers adjust their gradients and sufficient amounts of muddy intertidal sediments accumulate. Davis and Jenevin (2008) note that with a 12,000-year presence of humans along the Oregon coast, the cycle of relocation and resettlement of a particular area may have occurred 24 times. At least eleven such events have been documented, with the last large earthquake occurring in A.D. 1700, which may have dropped land surrounding the bay up to 3 ft (Charland and Reckendorf 1998:5-14). Sediments carried by the tsunamis and deposited inland have been identified in estuaries and coastal lakes along the length of the zone (Kelsey et al. 1996; Losey 2002).

Paleoenvironment

No study of vegetation history has been conducted for the site 35TI90 area but several have been produced for adjacent or nearby areas or are intended to apply to large areas that encompass the site location (Briles et al. 2005; Long et al. 1998; Long et al. 2007). These vegetation histories and climatic reconstructions indicate three major stages of forest composition and inferred climate conditions during the Holocene:

From maximally 11,000 BP to ca. 5000 B.P. climate was warmer and drier than present with more open forest structure composed of more xerically adapted species;

The interval ca. 5000-2000 B.P. was characterized by an increasing trend towards mesic, or cooler and moister conditions associated with more closed forest structure and an increase in shade loving fire resistant species;

The most recent interval, ca. 2000 B.P. to present, is marked by the establishment of modern forest composition in all study regions, with species varying by region but consistent with continued mesic conditions.

Table 3 summarizes climate-historical interpretations for several studies pertinent to understanding vegetation and climate changes in the Tillamook area. These studies include pollen cores from lakes in the northern, central, and southern Oregon Coast Range (Briles et al. 2005; Long et al. 2007; Worona and Whitlock 1995) and from wetland areas in the central Cascade Range of Oregon (Sea and Whitlock 1994). Also included are studies encompassing a greater portion of the Pacific Northwest region including Washington and Oregon (Whitlock 1992) for the purposes of demonstrating the overall similarity of the findings from more localized studies have with broader regional climate and vegetation changes. While there is broad agreement in timing and trends between each of these studies, they do vary in terms of the timing of onset, duration, and species composition. This is largely due to latitudinal and elevation differences in study locations, a variety of microenvironmental controlling factors, and the time depth afforded by any given study.

The period of the Holocene beginning between 11-9,000 years ago and extending to approximately 5,000 years ago is widely recognized to be a time of significant warming and drying throughout the Pacific Northwest. Ecologically this trend was expressed in northwestern Oregon as a shift from the cooler moister post-glacial period characterized by sub-alpine *Pinus-Abies* parkland and *Abies-Pseudotsuga-Tsuga-Alnus* forests at higher elevations (5,000-7,500 ft amsl) to open forest stands composed of xerically adapted *Pinus* and *Quercus* species (Briles et al. 2005; Mohr et al. 2000). In the northern Oregon Coast Range data going back 9,000 years indicate a period of warmer drier conditions lasting until ca. 6700 B.P. with open forests composed of *Pseudotsuga menziesii, Alnus rubra,* and *Pteridium* at lower elevations (0-1,500 ft amsl) (Long et al. 2007). In the central Oregon Coast Range studies of macroscopic charcoal from lake sediment cores have identified evidence for increased fire frequency in association with pollen from xerophytic and fire adapted species such as *Pseudotsuga menziesii* and *Alnus rubra* in layers dating between ca. 9000-6850 B.P. (Long et al. 1998), while slightly further inland, in the central Cascade Range of Oregon, pollen studies have identified warm and dry conditions at all elevations and latitudes associated with xerophytic *Pseudotsuga* and *Abies* species in higher elevations and *Quercus* and *Corylus* species at lower elevations ca. 10,000-5000 B.P. (Sea and Whitlock 1994).

Following this long period of warming and drying a region-wide shift to cooler and moister conditions is evident in studies throughout the region beginning as early as ca. 6500 B.P. in the northern and central Oregon Coast Range and as late as ca. 4500 B.P. in the central Cascade Range of Oregon and southern Oregon/northern California. The difference in timing for the onset of this mesic period is attributable to both latitude and altitude of the study areas as well as inland versus coastal contexts. In southern Oregon and northern California higher elevation forests develop closed structures and became dominated by *Abies-Picea* and *Abies-Pinus* species respectively, indicating a downslope shift of xerothermic taxa (Briles et al. 2005; Mohr et al. 2000). In the central Cascades, xerothermic taxa such as *Quercus* and *Alnus* give way to more mesophytic species such as *Abies*, *Tsuga*, and *Pseudotsuga* (Sea and

Table 3. Summary of Relevant Vegetation and Inferred Climatic Change Studies

<table>
<tr><th rowspan="2">Years BP</th><th>Oregon Coast Range: South</th><th>Oregon Coast Range: Central</th><th>Oregon Coast Range: North</th><th>Oregon Cascade Range: Central</th><th>Pacific Northwest</th></tr>
<tr><th>Briles et al. 2005</th><th>Worona and Whitlock 1995</th><th>Long et al. 2007</th><th>Sea and Whitlock 1994</th><th>Whitlock 1992</th></tr>
<tr><td>Present</td><td rowspan="5">Mesic Modern Forest: Abies-Pseudotsuga</td><td rowspan="6">Mesic Modern Forest: cooler less effective moisture with increased Pseudotsuga and decreased Thuja plicata</td><td rowspan="6">Mesic Modern Forest Pseudotsuga menziesii, Picea sp., Abies</td><td rowspan="5">Mesic Modern Forest expansion in Tsuga in high elevations</td><td rowspan="5">Mesic Modern Forest</td></tr>
<tr><td>500</td></tr>
<tr><td>1000</td></tr>
<tr><td>1500</td></tr>
<tr><td>2000</td></tr>
<tr><td>2500</td><td rowspan="5">Mesic: cooler wetter Closed Abies-Picea forest</td><td rowspan="5">Mesic Abies, Tsuga, Pseudotsuga</td><td rowspan="6">Mesic: cooler and wetter</td></tr>
<tr><td>3000</td><td rowspan="6">Mesic Trend: cooler and moister Pseudotsuga menziesii, Tsuga heterophylla, Thuja plicata</td><td rowspan="8">Mesic Trend: cooler and wetter Tsuga heterophylla, Thuja plicata, Picea sitchensis</td></tr>
<tr><td>3500</td></tr>
<tr><td>4000</td></tr>
<tr><td>4500</td></tr>
<tr><td>5000</td><td rowspan="13">Xeric: warmer drier Pinus-Quercus Woodland</td><td rowspan="11">Xeric: warmer and drier Pseudotsuga, Abies, Quercus, Corylus</td></tr>
<tr><td>5500</td><td rowspan="10">Xeric: warmer and drier</td></tr>
<tr><td>6000</td><td rowspan="9">Xeric: warmer and drier Pseudotsuga menziesii, Alnus rubra</td></tr>
<tr><td>6500</td></tr>
<tr><td>7000</td><td rowspan="5">Xeric: warmer and drier Pseudotsuga menziesii, Alnus rubra, Pteridium</td></tr>
<tr><td>7500</td></tr>
<tr><td>8000</td></tr>
<tr><td>8500</td></tr>
<tr><td>9000</td></tr>
<tr><td>9500</td><td rowspan="4"></td></tr>
<tr><td>10000</td></tr>
<tr><td>10500</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>11000</td></tr>
</table>

Whitlock 1994). On the northern Oregon coast at lower elevations forests also become closed but are composed of *Tsuga heterophylla*, *Thuja plicata*, and *Picea sitchensis*, indicative of cool moist coastal rainforests (Long et al. 2007). Evidence from the central Oregon Coast Range shows similar patterning, though at higher elevations, with a shift to *Pseudotsuga menziesii*, *Tsuga heterophylla*, and *Thuja plicata* (Worona and Whitlock 1995). In all areas modern forest composition, reflecting more mesic conditions, is established between 2500-2000 B.P.

It is important to note that these trends are replicated in synthesized data from the Pacific Northwest more generally (Whitlock 1992). The findings of Long et al. (2007), Long et al. (1995), and Worona and Whitlock (1995) stand out in this comparison as indicating a much earlier onset of mesic conditions for the northern and central Oregon Coast Range than areas further inland or to the south. Taken as a whole the findings of these studies are useful for understanding the nature and timing of Holocene vegetation and climate changes in the study area near Tillamook Bay, Oregon on the Trask

River, though data from the northern and central Coast Ranges appear to be more pertinent in terms of the details of the findings.

Flora and Fauna

The study area lies within the Sitka spruce (*Picea sitchensis*) forest zone. Major tree species of this forest zone include Sitka spruce, Western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), and red alder (*Alnus rubra*) (Franklin and Dyrness 1988). Understory vegetation is dense and includes a variety of shrubs, herbs, and ferns including sword fern (*Polystichum munitum*), wood sorrel (*Oxalis oregona*), red and evergreen huckleberry (*Vaccinium parvifolium* and *V. ovatum*), salal, red elderberry (*Sambucus racemosa*), and western rhododendron (*Rhododendron macrophyllum*) (Franklin and Dyrness 1988). This forest zone extends inland from the coast several miles and along major river valleys to an elevation of approximately 500 ft amsl. Some variation in forest composition occurs in relation to microenvironmental factors. For instance, areas with high water tables such as lowland valley floodplains feature water tolerant species such as red alder, big leaf maple (*Acer macrophyllum*), and black cottonwood (*Populus trichocarpa*) more so than drier areas .

This vegetative zone supports a wide array of terrestrial mammals including deer (*Odocoileus* sp.) elk (*Cervus elaphus*), coyote (*Canis latrans*), black bear (*Euarctos americanus*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), beaver (*Castor canadensis*), snowshoe hare (*Lepus americanus*), raccoon (*Procyon lotor*), a wide variety of species in the Family Mustelidae such as weasels, minks, martens, and skunks. Bird species are many and include varieties of blue (*Dendragapus* sp.) and ruffed (*Bonasa umbellus*) grouse, mountain quail (*Oreortyx pictus*), and owls such as the great horned (*Bubo virginianus*) and long-eared (*Asio otus*) owls (Bailey 1936; Ingles 1965).

Estuary and riverine environments in the Tillamook area are productive and provide habitat for a diverse array of aquatic and littoral species. Surveys in the 1970s found that five species of salmon: Chinook, *Oncorhynchus tshawytscha*; Coho, *O. kisutch*; chum, *O. keta*; steelhead trout, *O. mykiss*; and sea-run cutthroat trout, *O. clarkia*, run in Tillamook Bay and its tributaries. In addition to these, over 60 species of non-anadromous fish were identified, with the most abundant being smelt (Osmeridae), northern anchovy (*Engraulis mordax*), perch (Embiotocidae), and herring (*Clupea pallasii*). Sole (*Parophrys vetulus*), starry flounder (*Platichthys stellatus*), rockfish (*Sebastes* spp.) and sculpin (Cottidae) were also noted (Ellis 1998:3-2). Although the 1970s survey of fish did not identify sturgeon (*Acipenser* spp.) in Tillamook Bay (probably due to sampling methods), sturgeon are known to have been present in the bay ethnohistorically (Byram 2002:67).

Salmon, as anadramous fish, are present seasonally in the Tillamook watershed during spawning season. While most salmon species run once a year, both fall and spring runs of Chinook salmon occur in the Tillamook watershed. Fall Chinook return to all five rivers from early September through mid-February. Spring Chinook salmon are primarily found in the Trask and Wilson rivers with numbers peaking in May. Tillamook Bay historically supported the Oregon Coast's largest chum salmon fishery, as well as substantial runs of Coho. At present, runs of steelhead occur within the Tillamook Bay watershed in the summer and winter but summer steelhead were introduced in the early 1960s. Winter steelhead are found throughout the sub-basin, generally entering streams from November through March. Sea-run cutthroat trout enter the bay in winter (Ellis 1998).

At least 12 species of bivalves are known to inhabit Tillamook Bay, including cockles (*Clinocardium nuttallii*), butter clam (*Saxidomus giganteus*), gaper clam (*Tresus capax*), Bodega tellin clam (*Tellina bodegensis*), jackknife clam (*Solen sicarius*), littleneck clam (*Protothaca staminea*), and species of saltwater clam (*Macoma* spp). Ghost shrimp (*Callianassa californiensis*), mud shrimp (*Upogebia pugettensis*), and Dungeness crab (*Cancer magister*) are also present (Ellis 1998).

Marine mammals present in the area include seals (*Phoca vitulina*), sea lions (*Eumetopias jubatus*, *Zalophus californianus*, *Callorhinus ursinus*), and sea otter (*Enhydra lutris*). Several species of whale migrate up and down the coastline but do not enter the bay. Resident bird species in the area include cormorants (*Phalacrocorax* spp.), common murres (*Uria aalge*), rhinoceros auklets (*Cerorhinca monocerata*), tufted puffins (*Lunda cirrhata*), and gulls (*Larus* spp.). A variety of migratory birds visit the area on a seasonal basis.

CHAPTER 3
ETHNOGRAPHIC AND HISTORICAL OVERVIEW

Prior to the arrival of Euroamericans, the Tillamook occupied the area surrounding site 35TI90. The name Tillamook, and the many variations of that spelling, is a Chinookan word for the inhabitants of the Nehalem area (Boas 1923), with the inhabitants of the Tillamook Bay area known as the Hoquartons, a name shared by a slough in the center of town, and an early name of the Tillamook townsite (Sauter and Johnson 1974: 24-25). The Tillamook were the southern-most Salishan speaking people in the Pacific Northwest (Seaburg and Miller 1990:560). Their language was closely related to the Salishan languages spoken in western Washington and more distantly to Salishan languages spoken in eastern Washington and Idaho (Zucker et al. 1983). Tillamook territory stretched from Tillamook Head just south of Seaside, Oregon to the Siletz River in the south. According to Jacobs (2003:xi), the Tillamook peoples who occupied the area encompassing the location of site 35TI90 spoke the Nehalem dialect, which prevailed between Tillamook Head and Cape Lookout.

Little formal documentation of Tillamook lifeways was made prior to significant disruption in the late eighteenth and mid-nineteenth centuries wrought through direct and indirect consequences of Euroamerican activities in the region. One of the most devastating consequences of contact with Euroamericans during this time period was the spread of infectious diseases against which the Tillamook had no resistance, and which consequently decimated them and the overall Native American population in western Oregon. The earliest documented epidemic involved smallpox that spread through the Tillamook and other groups along the Oregon coast beginning ca. A.D. 1775 (Boyd 1990:137). All groups lost at least a third of their members in this epidemic, which may have spread from a Spanish expedition ship (Boyd 1990:138). In 1788, Robert Haswell, a crewmember of the Lady Washington, noted that many of the Tillamook Indians who came to trade, showed evidence of scars from smallpox (Taylor 1974). A second epidemic followed in 1801, spread from the Great Plains through the Columbia Plateau. Various other epidemics of measles, small pox, malaria, or other infectious diseases occurred periodically between the 1820s and the 1860s. The cumulative effect of the epidemics was to reduce the population of the Tillamook from an estimated 4,320 in the early 1800s to 193 in 1854 (Boyd 1990:136, Table 1, 146).

Some information regarding the Tillamook way of life is contained in reports, travelogues, and narratives written by explorers, traders, missionaries, and early settlers (Lee and Frost 1968; Summers 1994; Taylor 1974;Vaughn 2004). Formal documentation by anthropologists who spent time interviewing Tillamook people at various times between the late nineteenth and mid-twentieth centuries followed significantly later than these earliest accounts (Barnett 1937; Boas 1898a, 1898b, 1923; Jacobs 2003). For the most part, the combined effects of extreme population losses, dislocation from traditional territories, and acculturation to Euroamerican culture, limited the amount and kind of information regarding traditional cultural practices recorded by anthropologists. Consequently, available accounts of traditional Tillamook lifeways lack many important details. The summary of Tillamook culture presented here applies generally to all Tillamook and describes their lifeways in the nineteenth century. It is important to remember that not all aspects of their culture were evenly documented, largely due to the interests and biases of observers, as well as the access to different types of information granted them by Tillamook informants.

Settlements and Structures

Traditional Tillamook territory extended from Tillamook Head south to the Siletz River, encompassing the lower Nehalem, Nestucca, Salmon, and Siletz rivers, Netarts and Tillamook bays, and Sand Lake. The Tillamook lived in permanent winter villages that were usually located at the mouths or confluences of major rivers, but also along estuaries and bays (Jacobs 2003:2; Seaburg and Miller 1990:561), though some villages may have been located in upriver locations (Vaughn 2004:22). At the time of Euroamerican contact, the largest villages contained as many as 25 houses (Jacobs 2003:69).

Jacobs (2003:xxii) reports that there were at least 12 villages around Tillamook Bay, most near the mouths of rivers and creeks (Figure 21). One, a site called '*Thu-qa-tən*' or '*Tow-er-quot-tons*' was located between Hoquarten Slough and the east bank of the Trask River in the general vicinity of site 35TI90 (Jacobs 2003:xxii; Sauter and Johnson 1974:iv). Lewis and Clark did not visit the bay but an Indian they spoke with told them of seven Tillamook villages that were around it (Moulton 1990 [6]:183-185; Sauter and Johnson 1974:20-23).

Houses at winter villages were rectangular, made of upright cedar plank walls and gabled roofs, and included both semi-subterranean and aboveground styles (Jacobs 2003:2; Seaburg and Miller 1990:561). House interiors usually featured a central fire pit and raised sleeping platforms along the sides (Seaburg and Miller 1990:561). Floors were covered with mats and goods were stored in baskets under the platforms or hung from the house rafters for smoking and drying. Besides houses, villages included sweat lodges, menstrual huts, ancillary structures, and cemeteries. One type of ancillary structure consisted of grass huts that Boas (1923) states were used to store provisions and firewood, but which Jacobs (2003) indicates were used only for firewood. Boas (1923:4) also notes that sometimes poor people built their houses from grass rather than wood plank. Minor et al. (1980) note that rectangular semi-subterranean houses made of grass with gabled or planked roofs, were used by the Tillamook year round, although it is poorly documented if such houses were built away from winter villages, such as at fishing stations (Minor et al. 1980:76). In 1853 Summers (1994) noted a village of two or three hundred inhabitants. The houses:

> "were built with four stout corner posts and two taller ones central at the two ends, bearing a regular ridge pole. Strong cedar boards laid like clapboards, made close, impervious walls; and the roof was like these walls, except the all the better ones were then overlaid with bark. In one end the characteristic opening served for both door and window and was covered at pleasure with a suspended mat, a board or a fur curtain. Inside, a row of posts, or poles, was set on the ground and bound to the roof some three or four feet from one or more sides of the room, or of the house if it was a small one, and a stout platform laid from the poles to the wall. This platform served as bedstead and, if there was any extra room, as a shelf. It was two or more feet above the ground (which did duty for a floor) and under it boxes, bags and one-knew-not-what-more found a resting place. In the center lay mats, around a square excavated fire-place...A variety of what might be called plates and dishes hung or sat wherever a convenient place presented itself; bows and arrows ornamented the walls. A stone mortar and pestle, or a basket-mortar with an opening at the bottom, sat idly in the corner, or was in use for pounding something into flour for the bread that should help to make the next meal" (Summers 1994:13-14).

Subsidiary residential sites were occupied seasonally from late spring to late autumn at fishing, hunting, and plant gathering sites. Structures were sometimes constructed at these locations, but were not as substantial as winter houses (Jacobs 2003:2-3), often consisting of a light pole frame draped with woven cattail reed mats, brush, or other available material (Jacobs 2003:69-70). For instance, Nash (1882:229) described a smoke house (that appears to have doubled as living quarters at an Indian fishing camp on the Yaquina River where a small weir had been built at the base of a small falls.

> "The Indian tyhees or shelters were on the bank close by…[they were] made of boughs, and some old boards they carried up-and hung around with torn and dirty blankets to keep in the smoke. Poles were set across and across, and from these hung the sides and bellies of the salmon, while a little fire of damp wood and grass was kept constantly replenished in the middle of the floor."

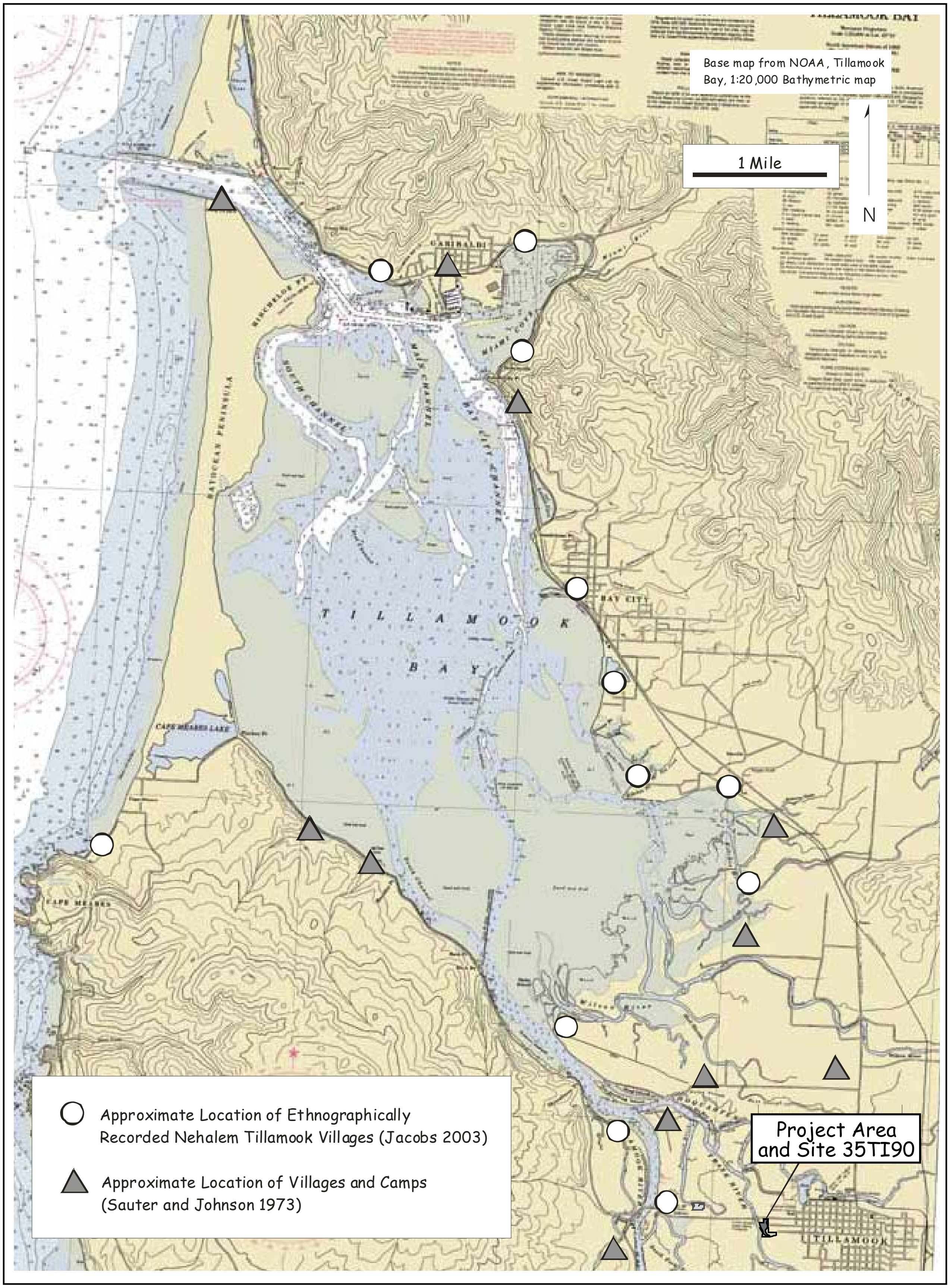

Figure 21. Approximate location of ethnographically recorded villages and camps in the vicinity of 35TI90.

Subsistence: The Seasonal Round

Tillamook subsistence incorporated a wide array of fish, shellfish, roots, berries, and mammals, both terrestrial and marine (Jacobs 2003:75, 80-81; Seaburg and Miller 1990:562). In fact, Zobel (2002) identified a minimum of 68 plant and 256 animal species potentially utilized by the Salmon River Tillamook, who lived just to the south of the Trask River area. Among these diverse resources, camas and berries, eels, salmon, shellfish, and elk were among the most important, though of these major resources land mammals perhaps contributed the least to the overall diet of Tillamook peoples (Suphan 1974:199). Resources were taken when available and were either consumed directly or processed and stored for future use. The pursuit of these different resources throughout the year, the seasonal round, was structured by their seasonal and spatial availability and involved families or task groups travelling throughout an established territory in time with shifting availability of the different resources. The Tillamook seasonal round was structured around seven seasons each of which was named for the major resources exploited at the time (Jacobs 2003:80). These seasons are listed in Table 4. In general, the seasonal round began as soon as the first salmon and root crops appeared in spring. At that time winter villages dispersed with groups traveling to root grounds (typically women and children) and fishing stations (typically men). In late spring and summer groups moved up the tributaries with the fish runs. The Tillamook seasonal round is outlined in more detail below.

Spring (April-June)

Spring began in April when people moved out of their winter villages and dispersed into small family-based foraging parties. The principle food targeted in the earliest spring (*hanxí·giu*) was salmonberry sprouts. During the months of May and June (*hanyítəgən*) foraging shifted to the harvest of the ripening berries of these plants (Jacobs 2003:80; Seaburg and Miller 1990:564). During this time seals and sea lions begin to congregate at terrestrial haul outs such as off shore islands and rocky points of land for breeding. Though the ethnographic documentation makes no reference to the season of sea mammal hunting it is likely that hunting parties targeted certain species of seals and sea lions during this season when they were abundant, concentrated, and disinclined to flee into the sea when hunters approached (Hilldebrandt and Jones 1992:361). Both these and other sea mammal species were likely taken on an encounter basis during the rest of the year.

Summer (July-September)

By late June, as spring was giving way to summer, camas, one of the most economically important root resources harvested by native peoples, was coming into season (Seaburg and Miller 1990:564). This would have begun the seasonal transhumant patterns of native peoples into upland and other meadow areas where these plants grew in abundance. Large quantities of camas and other root plants were harvested and roasted in earth ovens. While root harvesting groups, typically composed of small groups of women and children, were engaged in the camas fields, presumably largely male task groups concentrated on exploiting lamprey eel runs which spawn from June to July in the Oregon coastal rivers (Seaburg and Miller 1990:564).

As summer progressed and the camas season came to a close, female foraging behaviors shifted to the collection of a wide array of berries including salal berries, huckleberries, elderberries, and strawberries (Jacobs 2003:80; Seaburg and Miller 1990:564). Most of these berries were subjected to a lengthy process of repeated drying and mashing and ultimately were formed into berry loafs which would preserve over the winter. July and August (*hánuwú·ciɬ*) were prime berry harvesting months. By mid- to late August berries were out of season and subsistence efforts shifted to the exploitation of the August-September Chinook salmon runs (*hánqɛ̨́lu*). Fishing camps appear to have been composed of both males and females. Men made fishing equipment such as spears and weirs and engaged in most primary procurement of salmon. Women primarily engaged in processing of fish and salmon eggs, to judge from early accounts (e.g. Nash 1882:229).

Table 4. Tillamook Seasonal Subsistence Activities

Tillamook Season*	Translation	Calendar Months
hanxí·giu	time of salmonberry sprouts	April-May
Hanyítəgən	salmonberrying time	May-June
hánuwú·ciɬ	salal berry time	July-mid-August
Hánqɛ́lu	Chinook salmon season	late August-Sept
hánšɛšˀáwəɬ	silverside season: Coho salmon	October
hanƛ'xai	Chum salmon season	November
Hansútič	winter: steelhead season	December-April

*as listed in Jacobs (2003:80).

Fall (October-November)

Salmon fishing continued through the fall, with Coho salmon targeted during their October run (*hánšɛšˀáwəɬ*) and Chum salmon targeted in November (*hanƛ'xai*) (Jacobs 2003:80; Seaburg and Miller 1990:564). All species of salmon as well as other fish and shellfish harvested throughout the year were processed for immediate consumption as well as for storage and future consumption. During the processing of the fish, the salmon bones were thrown into the fire, the cooking structure was burned, as well as any materials used for processing the fish (Boas 1923:9). Vaughn (2004:17) describes the methods for drying salmon and other meat:

> "Their method of drying was to split the salmon from head to tail through the back, then spread them with cedar sticks split in small strips and stuck in the flesh crosswise, holding the fish apart. A rack was made the entire length of the drying house, and they laid the fish thereon and built a fire under them. When nearly dry, the rack was raised, a fresh one put in its place, and so on until the house was about full. We have seen tons of fish dried in their houses at a time. The Indians also dried a large stock of salmon roe, likewise their fresh meats such as elk and deer. Many also dried cockles, a species of clam with a rigid shell. Those they extracted from the shell, strung them on strings, and suspended them over the fires."

Although men hunted alone year round, larger groups of men would organize hunting parties during the fall elk season which coincided with the chum salmon harvesting season (*hanƛ'xai*). Bow and arrow, spear, traps, and pitfalls were used to capture and kill not only elk and deer, but also bear, beaver, muskrat, and other small mammals (Jacobs 2003:75). Hunting expeditions could involve day trips or longer-term forays.

Winter (December-April)

Winter was primarily a time of ceremonial activity, though some primary subsistence activity occurred (Seaburg and Miller 1990). For instance, winter was the time of steelhead runs (*hansútič*) which provided a source of fresh food to a diet based largely on dried and processed foods collected during the warmer months. Deer, elk, and other mammals were also occasionally targeted for fresh meat. During December a limited number of plant resources such as fern, wild carrot, lily root, and kinnikinnick were available for harvest.

In addition to these major resources a variety of other plant and animals species were harvested throughout the year. Sturgeon, flounder, herring, crab and various sea mammals were exploited at different times or on an encounter basis (Jacobs 1934, in Losey 2002:85; Jacobs 2003:77). Beached whales were not uncommon, with many washing ashore by the eddy north of Cape Lookout (Lee and

Frost 1968: 92-93), and were also opportunistically exploited for oil from the blubber (Moulton 1990:193; Vaughn 2004:25-26).

From an archaeological standpoint, important resource procurement and processing sites are known to have contained many kinds of features such as hearths, ovens, drying racks, and associated facilities depending on the specific resources and range of activities. Those used for fishing might also contain fish weirs and traps (Sauter and Johnson 1974:54).

Organization of Society and External Contacts

Tillamook society was organized on the basis of kinship such that multiple related families shared homes and winter settlements. Villages varied in size, ranging upwards of 100 individuals, though a more typical village contained around 25 people and might represent three to four related families (Sauter and Johnson 1974:26). The people of a village were distinguished as either free born or slaves. Most slaves were war or raiding captives taken from neighboring groups, or were individuals from other groups bought or traded for. Among the freeborn several social classes existed, including leaders, a middle class, and the poor. These class distinctions were fluidly defined by material wealth and acquisition of spirit powers (Jacobs 2003:96; Sauter and Johnson 1974:26-27). The leaders included village headmen as well as individuals granted leadership in the execution of specific tasks on the basis of their skill and knowledge (Sauter and Johnson 1974:26; Seaburg and Miller 1990:565). By far the most numerous social group was the middle class and as such they constituted a formidable political unit. Leaders had to consult with these people regarding decisions that would affect village life, thus severely limiting the power and authority of individual headmen (Sauter and Johnson 1974:27). This system produced a decentralized political structure that never coalesced above the level of the village (Seaburg and Miller 1990).

The Tillamook intermarried and had alliances with the Clatsop and other Lower Chinookan groups, as well as the Alsea (Hajda 1984) and Tualatin Kalapuya (Zenk 1990). Also, the Tillamook participated in a wide ranging trade network, exchanging canoes, baskets, and beaver pelts for buffalo hides, dentalium shells, and dried salmon (Seaburg and Miller 1990:561). They were known to travel via the Wilson River as far northeast as Sauvies Island in the Portland area to trade for wapato (Moulton 1990). Hajda (1984) describes the Tillamook as part of the Greater Lower Columbia interaction sphere that connected peoples through economic and social ties that lived between the The Dalles in the Columbia River gorge to the Pacific Ocean, including the Oregon Coast from Alsea northward. Participation in the network facilitated marriage, socializing, resource sharing, conflict resolution, and trade.

There are a few documented cases of conflicts involving the Tillamook mainly with Chinookan people (Franchere 1967) and the Tualatin Kalapuya (Mallery 1886 in Seaburg and Miller 2003). Lee and Frost (1844:103) describe the Tillamook raiding the Alseans and capturing slaves which they sold to the Clatsop or Chehalis. Such raids were conducted primarily for the purpose of obtaining slaves (Seaburg and Miller 1990).

Treaty Period

Treaties negotiated in 1851, but never ratified, led to the Tillamook ceding their traditional lands. However, no concerted effort was made by White settlers or the military to remove the Tillamook to either the Siletz Reservation, established in 1855 or to the Grand Ronde Reservation, established in 1858 (Kent 1973; Seaburg and Miller 1990:561). After the Siletz Reservation was reduced in 1875, many Tillamook remained on the coast, though many also moved to the Grand Ronde Reservation in search of government assistance (Zucker et al. 1983:113). The United States Congress disposed of land claim cases raised by the Tillamook in 1897 and 1912 and the courts dismissed a lands claim case in 1945. The

Tillamook received awards from the Indian Claims Commission in 1958 and 1962 (Seaburg and Miller 1990:561).

Historical Background

The first Euroamericans on the northern Oregon coast may have been Spanish explorers (Ruby and Brown 1976:26-31). Captain Robert Gray, an American, and his ship Columbia were the first Euroamerican ship and crew to cross the bar at the mouth of Tillamook Bay in 1788. George Vancouver arrived later that same year, exploring the Columbia River to upstream of the Willamette River (Silverstein 1990:535). In 1805, Lewis and Clark reached the mouth of the Columbia, over wintering at Fort Clatsop. Traveling as far south as Seaside, Oregon, they describe Tillamook Bay based on information from native peoples. These initial visits helped to open the region to further exploration and to trade.

Most early Euroamericans on the northern Oregon coast were engaged in the fur trade. Traders exchanged guns, powder, shot, items of Euroamerican clothing, knives, beads, and tobacco, as well as metal implements such as copper and brass kettles for furs provided by native groups (Silverstein 1990:535). The coastal fur trade focused on sea otters and resulted in the near annihilation of those animals by the early 1830s. Thereafter, the focus shifted to inland mammals such as beaver (Cole and Darling 1990:131). With production of sea otter furs declining, ship-based, coastal trading moved to land-based posts at Astoria, Fort Vancouver, and in the Columbia Basin of eastern Oregon and Washington.

Joseph Champion was the first Euroamerican settler in the Tillamook region, arriving in 1851 (Orcutt 1951:39). His stay was short, but the next year Henry Wilson arrived with some of the first cattle and Elbridge Trask settled on his donation land claim (DLC) along the Trask River. Downstream from Trask, Edrick Thomas claimed land on both sides of the Trask, including where the TWTP would later be built. Thomas's house and farm are shown on an 1858 General Land Office (GLO) map to have been located northeast of site 35TI90. In 1861, Thomas Stillwell bought out Thomas and began laying out a townsite he called Lincoln (Orcutt 1951:212). The name was eventually changed to Tillamook and by the 1890s the town had stores, hotels, saloons, a bank, and a courthouse, much of which burned in an 1893 fire (Orcutt 1951:215). By 1900, the rebuilt town had a telegraph and police and fire departments; municipal water was available by 1905.

Transportation issues and improvements were an important element in the development of Tillamook and early growth was hampered by transportation difficulties (Orcutt 1951:74-74). Access to Tillamook Bay was difficult due to the bar across its mouth mountainous terrain inland. Parts of the bay were dredged several times but attempts to clear its southern part through dredging were abandoned by the U.S. Army Corps of Engineers in the early 1900s (Komar et al. 2004:460). Construction of the north jetty at the mouth of the bay in 1918, however, allowed deeper draft ships access to Garibaldi (Orcutt 1951:74).

In spite of transportation problems, timber, dairy, and other agricultural industries thrived in the Tillamook Bay area, especially after the arrival of the railroad in 1911 (Orcutt 1951:74). Land clearing for farms and pastures began with the first settlers and levees and dikes were constructed throughout the late 1800s and early 1900s, effectively channelizing most parts of the rivers. By 1885, the first sawmill opened in Tillamook, soon followed by many others. By the turn of the century, however, dairy production supplanted lumbering as the most profitable business and fruit growing increased in importance.

Huckleberry (1970) notes that before the construction of the wastewater treatment plant, a sewage disposal system had been set up in the city and that a sewage pipe emptied directly into the Trask River. In 1946, an oysterman on Tillamook Bay protested to the City Council that city's sewage had contaminated his oyster beds. In response, money was appropriated for a treatment plant that became the TWTP (Orcutt 1951:190).

Historical maps dating to 1858 and 1955 prepared by the GLO, the United States Geological Survey (USGS), and National Oceanic and Atmospheric Administration (NOAA) were analyzed to determine the use and occupational history of the lands where land where the facility was sited. Based on the analysis, throughout the part of the historical period for which there is cartographic evidence, the lands appear never to have been occupied. The first development within the site area is seen on the 1955 edition of the USGS Tillamook, Oreg., 15-minute quadrangle, which is based on fieldwork conducted in 1953. That map shows a road extending due south from 3rd Street and terminating at a round structure in the approximate location of the existing TWTP. The structure appears to be a settling pond at an early version of the existing facility. The area east of the facility is shown to be a neighborhood on the western outskirts of Tillamook, much as it is today. To the west is shown the home that at present is next to the expanded TWTP. Beyond it to the west, a few dispersed structures are shown.

A 1939 aerial photograph (Figure 9) of the site area shows the future plant site and the upgrade and expansion project area as open fields. The photograph shows the neighborhood homes, garages and outbuilding east of the expansion area and a farm complex to its west, north of the staging area. No homes are shown to be within the expansion and upgrade project area. A small rectangle is shown in the northern part of the expansion area directly south of 3rd Street. It may be an outbuilding. It is outside of the site 35TI90 boundary.

CHAPTER 4
PREHISTORIC ARCHAEOLOGICAL CONTEXT

The Oregon Coast is included in the southern part of the Northwest Coast culture area of North America, which extends from the Copper River delta on the Gulf of Alaska to the Winchuk River near the border of Oregon and California. Inland, the Northwest Coast culture area ranges from the Chugach and Saint Elias mountain ranges of Alaska through the Coast Range of British Columbia, and includes the area between the coast and the Cascade Range in Washington and Oregon (Suttles 1990:1). Cultural characteristics common among the prehistoric and ethnographic peoples of this region include an "overriding" emphasis on personal wealth and status, an economy based on intensive harvesting and preserving of natural resources (particularly of salmon), multifamily households, and complex exchange systems (Matson and Coupland 1995:36). Northwest Coast peoples also possessed a distinctive woodworking technology that was expressed in wooden plank houses, ocean going canoes, and numerous items of everyday domestic use as well as items of spiritual and ceremonial use. The artwork of this culture area is very distinctive, and includes carvings, paintings, and textiles in wood, fiber, horn, shell and antler among other media.

In regional syntheses the Oregon coast is often treated as exhibiting weak expressions of many of the main overarching cultural developments that characterize the Northwest Coast cultural pattern. This is due at least in part to the fact that comparatively little ethnographic and archaeological work has been conducted in this region, making our understanding of the timing and nature of cultural developments necessarily limited. This situation has begun to be remedied over the last couple decades and it is now becoming apparent that prehistoric cultures along the Oregon coast developed along similar lines in tandem with coastal areas further north. These developments, however, were not identical, being structured by the unique patterns of resource availability offered by the open coast and estuarine environments that characterize the Oregon coast.

Even after 100 years of archaeological research, the prehistory of coastal Oregon remains poorly defined and understood (Lyman 1991:18, 76-77; Lyman and Ross 1988:104). Focus on research in coastal/estuarine/riverine settings has produced a bias within the available dataset for describing complete settlement-subsistence systems and how they changed over time. The exposed shoreline that characterizes this portion of the Pacific coast creates a heavy erosional environment which, in conjunction with the dynamic and often dramatic geologic forces operative in the region, has produced a heavy bias towards the identification and recovery of sites dating to within the last 2,000 years. In fact, it has only been in the last 20 years that researchers have begun to identify sites dating to the late Pleistocene/early Holocene in this region (Erlandson et al. 2008; Hall and Davis 2002; Hall et al. 2003; Hall et al. 2005; Punke and Davis 2006). Similarly, attempts to synthesize the Oregon coastal research and to integrate the prehistory of the area into the larger context of the Northwest Coast have only been relatively recent, within the last 20 years (Ames and Maschner 1999; Lyman 1991; Lyman and Ross 1988; Moss and Erlandson 1998). The following discussion presents several models of human adaptation that are relevant for understanding Northwest Oregon Prehistory and situates these models within the overarching trajectory of Northwest Coast cultural development.

Northwest Oregon Prehistory: Models of Human Adaptation

Ross (1990) has divided the Oregon coast into northern, central, and southern cultural and geographic sections. Site 35TI90 is located in his Northern Oregon coast that is defined as the area extending north from the Siletz River to the Columbia River. The Central Oregon coast is between the Siletz and Coquille rivers, and the Southern Oregon coast extends south from the Coquille River to the California border. These divisions correspond to historic linguistic distributions along the coast. The Northern Oregon coast was occupied by Salishan speakers (Tillamook), the Central Oregon coast by Alesan (Yaquina and Alsea), Siuslawans (Siuslaw and Lower Umpqua), and Coosan (Hanis) speakers, and the Southern Oregon coast by a variety of Athapaskan speakers, including the Upper Coquille and

Tutuni groups, who are believed to have emigrated to the area sometime during the last thousand years. In terms of overarching patterns of cultural development, the north coast appears most closely associated with cultures of the lower Columbia River, while further south, Willamette and other interior valley groups were more influential. Finally, the Southern Oregon coast shares many cultural developments with northern California.

A localized cultural chronology useful for understanding cultural developments associated with site 35TI90 and the Northern Oregon coast was proposed by Minor (1983). His chronology was developed for the lowermost section of the Columbia River, located approximately 50 miles north of Tillamook Bay, and defined four sequent periods of development. The oldest period, the Youngs River Complex, dates to between ca. 6000 and 4000 B.C. (ca. 8000-6000 B.P.) and is defined by an artifact assemblage containing shouldered lanceolate and leaf-shaped projectile points, stemmed scrapers, and bola stones. Although no artifacts from this complex have been found in datable contexts, stylistically such artifacts have been dated to this time interval in other parts of the Pacific Northwest. Following this period, Minor defined the Seal Island Phase, dating between 4000 B.C. and A.D. 1 (ca. 6000-2000 B.P.). Artifact assemblages associated with this cultural phase are known to contain broad-necked projectile points most likely associated with dart technology, as well as higher frequencies of cobble flake tools used as knives, scrapers, and simple used flakes. The next cultural period, the Ilwaco Phase, dates from 1 to A.D. 1775 (ca. 2000-200 B.P.). This phase is divided into subphase I (A.D. 0 to A.D. 1050) and subphase II (A.D. 1050 to A.D. 1775). Throughout both subphases, narrow-neck projectile points, likely associated with bow and arrow technology, dominate weapon systems. The key differences between the two subphases appear to be lack of broad-necked points in the Ilwaco II subphase, and a change in harpoon technologies, from single piece non-toggling harpoon dart heads to composite toggling harpoons. The final period, the Ethnographic Phase, dates from A.D. 1775 to 1851 and is distinguished by the presence of artifact types and materials introduced by Euroamericans.

Minor (1983) also proposed a settlement model for the Lower Columbia region. He described a settlement system consisting of four site types – winter villages, summer villages, shellfish-gathering camps, and hunting and fishing camps. Plank houses were present at both winter and summer villages. The village types were distinguished based on where houses were sited. At winter villages they were located in sheltered areas away from the Columbia River, and summer villages were located along the mainstem Columbia River. Minor also suggested that some village sites may have been located to serve as year-round villages. Shellfish gathering camps were located near shellfish habitat, usually along the outer coast or along estuary margins, and were primarily occupied during the summer. Hunting and fishing camps were located in a variety of environments, often along small tributaries. These sites may have been used at any time of year, and may have also been used for root/berry/plant gathering. This settlement model is most relevant to understanding the last 2,000 years, which includes the Ilwaco and Ethnographic phases, during which time cultural patterns are most consistent with the ethnographically documented ways of life. No similar settlement models were described for the earlier periods. Whether this settlement pattern describes cultural behavior along Tillamook Bay and its tributaries is open to debate. It does not seem to characterize historic-era Tillamook settlement practices which relied more on temporary summer encampments at a variety of resource extraction locales. However, broadly, the general pattern outlined by Minor (1983) is common to all Northwest Coast societies.

A second approach, adopted by Lyman (1991) and Lyman and Ross (1988), presented a cultural chronology for the Oregon coast as a whole and defined three periods of adaptation to varying combinations of riverine, terrestrial, and littoral resources: the Pre-Littoral Stage, the Early Littoral Stage, and the Late Littoral Stage. The approach has been critiqued on semantic grounds for implying a period in Oregon coastal prehistory when marine and littoral resources were not used, when archaeological evidence from early dating sites clearly suggests otherwise (Minor 1997; Moss and Erlandson 1998).

The Pre-Littoral period represents the earliest period of known human occupation on the Oregon Coast and though the precise onset of the period is uncertain, it appears to have lasted until ca. 5-6000

B.P. This period takes its name from an apparent limited use of marine resources in the subsistence economy. Interior or terrestrial resources are believed to have comprised the bulk of the Pre-Littoral diet. Pre-littoral populations inhabited the coast, river valleys, and western foothills of the region. Lyman and Ross (1988:98) suggest that these people were "generalist foragers" using a broad range of resources, primarily from interior riverine and upland sources. Artifacts common to this period include flaked stone tools such as scrapers, blades, knives, and a variety of projectile points made from CCS and obsidian, as well as groundstone tools used for processing plant products. This period is fairly well represented on the southern Oregon coast, but to date little information has been recovered from the central and northern portions of the coast.

The beginning of the Early Littoral period overlaps with the end of the Pre-Littoral period at ca. 5-6000 B.P., and extends to around 1500 B.P. Sites associated with this era are found along the entire coast, although it is more poorly represented on the north coast. The Early Littoral represents initial adaptation to the use of marine resources, particularly the inter-tidal zone. Shifting subsistence strategies were likely due in part to middle Holocene sea level stabilization and the resulting coastal and estuarine development and stabilization (Lyman and Ross 1988:100). This period is associated with an increase in use of bone tools for fishhooks and harpoons and a concomitant reduction in the manufacture and use of lithic tools, though this must to some degree be related to preservation issues. Evidence for use of riverine/estuarine fish, waterfowl, and small mammals and marine mammals, rockfish, and shellfish has been found.

By ca. 1500 B.P., the Late Littoral cultures were in place at all locations on the Oregon coast. During this time most permanent and temporary sites were located directly on or in close proximity to the coast. Settlements became more permanent and sedentary, and marine, riverine, and estuarine resources, supplemented by terrestrial resources, formed the basis of economic subsistence. The transition to the Late Littoral period was gradual, taking place perhaps over 500 to 1,000 years, becoming complete by ca. 2000-1500 B.P. and continuing until Euroamerican exploration and settlement in the late-eighteenth and early- to mid-nineteenth centuries. Large shell midden sites are common during this period, reflecting increased sedentism and/or population increases. Reliance on lithic technology continues to decrease, and bone tools become more prevalent, including antler wedges, flaking tools, chisels, bone needles, awls, fishhooks, pendants, fish lures, composite harpoon heads, and gaming pieces. While flaked stone tools are less common, diagnostic projectile point styles shift to concave-based, triangular, tanged forms designated as Gunther Barbed types.

Ross and Lyman (1988) propose that from 1500 to 300 B.P. the settlement patterns along the northern Oregon coast consisted of four basic site types: Winter villages, spring/early summer hunting camps, spring/early summer shell midden camps, late summer/fall salmon fishing camps. Fishing camps may have been located very near to winter villages, but not necessarily. Winter villages were located along the estuary, from the mouth to tidewater. By spring, the winter village population split up, and headed to resource procurement camps, many on the outer coast at shell gathering sites, or at hunting camps in the uplands. By mid to late summer, the populations came together at fishing camps, where fish were caught, processed, and moved to the winter village for later consumption.

Relation to Regional Syntheses

These models of human adaptation can be fruitfully compared against broader regional perspectives (Table 5). Two major syntheses of cultural developments on the Pacific Northwest coast have been presented (Ames and Maschner 1999; Matson and Coupland 1995). These syntheses differ primarily regarding timing and not characterization of sequent cultural adaptations. Such differences in interpretation of the available data may relate to differences in regional emphases of the various scholars as well as to epistemological stances pertaining to the relationship between evidence and inference. For instance, researchers may differ regarding the minimum set of traits and which traits are necessary to

Table 5. Comparison of Cultural Development Models

<table>
<tr><th rowspan="2">Years B.P.</th><th colspan="2">Northern NW Coast Models</th><th colspan="2">Macro-Regional Models</th></tr>
<tr><th>Lyman 1991</th><th>Minor 1983</th><th>Matson and Coupland 1995</th><th>Ames and Maschner 1999</th></tr>
<tr><td>500</td><td rowspan="4">Late Littoral logistical collecting sedentism</td><td rowspan="4">Ilwaco Phase logistically organized collecting</td><td rowspan="5">Ethnographic Pattern</td><td rowspan="3">Late Pacific ethnographic pattern</td></tr>
<tr><td>1000</td></tr>
<tr><td>1500</td></tr>
<tr><td>2000</td><td rowspan="4">Middle Pacific logistically organized collecting</td></tr>
<tr><td>2500</td><td rowspan="6">Early Littoral coastally oriented mobile foragers</td><td rowspan="7">Seal Island Phase coastally oriented mobile foragers</td></tr>
<tr><td>3000</td><td rowspan="2">semi-sedentary logistical collecting</td></tr>
<tr><td>3500</td></tr>
<tr><td>4000</td><td rowspan="2">mobile foragers, coastally oriented</td><td rowspan="4">Early Pacific coastally oriented mobile foragers</td></tr>
<tr><td>4500</td></tr>
<tr><td>5000</td><td rowspan="9">Old Cordilleran mobile generalized foragers</td></tr>
<tr><td>5500</td><td rowspan="10">Pre-Littoral mobile generalized foragers</td></tr>
<tr><td>6000</td><td rowspan="5">Youngs River Complex mobile generalized foragers</td><td rowspan="10">Archaic mobile generalized foragers</td></tr>
<tr><td>6500</td></tr>
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<tr><td>10,000</td></tr>
<tr><td>11,000</td><td></td></tr>
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define a cultural adaptation as heralding the emergence of the ethnographic pattern. These differences aside, the basic cultural patterns identified are similar.

Matson and Coupland (1995) provide the first synthesis of the Pacific Northwest Coast archaeology. They divide the Northwest Coast into three regions: the North, Central; and South coasts. Site 35TI90 is located in the South Coast subregion. They refer to the earliest dated occupation along the Central and South coasts as representing the Old Cordilleran culture, which they date to between 9000 and 4500 B.P. People of this culture lived on the coast as well as in the interior. The material culture of groups living in each region was similar. Matson and Coupland (1995) identify components of this tradition, including those identified to the Cascade phase, from the Oregon-California border north to British Columbia and west to Idaho. This culture had clear interior and coastal variants and though generally interpreted to represent a highly mobile, broad-based hunting and foraging culture focused primarily on terrestrial mammals, early dating coastal Old Cordilleran sites such as Glenrose and Bear Cove in British Columbia (Matson and Coupland 1995) and early dating sites on the southern Oregon coast such as Indian Sands (Moss and Erlandson 1998), Tahkenitch Landing (35DO130), and Neptune (35LA3) indicate a broad based coastal adaptation existed at this time. The Old Cordilleran concept incorporates Lyman's (1991) Pre-Littoral period and Minor's (1983) Youngs River Complex that includes undated but presumably early sites located on high terraces near the mouth of the Columbia River that contain shouldered and leaf shaped points.

Following the Old Cordilleran Tradition, Matson and Coupland (1995) recognize growing differences between material inventories and adaptive patterns between coastal and interior regions during the period 4500-3300 B.P. as well as the development of regionally distinct cultures along the Central and Northern Northwest coasts. Adaptations in coastal environments at this time become unequivocally coastally oriented, no longer appearing to be primarily terrestrial based. Limited evidence for residential structures or village sites exists for this time period leading to the impression that the basic adaption was one of generalized mobile foraging. A similar adaptation occurred slightly later on the South Coast, ca. 3500-2000 B.P.

Between roughly 3500-2500 B.P. the Central and North Coast exhibit a stage of cultural development in which all the elements of seasonally sedentary collecting are in place but for which other aspects of the ethnographic pattern are lacking, most notably evidence for social differentiation. No similar period on the South Coast is recognized by the authors. According to Matson and Coupland (1995) social differentiation and the development of the full Northwest Coast ethnographic pattern appears on the Central and North coasts by 2500 B.P. and not until after 2000 B.P. on the South Coast.

The second major synthesis of Pacific Northwest Coast cultural developments was offered by Ames and Maschner (1999). While their model strongly parallels the one presented by Matson and Coupland (1995) their characterization of cultural developments encompasses a greater time span, going back ca. 11,000 years. Ames and Maschner (1999) also identify the shift to greater incorporation of coastal and marine resources as having occurred almost one thousand years earlier than Matson and Coupland (1995), but identify the shift to logistically organized collecting and seasonal sedentism as occurring at the same time, ca. 3500 B.P. However, where Matson and Coupland (1995) identify the ethnographic pattern as emerging ca. 2500 B.P., Ames and Maschner (1999) do not believe this pattern emerged until ca. 1500 B.P.

Taken together these syntheses indicate a very similar pattern of human adaptation and cultural development between early post-glacial times to the mid-Holocene. The earliest groups of people in the greater region were highly mobile generalized foragers. After ca. 5000 B.P., as sea levels began to stabilize, people began to rely increasingly on littoral and marine resources. By around 3500 B.P. evidence is seen for an adaptive state that featured logistically organized collecting systems. Finally, somewhere in the neighborhood of 2000 B.P. the way of life noted at contact evolved into being. It is not expected that these changes occurred simultaneously throughout the Northwest Coast culture area, but it is important to recognize that each of these cultural developments can be identified in the archaeological record from southern Alaska to the California/Oregon border. More work is required at the local level to flesh out the details and timing of these developments in different areas of the coast.

Previous Archaeology in the Site 35TI90 Vicinity

Local to site 35TI90, very little archaeological research has been conducted either around the southern end of Tillamook Bay or the lower reaches of its tributary rivers. At the time of AAR's fieldwork there were no archaeological sites recorded within a mile of 35TI90. The lack of recorded sites almost certainly reflects a limited amount of previous archaeological fieldwork in the general area and the reliance on surface surveys to locate archaeological sites (Connolly 1996; Fagan 1980; Pettigrew and Cole 1977; Swanson 1976).

In this section previous archaeological investigations conducted around Tillamook Bay and adjoining sections of the Oregon coast to the north (Nehalem Bay) and south (Netarts Bay) are reviewed to situate regional archaeology in relation to the expectations of Minor's (1983) and Lyman and Ross' (1988) settlement models. Since most of these recorded sites date to within the last 2,000 years, this review can be used to inform hypotheses regarding the function of site 35TI90 in Tillamook Indian land use and settlement systems.

Tillamook Bay

Many archaeological sites are known to be located in the greater Tillamook Bay area but have received minimal attention. Most were recorded in the early 1950s by Lloyd Collins (1953) who noted more than 60 years ago that many sites were being damaged or destroyed by real estate developments, other construction, and looting by relic seekers (Collins 1953:52, 62-63). Much of what is known regarding the prehistory of the Tillamook Bay area comes from the work of two amateur archaeologists, John Sauter and Bruce Johnson (1974), who co-authored a book on the Tillamook Indians. Although amateurs, and despite their being disparaged by Woodward et al. (1990) as mere relic hunters, their work is not atypical of much of the archaeological work that was conducted in the Pacific Northwest in the 1950s-1970s. It is mainly descriptive, short on details, and presented in a fashion that does not address any overarching research goals.

The two conducted extensive fieldwork around the bay (and elsewhere along the northern Oregon coast) and identified numerous archaeological and ethnographic sites. These include the Netarts Landing site located on the west bank of the Tillamook River that was along the travel route over Cape Meares to Netarts Bay; a location approximately one mile south of the Miami River where several Tillamook women lived and sold baskets into the 1920s; Hobsonville Point, located near the Miami River that was a possible village and canoe burial ground; Goose Point, a village site reportedly destroyed years ago during road construction in Bay City; Flower Pot Hole, a small village located on a cove on the west side of Tillamook Bay; the Bay Ocean Sand Spit village that was located near the southern end of the spit stretching up to a mile along it; and the Dam Hole that was located several miles up the Trask River and was a popular fishing spot for the Tillamook (Sauter and Johnson 1974:62, 140-177).

They conducted large-scale excavations at site excavations at 35TI2, the Chishucks site located where the Wilson River formerly drained into Tillamook Bay, before in-silting shifted the bay westward. It is located approximately 2 miles north of site 35TI90, on the north bank of the Wilson River about 2.5 mile upstream from its 1970s mouth (Sauter and Johnson 1974; Woodward et al. 1990). The site was a winter village that was occupied into the nineteenth century (Sauter and Johnson 1974:144; Vaughn 2004). William Clark, of the Lewis and Clark expedition, was informed by Tillamook people he met in the vicinity of the present-day Cannon Beach (while attempting to purchase whale blubber from them) of the presence of several Tillamook villages on Tillamook Bay. A map later prepared by Clark shows the bay and the villages around it including one on the lower Wilson River that probably represents the Chishucks site (Moulton 1990:184).

The site contained shell and non-shell midden deposits that yielded a large number of stone and bone artifacts and economic bone. Among the latter were bones from birds, elk, deer, beaver, sea otter, cougar, salmon, and whale. Stone artifacts included projectile points, scrapers, drills, gravers, a stone bowl, and flakes. A total of 958 projectile points were found, including 372 stemmed points, and 586 with no stems. Many of them were serrated and resembled a style more common in the Willamette Valley among the Kalapuya. Bone tools included wedges, awls, digging stick handles, toggling harpoon heads, fishhooks, toggle points, and whalebone clubs, scraper and bi-pointed knife. Several bone artifacts were carved into anthropomorphic and zoomorphic shapes, including beaver and bird digging stick handles, and whalebone club handles with possible human and bird designs.

Several features were located at the site, including tool caches, circular fire pits, and cedar posts. The fire pits were constructed of small basalt rocks and were 60 to 75 cm in diameter and 30 to 45 cm deep. Below the rocks was a layer of brown clay, hardened from the heat. Three possible cedar house posts were also found. Each was about 6-7 cm diameter, the bottoms of which had been burned, probably to retard decay.

Historic-era artifacts were recovered from some areas of the site, including rolled sheet copper, broken colored glass, a Chinese coin with a date of 1820 on it, a large piece of beeswax, a large blue bead, and a trade button (Sauter and Johnson 1974:147). In addition, several “Columbia River style artifacts” were recovered, suggesting trade between the Tillamook Bay area and the lower Columbia River.

A professional archaeologist, John Woodward, conducted additional excavations at the site in 1989 and 1990 with students from Tillamook Bay Community College and Mount Hood Community College (Woodard et al. 1990). The crew excavated a trench 24 m long and 2 m wide parallel to the Wilson River in an area untouched by Sauter and Johnson (1974). The results of the excavations are described in four pages within a brief article related to paleoseismic activity on the northern Oregon Coast published in Oregon Geology (Woodward et al. 1990:58-61). Woodward et al. (1990) noted that the main cultural deposits at the site consisted of a lower shell midden that directly overlay cobbles, a non-shell midden over the lower shell midden, and an upper shell midden nearest the surface. Shellfish species in the lower and upper middens were different indicating a change in ecological conditions and biological communities near the site. Woodward et al. (1990:61) interpret their findings as suggesting that during the early period of site occupation the locale featured an open coast environment. The later shell midden deposits are composed of estuarine shellfish species similar to those found in the modern Tillamook Bay. Charcoal from the lower midden deposit was radiocarbon dated to 1030 + 60 B.P., which provided a calendar date of around A.D. 920 (Woodward et al. 1990:59-60). The other important observation derived from the work is that despite a perturbation of unknown scale that altered the environment of the bay, there were no appreciable gaps in occupation. The non-shell midden directly overlay the lower shell midden indicating that the time period during which new shellfish species colonized and became established in the bay, people continued to use the site. Of note, only the non-shell midden deposits contained duck bone. Other than that difference, other economic bones, and artifacts are similar throughout the cultural layers.

<u>Nehalem Bay</u>

Located north of Tillamook Bay, in ethnographic times Nehalem Bay and estuary were occupied by groups linked dialectically to the ones on Tillamook Bay (Seaburg and Miller 1990:560-561). Ten prehistoric sites are recorded on the tidewater section of Nehalem Bay, nine of which were habitation sites. The tenth is a possible wood stake fishing weir. Some excavation has been done at five of the habitation sites. Four of these form the Cronin Point site complex. They include the Cronin Point site, 35TI4, which originally was recorded by Collins in 1951 (Collins 1951). Fieldwork was conducted at the site in the 1980s and 1990s (Scheans et al. 1990; Woodward 1986; Woodward et al. 1990). As recorded, the site is expansive and extends around the west and north sides of the bay. In 2000, to facilitate nomination of the site to the NRHP, it was divided into four separate sites (Losey et al. 2000) that were designated 35TI4, the Cronin Point site; 35TI75, the Spruce Tree site; 35TI76 the North Trail House site; and 35TI77, the Elk Meadow site.

Prior archaeological research at Nehalem Bay was reviewed by Losey (2002:427-452) as part of his dissertation research into Tillamook Indian responses to an earthquake and tsunami known from Japanese historical records to have occurred in January A.D. 1700. He also conducted his own, limited investigations at the sites (Losey 2002:453-539). This review is drawn from Losey (2002) except where noted.

Despite several rounds of fieldwork at the Cronin Point site, 35TI4, information from it is limited, based largely on poor or incomplete reporting and the narrow focus of some of the investigations. Based on Losey's (2002:462) work there it appears to consist almost entirely of eroded archaeological material. It appears to have been a late prehistoric campsite (non-winter village). Four radiocarbon dates have ostensibly been returned on materials collected from the site but two of the dates are so poorly documented that they are not useful for dating the site. A third radiocarbon date is modern and a fourth date, of ca. 2100 B.P., is not related to occupation at the site but instead on the formation of a buried soil (Losey 2002:460-461). Perhaps the most noteworthy observation to come from the several investigations conducted at the site is that it contains a relative abundance of east Asian porcelain shards, one of which was fashioned into an arrow point. The porcelain appears to have been manufactured in the mid-1600s (Losey 2002:433).

Based on the presence of housepits and related features Losey (2002) believes sites 35TI76 and 35TI77 probably represent winter villages, while sites 35TI4 and 35TI75 likely functioned as seasonal fishing and hunting camps that were closely linked to the village sites (Losey 2002). Most of these sites date to a relatively narrow time period before and after A.D. 1700. Although there was some evidence for possible earthquake-related subsidence, radiocarbon dates and associated artifacts suggest that this part of the bay was not abandoned for a substantial period of time after the A.D. 1700 event (Losey 2002).

Site 35TI57 is located on the north end of Nehalem Bay, at its confluence with a small, unnamed creek, approximately 500 m south of 35TI4. Found at the site was a non-shell midden that contained abundant lithic artifacts, some bone and wooden artifacts, and a large quantity of FCR (Minor 1991). Radiocarbon dates from the site range between 340 + 60 cal B.P. (Beta-41035) and 640 + 60 cal B.P. (Beta-41032).

Excavations at the site led to the recovery of 12,619 pieces of lithic debitage, 108 stone tools, four bone artifacts, and three wood artifacts. The debitage was primarily CCS (97%) with small amounts of basalt (2%) and obsidian (1%). Flaked stone tools include nine cores, 22 bifaces, 24 used flakes, 21 projectile points, 14 projectile point fragments, four perforators, and four scrapers. Cobble tools included four hammerstones, and three hammerstones/anvils. In addition, three abraders were recovered. The bone and wooden artifacts were fragmentary and largely unidentifiable as to form or function.

Animal bone was common in the midden deposit and 12,605 pieces of faunal material were recovered, most of which were highly fragmented. Salmon remains were the most abundant with 7,933 pieces, followed by unidentifiable mammal (n=589) and unidentifiable fish (n=532). Despite being located on an estuary, no shellfish were recovered. At present, Nehalem Bay is known for its lack of shellfish beds and the lack of shellfish in the midden suggests that they were also scarce during the period of site occupation. Although the salmon bone suggests that this was primarily a fishing camp, none of the recovered tools are for fishing, suggesting that fish were caught through other means, such as weirs, baskets, and nets. The presence of mammal remains and the flaked stone tool industry suggest that the site was also used as a hunting camp, with tool manufacture and maintenance, and the processing of mammal remains.

Another Nehalem Bay area site is 35TI91, which is located three miles up the Nehalem River, just upstream from its confluence with Fork Island Slough, and the North Fork Nehalem River. It is located on the north bank of the river on a small rise that is the most-elevated part of the landform. Archaeological material was found during a survey in four STPs between 50 and 100 cm below the contemporary ground surface. One of the STPs encountered dark-colored midden deposits from which 21 pieces of lithic debitage, one scraper, one core, two pieces of bone, two pieces of possibly culturally modified wood, and 119 pieces of FCR were recovered. Three other STPs contained a total of seven pieces of FCR. Investigators of the site suggest that it became buried as a result of alluvial processes but add that its burial might have been hastened by tectonic subsidence (Becker 2007).

Netarts Bay

Netarts Bay is south and west of Tillamook Bay. It is a shallow embayment separated from Tillamook Bay by a northwestward projecting spur of Coast Range, the northwest tip of which is Cape Meares. Several low-order streams but no rivers flow into Netarts Bay. It is separated from the Pacific Ocean by a long sand spit (Netarts Spit) that runs nearly the entire north-to-south length of the bay. In ethnographic times the bay and surrounding territory were within the territory of speakers of the Nehalem dialect of the Tillamook language (Seaburg and Miller 1990:560-561).

The most important site located on the bay is the Sandspit Village, 35TI1, a winter habitation located on Netarts Spit. The village is the most intensively studied site near 35TI90. It was identified Collins in 1951 during his survey of the Oregon coast in 1951 and 1952 (Collins 1953). He described the site as containing 25 to 50 house depressions and noted that only a few of them had been damaged by relic seekers. He describes artifacts collected from the site as including bone wedges, horn flaking tools, and seven-inch-long mahogany obsidian blades (Collins 1953:62-63). Collins conducted test excavations at the site in 1952 (Collins 1953). A five-page account of the excavations is included as an appendix in his manuscript describing the results of his survey along the coast. Based on his closer examination of the site, Collins revised his estimate of the number of house depressions at the site to 15 or 16. The ones that were not overgrown by vegetation and thus could be most readily measured were 1 to 2 m deep, 13 to 25 m long, and 6 to 10 m wide. He excavated a trench 2 m wide and 16 m long inside of the depression that he referred to as house pit #2. During the excavations it was seen that house pit #2 was truncated at its northeastern end by another house pit, which Collins designated house pit #3. The latter was circular and 8 m across.

The trench was excavated to between 35 and 65 cm. It extended to the floor of the house. Above the floor was a 20-cm thick deposit of cultural material that contained shellfish remains and above that a 40-cm thick layer of blackened sand. A hearth was uncovered in the trench associated with the house floor. It consisted of a bed of cooking rocks on top of which were a whale femur and part of a whale vertebrae (Collins 1953:ii-iv).

The shell and artifact bearing zone contained “chips of green chert” and apparently was the source of most of the cultural material recovered from the excavations. Animal bones representing sea lion, whale, seal, sea otter, fowl, elk, deer, and possibly dog were found as were shells from various clams, cockles, limpets, crabs, mussels, and chiton. Pockets of red elderberry and coprolites infused with husks from the seeds were noted. Worked items were not common and only 25 objects were found. They included a bone harpoon barb, worked shell, a bone wedge, choppers, and several small pieces of worked bone. In his summary, he states that artifact collectors had caused considerable damage to the site. He also updates his inventory of objects found by relics seekers to include whalebone clubs, carved bone, fishhooks, pipes, and harpoon points (Collins 1953:v).

Newman (1959) conducted extensive excavations at the site as part of his dissertation research into the prehistory of the Tillamook Indians and their place in Pacific Northwest Culture Area. During three seasons of fieldwork, Newman (1959) excavated at least 426 m2 at the site, which included trenches and small excavation blocks (measuring 2 x 2 m). Excavated sediment was not typically processed (Losey 2002:193).

Newman identified 13 housepits excavated within at least six of them. The houses were arranged in two rows, separated by a 30-m wide swale. Each of the housepits was surrounded by a ridge of shell midden. Most of the housepits were interpreted as representing the subsurface element of rectangular longhouses. One, referred to as pit 10, appeared to contain the remnants of a smaller, less permanent structure. Features observed within the housepits include fire hearths, both with and without FCR, post molds, split cedar planks, a storage pit, a tool blank cache, and a burial. The lowest occupation stratum was approximately .5 m below the fresh water table during summer, when the water table is at its lowest.

Since little was known of the tectonic history of the region in 1959, Newman (1959:30) suggested that the sea level and water table must have been much lower during the period of occupation.

Shell middens were associated with all of the housepits, though they were not specifically investigated. The most common species of shell were listed as Schizothaerus nuttallii (blue clam), Cardium corbis (cockle), Saxidomus giganteus (butter clam), and Macoma nasuta (bent-nose clam), with the first two the most common. Faunal remains identified at the site are from Stellar sea lion, California sea lion, sea and land otter, seal, porpoise, whale, beaver, elk, and deer. Bird and fish bone were also recovered but not further identified.

Although specific numbers are not provided, the majority of recovered tools were of bone. Bone artifacts include wedges, adzes, awls, needles, blades, pins, composite harpoon barbs, chisels, digging stick handles, bone haft, carved zoomorphic bone objects, and whalebone of uncertain use. Stone artifacts include projectile points (n=2), blades, scrapers, gravers, cores, choppers, modified flakes, double pitted cobbles (net weights?), hammerstones, whetstones, and two ‘eccentrics’ that were ground and pecked all over and were probably discarded before completion. Trade goods included a copper pendant, six rusted iron objects, a rectangular bar of iron, and nearly 100 porcelain sherds from at least five vessels (Newman 1959:17).

Newman (1959:31) obtained three radiocarbon dates on wood charcoal collected from two of the housepits. The conventional radiocarbon dates were 150+150, 280+150, and 550+150 B.P., which provide a calendar date range for site occupation of approximately A.D. 1400 to 1805. Historical artifacts of porcelain, iron, and copper were found in one of the housepits and were interpreted as being introduced between 1790 and 1825, at which time Newman believes the village had largely been abandoned.

Site 35TI1 was also studied by Losey (2002) as part of his research into the effects of Tillamook Indian responses to an earthquake and tsunami known from Japanese historical records to have occurred in January A.D. 1700. He and others have published extensively on the site and its material content (Losey et al. 2003; Losey 2005; Losey et al. 2004).

Losey’s (2002) excavations at the site were small-scale (three square meters of excavated area) and resulted in the recovery of a modest quantity of artifacts but a large quantity of FCR (708 pieces weighing 90.5 kilograms [kg]) proportional to the excavation volume. Recovered were six wedge fragments, two harpoon pieces, and one bipoint, all of bone, and four bifaces, three projectile points, and two unifacial scrapers of stone. He also found three beads made from dentalium, one bead from another material, one fragment of a ground mussel shell tool, two possible groundstone fragments, and two pieces of metal.

Analysis of faunal remains from his excavations and those recovered by Newman (n=67,264) resulted in the identified of 36 species of bird, nine of fish, eight of sea mammal, five of sea mammal, and one freshwater mammal (Losey 2002:259). In addition, over 20 taxa of invertebrates were identified. By the number of individual specimens (NISP) fish accounted for over 90 percent of the faunal material from vertebrates. Small fish, such as surfperches, were the most common represented in the faunal assemblage.

According to Losey (2002) the village was occupied from approximately A.D. 1300 until shortly after A.D. 1700. Faunal analysis suggests that after the A.D. 1700 earthquake, subsistence practices changed to a focus on terrestrial mammals, crabs, and smaller fish species, while larger fish such as salmon decreased in importance (Losey 2002).

Site 35TI47 is located north of Netarts Bay at Ocean Side, a coastal community south of the Cape Meares headland in the lee of Maxwell Point. The site was excavated by Oregon State University in 1977 (Zontek 1978) and further analysis of the recovered material was conducted by Erlandson and Moss

(1995). Artifacts recovered from the site included four projectile points, two bifaces, four utilized or retouched flakes, four cores, an incised, tabular piece of shale, and polished bone (Zontek 1978). Faunal analyses show that the shell to bone ratio changed from 179:1 near the top of the cultural deposit to 12:1 near the base of the deposits. This suggested that the site occupants had an initial emphasis on hunting birds and sea mammals, followed by an increasing emphasis on fishing and shellfish, as the mammal and bird productivity dropped (Erlandson and Moss 1995). Shellfish from the uppermost and lowest levels of the cultural deposits were radiocarbon dated and returned dates of 900 + 50 cal B.P. (Beta-80977) and 1220 + 50 cal B.P. (Beta-80978) (Erlandson and Moss 1995).

Summary

To summarize, archaeological research at Tillamook Bay and adjoining areas along the coast provides general support for the settlement models outlined by Minor (1983) and Lyman and Ross (1988) as they pertain to cultural patterns during the last 2,000 years. Both models identify a seasonally sedentary logistical organized collecting pattern composed of winter villages, summer camps and/or villages, and a variety of task sites in different ecological settings that pertain to a variety of subsistence pursuits. However, taken as a whole, there is greater support for the Lyman and Ross model for the Oregon coast than for Minor's model for the Lower Columbia River area. The major distinction between these models lies in their understanding of summer residence patterns. Lyman and Ross predict use of temporary base camps and task sites where Minor predicts the use of summer village sites along major tributaries. In the latter model winter villages are located away from rivers in sheltered locations. However, known village sites tend to occur along estuaries and the lower stretches of rivers rather than in locations away from these settings, which suggests a pattern more consistent with Lyman and Ross (1988). Both models predict shellfishing camps in outer coast and estuary margin locations, in association with shellfish habitat. Hunting and fishing camps are expected in a variety of locations from the coast to the uplands, typically along tributaries, though Lyman and Ross (1988) suggest major fishing camps may occur in relatively close association with winter villages. This suggests lower stretches of rivers as likely contexts for fishing camps, particularly salmon fishing camps. From this, we can infer winter village or fishing camp as likely functions for site 35TI90, though this remains to be evaluated on the basis of recovered cultural debris.

CHAPTER 5
RESEARCH DESIGN

Research designs were included in permit applications for testing and data recovery phases of the project. The one developed for the initial testing effort was rudimentary as essentially nothing was known of the site at that time. The research goals for the testing phase were to gain a preliminary understanding of the site's physical structure, its age, and function, and to assess the processes that contributed to its formation.

The testing phase provided some insight into site formation, function, age and structure. However, the information was hardly conclusive and those same topics remained important research avenues for the data recovery phase. The data recovery research design was based on the results of the testing (as summarized in Roulette 2007) and a general reading of Oregon Coast archaeology and prehistory. It included several overlapping and integrated research themes or topics including chronology, subsistence and season(s) of site use, settlement systems, possible trade networks (using obsidian sourcing data), and lithic technological organization. Within each of these themes one or more specific research questions was posed. The following research design subsumes the one developed for the testing phase. From the outset, it was recognized that the research themes and questions included in the permit application would probably not exhaust the research potential of the data recovery archaeological sample and that upon analysis data would be available to fruitfully pursue some themes and questions but not others, while other questions, not heretofore considered, might become apparent.

An initial review of archaeological literature revealed no known sites of comparable nature within the study region, as the majority of identified and excavated sites are located along the outer Oregon coast adjacent to the ocean or in estuary settings and contain shell middens. Consequently, little is known about non-shell-bearing midden sites along the northern Oregon coast in terms of their function, age, artifact assemblage, and geographical/environmental setting. Therefore, it appears that site 35TI90 is not only the first site along the lower Trask River to be intensively investigated, regionally, it is one of a very few riverine sites lacking shell midden deposits to be studied and as such stands to make significant contributions to regional archaeology.

It should be remembered, however, that investigations at the site were limited to the expansion and upgrade project APE. As a consequence, the issue of representativeness affected both the specific questions that could be asked about the site and the degree to which such questions can be answered. Despite these limitations, it was expected that data recovery excavations would provide new and important information on regional prehistoric subsistence and settlement patterns due to the apparent unique nature of the site. However, before addressing the research themes and questions, the structure and formation of the site were to be closely studied to identify the cultural and non-cultural processes that formed the archaeological record at site 35TI90.

Age of Site

One of the most critical components to research at site 35TI90 is to define when it was occupied because knowing site age allows us to anchor our understanding of other aspects of the site in relation to extant knowledge of regional prehistory. Based on previous work at the site, 35TI90 appeared to have been occupied sometime during the late prehistoric period, ca. 2000 to 200 B.P., suggesting that the basic elements of the ethnographically described lifeway were likely operative. It is, however, unclear if earlier cultural deposits were present at the site or if multiple periods of site occupation could be defined on the basis of radiocarbon dating, stratigraphic layering, and temporally diagnostic artifact types. If multiple components are present it opens up a range of questions regarding what types of changes, if any, can be identified in artifact types, technologies, and economic orientation, as seen in faunal remains, between temporal components.

Technological Systems

A variety of lithic raw materials, tool types, and a large amount of lithic debitage were recovered from site 35TI90. Because lithic tools function at the interface between differential resource distribution and primary economic behaviors (i.e., the toolstone and subsistence resources occur at different points on the landscape) individual tool and assemblage level characteristics such as tool(kit) design, manufacture staging, and patterns of production, use, reuse, and discard are responsive to a variety of conditions such as resource distribution, predictability, and periodicity, mobility patterns, distance to raw material sources, and quality of raw material sources (Andrefsky 1994; Bamforth 1986, 1991; Kelly 1988; Knell 2004; Kuhn 1994; Pecora 2001; Shott 1986; Torrence 1983). Technological organization, therefore, is a useful tool for understanding aspects of human behavior represented in stone tool and debitage assemblages (Nelson 1991). With this in mind the lithic tool and debitage assemblage from 35TI90 can be used to address the following questions that, when synthesized, provide a larger picture of how on-site behaviors linked to other aspects of the subsistence and settlement system of the site occupants.

- Was toolstone obtained locally or at a distance from the site?
- In what form were lithic raw materials transported to the site?
- What type of reduction behaviors are associated with each of the different raw materials represented in the assemblage?
- What do these reduction behaviors indicate about variables such as raw material availability (e.g., abundance, distance)?
- Were lithic materials heat treated prior to use and in what form were lithic objects heated (e.g., cores/nodules versus flakes/blanks)?
- What activities were conducted on-site (e.g., hunting, fishing, plant processing, tool production and maintenance, etc.) and in what proportions are these activities represented? What do these artifacts indicate about technologic systems related to subsistence behavior?
- Is there evidence for differential curation, maintenance, and/or recycling of tools from different raw materials?

Subsistence and Season(s) of Site Use

Animal remains provide important insight into past subsistence economies. Previous work at site 35TI90 produced a variety of animal remains, including several fish bones field identified as salmonids and members of the Cyprinidae family as well as abundant mammal bone, most of which was exceedingly fragmented and burned. The larger sample of faunal remains obtained during data recovery investigations permitted a more thorough assessment of the number and relative abundances of different utilized taxa. Knowing the relative contribution of different species to the faunal assemblage permits inference regarding the reason for site occupation (e.g., did people occupy this site for the primary purpose of fishing (for specific salmon runs?) or was hunting, shellfishing, or plant harvesting the primary draw?). Similarly it can be asked if the range of species identified were or could have all been procured within the immediate site area or if some were procured at a distance and transported to 35TI90. Evaluating this may be as simple as identifying species clearly outside their natural range such as outer coast shellfish or it may have to be inferred through other means such as element representation (Binford 1978; Metcalfe and Jones 1988). This can be important for evaluating patterns of landuse. For instance, it is generally assumed, on the basis of ethnographic analogy, that resource procurement sites, like 35TI90, were occupied by some subset of a winter village after the seasonal breakup of the winter community. It has been suggested that in the Willamette Valley, reduced mobility resulting from increased population packing led to kin-based groups developing exclusive usufruct rights over select resource procurement areas (Roulette 2006). Such places were proximal to a habitat where a primary target resource was procured but were used as a staging locale for the exploitation of other nearby habitats. The zooarchaeological signature expected to be associated with such a development includes a shift from single season primary target resource exploitation to utilization of many diverse animal species that were harvested during all parts of the year in microenvironments different from the site locus.

Following from issues of taxa utilization, the larger faunal sample is also expected to permit assessment of processing techniques (e.g., were faunal resources consumed fresh or processed for storage and if so how were they processed) based on element representation and fragmentation. It may also allow for evaluation of season or seasons of site use based on animal ages and known season of availability for different species. All of this information ultimately is necessary for interpreting site function and role is settlement-subsistence systems.

Settlement Systems and Site Function

There is strong archaeological evidence that indicates during the late prehistoric period, ca. 2,000 years before present to contact, people residing on Tillamook Bay spent winters in semi-permanent winter settlements in a pattern similar to that documented ethnographically. There is significantly less archaeological evidence and only sparse ethnographic evidence to indicate where they spent other parts of the year during the annual food-gathering round. The archaeological record preserved at site 35TI90 was scrutinized to assess the role and function of the site in the prehistoric settlement system of the ancestral Nehalem Tillamook. A relatively small collection of formed tools was recovered during the preliminary investigations at the site (i.e., the testing phase and site damage assessment) but going into data recovery evidence was in hand to suggest the hunting of terrestrial mammals and fishing using nets in a river setting were conducted at the site or from the site. At the same time, the presence of (non-shell) midden sediment suggests that the site functioned as something more than a seasonal hunting camp and was an important locale where people focused activity and visited repeatedly. Data recovery excavations were expected to result in the recovery of a larger sample of formed tools and other archaeological materials that could be used to provide insight into the range of activities that occurred at the site. Once a better understanding of the site function was achieved, it would be possible to assess how the site integrated with winter settlements in the local residents' settlement pattern. This line of inquiry was to begin by assessing the function of the site through a careful analysis of formed tools, faunal remains, site structure, and other classes of data, as appropriate. Findings were to be related back to proposed settlement system models offered by Minor (1983) and Ross and Lyman (1988).

Site Formation and Structure

To conduct site structure and formation studies, AAR contracted with Oregon State University geoarchaeologist, Loren Davis, Ph.D., to identify the site geomorphological context and the local lithostratigraphic and pedological setting. This work was supported by field analysis by AAR's in-house geoarchaeologist, Fred Anderson, M.S. This research helped to identify the non-cultural processes that influenced the archaeological record as it was found. Cultural processes that shaped and gave rise to the archaeological record were examined by studying the interrelationship between site stratification and archaeological material. To the extent possible (given that the complete site is not available for study) the spatial distribution of different types of artifacts, FCR, and faunal material and of cultural features were analyzed to interpret site structure. The analysis provides insight into the use of space and the patterning of activities at the site. Questions pursued included: Will the distribution of artifacts indicate the preservation of task and activities areas? Do the midden deposits at the site reflect specialized waste management practices or in situ de facto refuse?

Trade

The presence of obsidian artifacts among the materials recovered during test excavations indicated the potential to examine issues related to long-distance trade because there are no obsidian source locations in close proximity to the site. This by implication indicates that obsidian represents an imported or exotic material. All obsidian of suitable size found during testing phase and data recovery investigations, or a large sample if an unexpectedly large sample is recovered, will be submitted to the Northwest Research Obsidian Studies Laboratory for geochemical source. This information will be used to address the nature of extra-regional contacts. Also, the entire recovered artifact collection will be carefully scrutinized to search for other items and materials that could represent trade or extra-regional contacts. Of special interest will be evidence for movement of objects and goods from the outer coast and estuary to the riverside site setting and evidence that could suggest participation in trade networks involving the Willamette Valley.

CHAPTER 6
FIELD AND LABORATORY METHODS

Field Methods

Two excavation units placed alongside a backhoe trench where a zoomorphic-decorated stone object was found measured 50 x 100 cm. All others excavation units were square and measured 50 cm or 1 m on a side. The smaller units are referred to as QTUs and the larger ones as TUs or EUs (to distinguish data recovery [EUs] from non-data recovery [TUs] contexts. In places the site was buried beneath fill. Introduced fill was removed without screening either by hand shoveling or by a backhoe. If by backhoe, all mechanical excavations were closely watched so that no native sediment was cut into.

All excavated archaeological sediment was processed using one-eighth-inch mesh hardware cloth. It was removed in 10 cm levels (or thinner levels in the case of cultural features) by natural or cultural strata. In most places, excavation extended to a layer of gravel and cobbles that was the surface of the landform underlying the site. Recovered artifacts were separated and bagged by level in each unit. Information from each excavation level was recorded on unit level records, including the unit provenience, depth range, excavation technique, a plan sketch (if appropriate), a detailed soil description, an inventory of samples (type, location, and volume), and artifact descriptions. Data regarding FCR were recorded on level forms, but the FCR itself was not collected. The pieces of FCR per level were counted and weighed. Attributes recorded for the FCR included raw material, size, and form. Forms included complete, blocks, or spalls. Units were numbered serially by type. Units measuring 1 m on a side were numbered 1 through 18. The prefix TU or EU before the unit number identifies the phase of investigation during which it was excavated. EUs 19 and 20 measured 50 x 100 cm and were excavated as part of the investigations following the inadvertent discovery. The QTUs were numbered 1 through 35 without a phase-identifying prefix.

Features were numbered sequentially as they were identified. In most instances, it was not possible to fully expose features. The parts that were exposed were documented with photography and scaled drawings. Whenever possible, features were excavated in arbitrary 10-cm or thinner layers and documented on field record forms. Profiles were photographed and drawn to scale. Feature sediment was processed using one-eight-inch mesh hardware cloth but in several cases, sediment within or comprising features was collected and processed in the laboratory through 1 millimeter (mm) mesh.

The site map was prepared using metric tapes and a global positioning system (GPS) device using an engineered site plan map as a base. The map shows site boundaries within the current project area, existing structures and other improvements. Horizontal provenience data were collected with a Trimble GeoXM. Post-field processing of the GPS data used Trimble Pathfinder software. When processed and corrected, horizontal provenience data collected with the Trimble GeoXM device are accurate to ca. +1 m depending on the quality of the satellite coverage when the device is in use.

Each step of the fieldwork was photodocumented using a digital camera. In AAR's offices the digital images were downloaded onto a compact disk in JPEG format for storage and curation.

Sedimentary Analysis

All exposed soil profiles were documented in the field using guidelines for soil and sediment description (Birkeland 1984; NACOSN 1983; Soil Survey Division Staff 1993). Profiles were drawn to scale on graph paper showing stratigraphic breaks, strata designations, soil constituents, feature boundaries, and disturbances. Profiles were recorded by site, provenience, unit, level, and facing direction. Cultural features were assigned site-specific consecutive numbers and were thoroughly documented by photography, written descriptions, and scaled plan and profile sketches. Sediment colors were recorded using a Munsell soil color chart. Select profiles were analyzed to identify lithostratigraphic, pedostratigraphic, and allostratigraphic characteristics.

Sediment samples were collected for laboratory analyses that were designed to clarify field observations about the pedological and sedimentological aspects of stratigraphic units. Particle size was determined by dry sieve and hydrometer. The former method involves passing a measured sample through series of wire-mesh sieves while manipulated by a Ro-Tap machine, with each sieve representing a grain size interval on the Wentworth scale (Wentworth 1922). The hydrometer method involves the passing a measured sample through a column of water and calculating the percentages of sand, silt, and clay based on their rate of settling (Gee and Bauder 1986). Sediment pH was measured from a sediment and water mixture. The organic and carbonate content of sediments was measured using a loss-on ignition method where measured sediment sample is heated to 550° C and weighed, and then heated to 1000° C and weighed again. The loss in weight from the first sample represents the sample's organic matter; the loss in weight from the second round represents the percentage of calcium carbonate in the sample (Heiri et al. 2001).

Laboratory Methods

Recovered artifacts were processed in AAR's Portland laboratory where they were cleaned, inventoried, cataloged, and analyzed. The processing of cultural materials followed the Secretary of the Interior's guidelines for archaeological curation. In general, all recovered lithic items were washed and air dried. Artifacts were placed in four-mil curation quality, re-sealable plastic bags onto which were affixed foil-back archival quality printed labels bearing site and provenience information. Plastic bags were placed into a metal-reinforced, archival quality storage box for long term curation. A comprehensive inventory of recovered materials was prepared that is arranged by catalog number, provenience, and artifact type. It is attached to this report as Appendix B.

Artifact Analysis Methods

The recovered prehistoric artifacts are predominantly of composed of stone but a few bone and antler tools fragments were also recovered. Technological and metric analyses were performed on recovered tools and a majority of recorded debitage. To the extent possible, artifacts were identified as to raw material, type, and function. Lithic raw material categories used include basalt (BAS), cryptocrystalline silicate (CCS), obsidian (OBS), quartzite (QTZ), sedimentary (SED), fine-grained volcanic (VLCf), and medium-grained volcanic (VLCm). The CCS category includes chalcedony (translucent to transparent; various colors especially milky and clear), jasper (opaque; red, brown, green and yellow), and chert (opaque; various colors). The sedimentary category refers to those sedimentary materials not consisting of CCS (a type of sedimentary rock). The majority of the fine- and medium-grained volcanic material consists of ignimbrite and tephra. It is very pumice-like and contains clasts of volcanic glass.

Lithic Debitage Analysis Methods

In all, 12,339 pieces of debitage recovered at site 35TI90 during the various stages of fieldwork. Of those, 11,817 flakes were formally analyzed. They represent all of the debitage recovered from the initial site testing in 2007 and from data recovery efforts in 2007 and 2009. The analyzed sample does not include 522 pieces of debitage from the four QTUs excavated as part of the second round of data recovery in 2008. Formal analysis focused on flakes with platforms or remnants of platforms (PRBs; n=4,195). Non-platform debitage (n=7,622) was identified as to raw material and cortical type, if present. They were then size sorted using four hardware mesh sizes including one-half-inch, one-quarter-inch, and one-eighth-inch wire mesh and fine "window screen" cloth.

The formal analysis focused on PRB flakes to determine the stone working technologies and strategies employed by the site occupants. Morphological characteristics of the PRB flakes can be used to infer the types of flintknapping activities that occurred (Andrefsky 2005, Callahan 1979). Each piece of debitage was analyzed and the following attributes noted: size, shape, degree of curvature, presence and complexity of the platform, dorsal scar morphology, and presence, absence, relative amount, and location of cortex. These attributes contribute to the identification of the reduction category as well as the technology used to produce the flake. Early and late stages of each category were also identified. Reduction technologies include free-hand core reduction, biface reduction, pressure flaking, and bipolar flaking. Non-specific percussion flakes (usually those lacking a platform or too fragmentary) were identified as PERC. Shatter (SH) was also identified.

Primary and secondary decortication flakes are produced during the initial stages of core reduction. Cortex covers the entire dorsal surface of primary decortication flakes and partial areas of secondary decortication flakes. Pieces of cortical debitage were generally recorded as early-stage core reduction flakes (CORE). Early stage core reduction flakes are usually large, relative to other flake types, flat to slightly curved, and triangular or blocky in cross section. Platform angles tend to be steep, often approaching 90 degrees, and flakes exhibit few or no dorsal flake scars. Under the assumption that raw, unmodified nodules of toolstone were not typically transported long distances, flakes with cortical surfaces can be used to infer use of locally available toolstone versus imported toolstone, which is inferred to have been transported in a modified or partly modified state and to lack cortex or most cortex. The type of cortex is used to infer the source of toolstone. For instance, incipient cone cortex (IC) indicates that raw material was weathered within the traction load of a stream or river. It therefore procured from a fluvial source. Primary geologic cortex (PG) suggests the material originated from bedrock. Weathered cortices (WTH) have undergone chemical alteration, such as from moisture or heat, and may originally have been primary geologic, incipient cone, or pyroclastic surfaces. Weathering may result in changes to the color or chemical composition of the stone. The size and shape of the raw nodule being reduced influences the proportion of cortical flakes in an assemblage (Andrefsky 2001). Late-stage core reduction flakes (CORL), are associated with the production of flakes from non-pattered core reduction. These flakes lack cortex, have cortex limited to the striking platform, or have minimal amounts of cortex on the dorsal surface. Typically, late-stage core reduction flakes exhibit single-facet platforms although cortical or multi-faceted platforms occasionally occur. There may be evidence of platform preparation. Dorsal morphology is less simple and most flake scars originate from the proximal end of the flake (Callahan 1979). These flakes may be selected as blanks for an expedient flake tool or reduced into a formal tool.

Percussion biface thinning debitage represents biface or flake blank reduction using a percussor such as a hammerstone or an antler billet (Crabtree 1972). Percussion thinning flakes usually have multifaceted platforms and sometimes show abrasion (Crabtree 1972). A remnant ventral flake surface may be present, especially on early-stage thinning flakes. Early-stage biface thinning flakes (BIFE) are curved in long section and have few dorsal flake scars. Symmetry of flake scars begins to become regularized. Platforms are small but thick and exhibit acute angles (Callahan 1979). Late-stage biface thinning flakes (BIFL) are more planar in long section and have a more complex dorsal flake scar pattern. Numerous flake scars exhibit a direction of force originating opposite the proximal end.

Overlapping scars indicate the flakes crossed the midline of the biface (Callahan 1979). Presence of percussion biface thinning flakes indicates production of formal tool shapes or production of flakes from bifaces, cores, or both. Percussion flaked bifaces or flake blanks may be further modified into a variety of tool types using pressure flaking.

Percussion and pressure flakes are formed through different applications of loads. The loading of static force, as opposed to the dynamic force required with percussion, results in pressure flakes (Andrefsky 2005; Crabtree 1972). Pressure is applied with an implement, such as an antler billet, to a tool margin. Pressure flakes usually exhibit multifaceted platforms and curvature or twisting in long section. In plan-view, the platform of a pressure flake often forms an oblique angle with the length of the flake. Early-stage pressure flakes (PREE) have a more complex dorsal scar morphology with numerous arrises oriented in varying directions, whereas late-stage pressure flakes (PREL) often show a single arris extending the length of the flake. Late-stage pressure flakes can exhibit attributes of final edge shaping such as notching or serrations.

Bipolar reduction involves the placing of the material to be reduced between a hammer and an anvil. Bipolar reduction flakes (BPO) produced by this technique are distinct from conchoidal flakes. The bipolar technique primarily results in compression flakes (Cotterell and Kamminga 1987, 1990) or sheared flakes. Bipolar flakes do not typically exhibit a bulb of force and termination is axial, rather than feathered. Early and late stages are recognized, differentiated by presence or absence of cortex. This technique may be used in conjunction with freehand percussion, resulting in a flake with bipolar compression characteristics on the dorsal surface, for instance, but then detached using a percussion technique, creating a bulb of percussion on the ventral surface. In this instance, the flake is recorded under the technology that last detached it.

The burin technique results in a specific flake type known as a burin spall (BURS), a flake that is detached from the end or edge of another flake or from a tool edge. The force applied to achieve burination can be either static (pressure) or dynamic (percussion). The resulting flake will yield a positive bulb and be characteristically long, thin, trihedral, and twisted, or long, thin, and rectangular. It will frequently end in a hinge or step (Odell 2004). Burination can serve several purposes: to create a burin, to retouch a flake to create an edge, to rejuvenate a tool edge, to back a flake or blade knife, to create a hafting element, or to create a burin spall, which may then itself be used as a tool (Crabtree 1969, Epstein 1960, 1963; Giddings 1963; Odell 2004; Shafer 1970; Tomášková 2005). The burin-blow technique, therefore, has both eliminator and creator functions (Vaughn 1985).

In addition to reduction category, heat treatment was assessed. Cryptocrystalline silicate debitage and tools were examined for attributes indicative of heat alteration. In the past, heat treatment of CCS was sometimes used to prepare the raw material for the manufacture of stone tools (Crabtree and Butler 1964; Luedtke 1992; Patten 1999). The vitreous luster of heat-treated material contrasts with the matte-like luster of raw material. Color is not generally used as evidence of heat treatment due to the poor correlation between color and heat treatment as well as the vast range of colors exhibited by CCS. Occasionally, however, a color change is evident where flaking subsequent to heat treatment leaves a portion of the heat-treated surface. Evidence of heat damage includes crazing, potlids, and crenated fractures (Andrefsky 2001). Occasionally, the potlids themselves (PTLD) are identified.

Formed Tool Analysis Methods

All 371 formed tools from all phases of fieldwork were formally analyzed. Tools were typed by overall morphology into descriptive classes that include: abraders and abraded stone objects, battered cobbles and pebbles, bifaces, bifacially retouched flakes, burins, cores, drills, edge-ground cobbles, flaked cobbles and pebbles, flaked cobble spalls, formed flake tools, flaked tool fragments, incised stone objects, indeterminate biface tool, manuports, metates, net weights, pièces esquillées, pestles, projectile points, stone disks, unifacially retouched flakes, and utilized flakes. Projectile points were assigned to class and type based on blade shape and width, haft shape and width, neck shape and width, length, and thickness. Method of manufacture for each tool was also assessed (e.g., pressure, percussion or bipolar flaking) as well as evidence that it was reworked or resharpened. Shape and location of the working element were recorded.

Tools were further analyzed to determine function, which can be independent of form. Function analysis considers not only overall morphology of an object but also the location and shape of the working edge and evidence of usewear. Stone tools become worn or damaged through use. This is especially true of their edges. Different types of activities produce specific and replicable wear (Hayden

1979; Keeley 1980). Usewear is expressed as attrition to the edge of a tool caused by contact between the working element and the material or object being worked; the bodies of tools sometime become worn as well. Attrition is dependent on the direction of action, the angle of force, the hardness of the material being worked, the hardness and crystalline structure of the tool, and the shape of the working element (Hayden 1979; Keeley 1980). Types of usewear include polish, striations, grinding and crushing. For the functional analysis tools were examined first with the naked eye or a 10VX hand lens. The tools that exhibited usewear were further examined using a boom-mounted NOVA UST 677 MaxiZoom Trinocular Stereo Microscope, mounted with a Moticam 2000 camera. Magnification up to 90 power was used to identify the usewear and assess the type of activity that produced it.

Because tools often have multiple functions, the number of tool types in a collection often exceeds the number of items. A primary analytical step is the classification of tools. Typologies, however, often create theoretical problems because artifacts do not always lend themselves to the clear-cut boundedness inherent in the classificatory approach (Tomášková 2005). In the following analyses, both descriptive classes and functions are discussed.

Three metric dimensions were measured for all formal tools. Length was measured along the longest axis of the tool. This measurement is independent of tool function except for projectile points, in which case length was measured as the distance between the most proximal and most distal points on the tool. Width is the maximum measurement perpendicular to the length. Thickness is measured on the sagittal, or median, plane along the maximum dimension of the tool. Neck width was measured for all applicable projectile points.

Tool Class Definitions

Abraders (AB) and **abraded stone objects** (ASO) were used primarily to abrade but also often functioned as polishers and smoothers. They are defined as handstones that have one or more rough surfaces used to remove material from contact surfaces (Adams 2002). Usually composed of a soft and coarse-grained material, such as pumice, there are multiple types including flat abraders, grooved abraders, and shaft straighteners (Adams 2002). Grooved abraders may have U-shaped or V-shaped grooves. V-shaped grooves, as in this collection, may be deeply incised or may be barely visible. Polishers and hide-processing tools are also recognized. Additionally, depending on the morphology of the object, the abrader may function as a hammerstone, a common combination since platform preparation during the flintknapping process requires abrasion. Technologically, the morphology is not as important as whether the tool was a passive or active tool. Active handstones are abraders (AB) whereas passive handstones have been termed lapstones, netherstones, or abraded stone objects (ASO).

Battered cobbles (BCOB) are cobbles or large pebbles that served multiple functions. They can be of various materials and sizes. Use results in at least one concentration of crushing or pitting. Battering may be localized to the distal end, unpatterned, or bilateral. Battered cobbles are not shaped or modified for use. Wear is the only evidence for their use. The working element on battered cobbles or hammerstones is usually at or near an end or protruding corner. Cobbles utilized as bipolar hammerstones, however, will exhibit pitting on at least one face.

Bifaces (BIF) are flaked on two sides, regardless of flaking technique (Andrefsky 2005; Crabtree 1972). Bifaces are often manufacturing rejects and broken formal bifacial tools that cannot be assigned to a more specific artifact class. Finished tools that cannot be ascribed a more specific type may also be termed bifaces.

Callahan (1979) has proposed five stages of bifacial reduction of fluted projectile points. His stage concept has been adopted in modified form throughout North America to describe the production sequence in the manufacture of bifacial tools. Bifaces are classified into progressive stages based on the degree and type of flaking. Stage 1 and Stage 2 bifaces represent the earliest stages of manufacture.

Pressure flaking is not present until Stage 4. Stage 1 bifaces exhibit sinuous margins and are thick in cross section. Cores are sometimes included in this classification. Cortex may be present on the remnant dorsal surface if flake blank technology was employed. Stage 2 bifaces are thinner in section and symmetrical margin modification is becoming more regularized. Flake pattern is more complex. Stage 3 bifaces exhibit biconvexity in cross-section and increased flake scar complexity. They are thin relative to length and width and have flake scars that extend across the midsection. They are well shaped and symmetrical with regularized margins. Stage 4 bifaces exhibit pressure flaking in preparation for the manufacture of a finished projectile point or working edge. Thin in section, flake scar morphology is complex and margins exhibit an acute angle sharp enough to act as a cutting edge. This class often includes blades, knives and drills. Often, fragments of the following stage are classed as Stage 4 if the fragment is non-diagnostic. Stage 5 bifaces represent finished formal projectile points.

Bifaces are often used as expedient tools such as scrapers. Such utilization can produce specific edge modification. Each biface was examined for evidence of use-wear. Additionally, condition of the specimen (e.g., complete, type of fragment), blank form (e.g. cobble, flake), fractures, and metric attributes were recorded.

Bifacially and **unifacially retouched flakes** (URT and BRT) are flakes that have been intentionally modified, or trimmed, to sharpen an edge or steepen an angle. Trimming refers to fine marginal modification, usually by pressure flaking, whereas retouching refers to specific techniques used to remove and rejuvenate a dulled edge, usually by percussion flaking (Shafer 1969). Various forms occur, such as unifacial, bifacial, and unifacial alternating.

Bifacially retouched flakes exhibit bifacial flaking, either percussion or more commonly pressure along at least one margin. Usually, when pressure flaked along a single margin, the retouching represents a resharpened edge. Bifacially retouched flakes are most commonly cutting implements. Unifacially retouched flakes exhibit unifacial flaking along at least one margin. Unifacially retouched flakes were usually used as scraping and shaving implements.

Burins and **burin spalls** (BUR and BURS) are specialized tools that were typically used for etching or engraving. Possessing a characteristic sharp triangular, beveled tip at the end and a negative bulb of percussion, burins also commonly exhibit two right angle edges whereas a snapped flake exhibits a curved or rounded edge on one side. (Odell 2003). Burins are emblematic of Paleoindian sites, but have been used throughout prehistory (Crabtree 1969; Epstein 1963; Leonhardy and Rice 1970; Miller 1956; Wormington 1957) and have been widely identified in North America.

The burin was originally named in French literature after a graving chisel but description emphasized the bevel from which the burin spall was removed (Tomášková 2005; Vaughn 1985). Several studies have shown that the specialized bevel edge, or burin tip, was used to produce deep grooves in bone, antler, and ivory to facilitate the removal of tool blanks by the groove-and-splinter technique (Odell 2003; Vaughn 1985; Wormington 1957). Boring and tracing lines were also functions of the burin bit. The sides were utilized, as well, for scraping or finishing surfaces, especially on bone, antler, or wood (Crabtree and Davis 1968). It has been suggested that the scraping function was the principal purpose behind using the burin-blow technique, rather than utilization of the bevel end or the creation of a burin spall (Vaughn 1985). The type boundary of the burin has been a research objective resulting in studies that indicate the burin may be a discarded byproduct of blade production or an improvised tool with a multipurpose function (Tomášková 2005). It is clear that the tool type, the burin technique, and the burin spall all had broad applications.

Several forms of burins have been recognized, such as the bec de flute, the angled burin, the burin on a break, the transversal, polyhedric, and dihedral burins, and the truncation burin (Epstein 1960, 1963; Gibson 1966; Miller 1956; Shafer 1970; Tomášková 2005; Vaughn 1985). Also, the utilized burin spall itself must not be overlooked (Crabtree 1969; Giddings 1963; Wormington 1957).

The burin as a type is problematic. It has become increasingly clear that as a group, burins are highly variable in their function, origin, and stage in production and reduction sequences (Tomášková 2005), representing a stage in tool production or modification as much as a final product. Usewear is varied, often compound, and may involve evidence of hafting (Keeley 1982).

Choppers (CHP) are usually classified under Flaked Cobbles. Generally, choppers are cobbles or large pebbles in which one or a few flakes have been removed along a single margin (Borden 1968). In this collection, however, the one identified chopper originally functioned as a core and was secondarily utilized as a chopper. The term "chopper core" has been proposed by some researchers to describe similar artifacts. Several functions have been proposed for choppers and flaked cobbles. Based on usewear and context, flaked cobble choppers have been interpreted as specialized wood procurement and processing tools, especially in non-residential sites (Hamilton and Roulette 2002; Hester et al 1976; Roulette 1989). Flaked cobble choppers at residential sites tend to be multifunctional, utilized for a variety of chopping and pounding tasks for processing wood and animal products (e.g. butchering and bone marrow extraction).

Cores and **core fragments** (COR and CORF) are nuclei or masses of raw material that show signs of flake removal. While usually functioning solely as sources of flakes or blanks (Andrefsky 2005), they were sometimes utilized as scrapers or choppers. Cores are classified according to several attributes including shape, material, and reduction technique. Flaking patterns were categorized as bidirectional, multidirectional or unidirectional. Bipolar cores were present within the collection. They are generally characterized by a bidirectional flaking pattern, crushing on both ends, sheared or compressed flake scars, and are often confused with angular shatter. Bipolar cores were commonly used to maximize raw material before it becomes exhausted or when raw material nodules are small (Andrefsky 2005). They have been shown to be many times smaller than freehand percussion cores (Andrefsky 2005). Cores made from cobbles are difficult to distinguish from flaked cobble implements and many implements used for other purposes may have also been used as flake cores.

Drills (DRL) typically have a long, narrow, relatively pointed working element. They may be completely manufactured, not at all, or minimally so. Ethnographic analogs and experimental data indicate that drills (and perforators) were used to drill or punch holes in materials such as hide, fiber, wood, shell, or stone. The bit may be bifacially flaked or multifaceted.

Edge-battered cobbles (EBC) and **pebbles** (EBP) and **edge-ground cobbles** (EGC) and **pebbles** (EGP) exhibit continuous battering, crushing, or abrasion along at least one lateral edge. The ground pieces differ from faceted hammerstones in that they have a single flat or beveled edge, while faceted hammerstones have multiple facets, usually on or near corners. Edge modification can vary from ground, smoothed, polished to crushed, battered, and flaked. This variability may occur on a single specimen. In addition to the modified lateral edge, many edge-ground cobbles have modification on the ends and faces. They often have one or two ends that are minimally pecked as if used as a hammerstone and the center of at least one and sometimes both faces are pecked and sometimes also smoothed or ground. At least some edge-ground cobbles show grinding wear and were possibly used in conjunction with "spot metates" (Chance and Chance 1985) for grinding foodstuffs and are recognizable by rounded and polished asperities and sometimes striations on faces and edges. Edge-battered cobbles and pebbles were generally utilized as hammerstones.

Flaked cobbles and **flaked pebbles** exhibit unifacial or bifacial flaking on at least one margin. They are sometimes difficult to distinguish from cores. However, most flaked cobbles documented have an acute, unifacially flaked margin and an unmodified opposing margin presumably used to hold the object during use (Borden 1968) and fit the classic definition of a chopping tool.

The system used for classifying cobble choppers has been adapted from Borden's (1968) typology that is based on his work in southwestern British Columbia. The system considers the overall object shape as well as shape and location of the working element to create morphological classes. Most flaked cobbles interpreted as choppers fall into Borden Types I, II, III, IV, V, VI, VII (Borden 1968). Type VIII flaked cobbles are more difficult to interpret functionally. Type VIII flaked cobbles are also referred to by Borden as plane-scrapers. They have relatively steep edge angles and are often flaked more than halfway around the perimeter. As the name implies they are often interpreted as scrapers. Alternatively, they are comparable to single platform flake-cores (particularly the extensively flaked ones), or heavily reworked, exhausted chopping implements.

Formed flake tools (FFT) are flakes that have been intentionally modified along at least one margin, either unifacially or bifacially, to achieve a specific working edge or tool shape. Either percussion or pressure flaking, or both, was employed. When pressure flaked along a single margin, the retouching often represents a resharpened edge. Location and shape of working edge was recorded as well as distribution of modification. Formed flake tools were commonly used as scrapers or shavers. Several formal forms are recognized.

A functional designation was given to formed flake tools based on working edge morphology and usewear (e.g., microflaking, edge rounding, polish, striae). The most common functional types are generally end scrapers and side scrapers. Other types identified in these collections are spokeshaves, chisels, and gravers. Utilized flakes and retouched flakes crosscut functional categories within the formed flake tool designation.

Flaked tool fragments (FTF) are often identified that are too fragmentary to ascribe to a category such as bifaces or unifaces. Typically, flaked tool fragments (FTFs) are blocky and have been split or broken longitudinally along the sagittal plane, thereby making identification of the tool as bifacial or unifacial impossible. Patterned and invasive pressure flaking, for example, makes it clear that the fragment is from a tool and does not constitute late-stage debitage. Reworking or other evidence of recycling can add to the determination.

Incised stone objects (ISO) are those items that have been scored or incised, sometimes with no discernible purpose. They may have been decorative or religious items and were often made on fine-grained, porous materials. Designs may be present or consist of random cross-hatches (Aigner 1972). Pattern and shape of incisions are described, as well as other modifications.

A **manuport** (MANU) is a lithic object, small or large, that shows no evidence of use or modification but was apparently transported by a person to the location rather than by natural depositional processes.

Metates (MET) are food-processing equipment that are used in conjunction with a handstone, or mano. Typically flat/concave or having a basin, metates are made from a variety of materials, including basalt or other volcanic rock. Morphology, which does not necessarily indicate what specific food substances were processed, is equally diverse and can include slabs or blocks (Adams 2002:100). In addition, they can be bifacial or unifacial, expediently used or extensively used, possess light grinding facets or deep well-defined basins, and they may be shaped around the circumference. This tool class commonly exhibits other usewear, such as abrasions or battering. Basin shapes also vary (Adams 2002).

A **net weight** (NWT) is a notched, girdled, or perforated stone used to anchor nets or fish lines. Notches are typically produced by flaking the edge unifacially or bifacially. Sometimes the interior edge is pecked and ground, presumably to dull the edge in preparation for attaching a cord. Many weights have two notches on opposing margins. Natural concavities are often utilized for one of the notches. Notch positions also vary: some are notched on the transverse, lateral margins while others are notched on opposing ends. Perforations are typically biconically drilled or pecked.

Pestles (PES) are defined as cylindrical- or phallic-shaped objects that are sometimes shaped by one or more techniques such as flaking, pecking, and grinding. Pestles are used in conjunction with mortars or other surfaces in the preparation of foodstuffs, pigments, and other substances.

Pièces esquillées (PE) are the lithic equivalents of wedges and were used to split wood, bone, or antler (Odell 2000; Wesley 1974). Meaning "splintered piece," a pièce esquille often exhibits opposed bifacial crushing on the longitudinal axis, battering, and hinge- or step-fractures. Frequently there are also relatively long columnar flake scars similar to those left during blade detachment or fluting and a direct result from battering during use (Wesley 1974). The crushing results in a straightened working edge on the distal end and a flattened, battered surface on the proximal end. A pièce esquille is generally multifaceted and lenticular or wedge-shaped in cross-section. Considerable debate has surrounded the tool type, with some interpreting the tools as bipolar cores (Odell 2000). Adding to the complexities, flakes, exhausted cores or formed flakes were utilized.

Projectile points (PPT) are bifacial tools used as tips to arrows, darts, or spears. They are classified according to common morphological attributes such as notch location (e.g., side-notched, corner-notched) or characteristics of the stem (e.g., contracting, expanding). Recorded attributes consist of material, point condition (complete or type of fragment), type of breakage, and evidence of rejuvenation. Basic metric attributes (including neck width) were also recorded.

Regionally, projectile points that formed the tips to arrows appear to have been introduced approximately 2,000 year ago (Minor 1983). Prior to the bow and arrow, prehistoric hunters used the atlatl and dart. The atlatl, or throwing stick, was used as an extension of the arm to propel a small spear, or dart, through the air. The tips of these darts were usually larger and heavier than arrows. Thrusting spears were probably used throughout prehistory to dispatch animals that had been caught in traps. The tips of these spears are hypothesized to have been large, thick, and often lanceolate in shape. Morphology alone cannot be used to separate spear points from dart points.

For projectile points, the terms dart and arrow are used to refer to the probable hunting technology based on blade shape, haft shape, and haft width. In this analysis, the dart point is lanceolate and bipointed and has a relatively broad haft width (e.g., > 7 millimeter [mm] haft width) whereas arrow points are relatively gracile with narrow neck widths (e.g., < 7 mm). The morphology of arrow points in this collection varies considerably.

Utilized flakes (UTF) attain modification only through use. Expediently-produced flaking is usually marginal and often recognizable by uniform microflaking along one or more edges. By definition, this tool exhibits much of the remnant dorsal and ventral surface of the flake blank. Almost any class of percussion or bipolar flake may be used, though heavier flakes are most common. The same attributes are recorded as for formed flake tools (see above).

Stone disks (SD) are those circular worked stone items that cannot be attributed to other classes such as beads or game pieces. They are perforated and often exhibit evidence of being ground or pecked. Materials tend to be relatively softer or more granular, such as pumice. These objects may have been used for decorative purposes or served other functions.

Faunal Analysis Methods

Faunal materials were identified to the most specific taxonomic level possible using comparative osteological and reference materials housed at AAR. Faunal materials were initially sorted into identifiable and unidentifiable categories by taxa and element. Specimens were then, when possible, identified to the genus or species level. When such identification was not possible due to the condition of the bone (i.e. fragmentation or degree of burning), elements were identified to the family, order, or class level. Specimens that could not be identified beyond the level of class were separated into general size categories of very small to very large, similar to those defined by Thomas (1969). Animals such as voles and mice represent very small mammals. Small mammals include small rodents such as squirrels, gophers, rabbits (hares and cottontails), and may include some of the smaller carnivores such as weasels. Medium mammals include animals such as skunk, raccoon, foxes, coyotes, dogs, and smaller artiodactyls, such as deer and pronghorn. Large mammals are elk and bear. Extremely large mammal would include ocean mammals such as dolphins and whales. Characteristics that determined size categories include the robustness or thickness of the cortical bone and its curvature. In the event that the bone did not retain characteristics to determine size, general categories of Mammal, Bird, Fish, Reptile, or Unidentifiable were used as descriptive attributes. An additional category of Bird or Mammal was created to exclude terrestrial from marine animals. This category was used when the analyst could confidently exclude the specimen as belonging to a fish but could not determine if it was bird or mammal. If an element was confidently but not positively identified, the notation "cf.", compares favorably, follows the identification.

When possible, each specimen was identified to element (humerus, femur, etc.) as well as side. Portion of the element such as proximal, distal, or shaft fragment was also recorded. When appropriate, any element that showed evidence of epiphysial fusion was recorded as immature, juvenile or adult. This information was then referenced to rates of epiphysial fusion and age for the identified animal and element in order to profile estimations of age at death. Specimens for which element could not be determined are allotted into longbone, flatbone, cancellous bone, and indeterminate bone fragments. Degree of burning was also noted for all specimens. Any cultural and non-cultural modifications to the bone have been recorded. Cultural modifications may include burning, cut marks, breakage patterns, or polishing. Non-cultural modifications include weathering, as well as gnawing and digestive pitting or staining by rodents, carnivores, and birds of prey. No attempt was made to determine the sex of individuals.

All bone was counted and number of identified specimens (NISP) recorded. All recorded data was entered into Microsoft Access for sorting and tabulation.

Fire-Cracked Rock Analysis Methods

Fire-cracked rock was analyzed in the field and not retained for curation. Pieces found during excavation that were at least 2.5 cm in one dimension were analyzed by excavation level or context (as in the case of features). The pieces were counted, identified as to raw material and fracture type, size sorted, and weighed. Following criteria presented in Wilson and Roulette (1998), the fracture type categories included spalls, blocky fragments, and whole stones; and size categories included small (2.5 to 5 cm), medium (5.1 to 10 cm) and large (greater than 10 cm).

Spalls and blocky fragments represent two different kinds of thermal fractures. Spalls result from "the thermal gradient stress of rapid heating of the rock surface. The temperature gradient between the surface and the interior of the rock can expand the outer parts so suddenly that the tensile strength of the rock is exceeded radically and fractures are formed more or less parallel to the surface" (Schalk and Meatte 1992:9.3). The spalls produced from this type of fracturing are generally thin slices, often from the surface of the rock, with lengths and widths that are much greater than thickness. Potlids are an example of this kind of fracture. Spalling in turn leads to thermal mismatch, in which thermal forces act on weak areas of the rock such as bedding planes, pores, and incipient cracks (Wilson and Roulette 1998:114). Thermal mismatch produces blocky fragments that are thicker than spalls and that exhibit large irregular fractures.

Generally, the small category consists of spalls that have flaked off of larger pieces of FCR due to thermal gradient stress and angular pieces of rocks broken into pieces by thermal shock (Wilson and Roulette 1998). Medium-size pieces consist of angular chunks resulting from the thermal degradation of heating stones and, at the upper limit of the size category, remnant masses of stone from which spalls and smaller blocky pieces have been removed. Large heating stones more than 10 cm in greatest dimension represent unbroken rocks or the central masses of partly degraded stones. The distinction between complete rocks that had not been fractured, spalls, and blocky fragments inform as to the stage of use at the time a thermal-rock feature was abandoned. A feature containing many whole rocks was likely abandoned at an early stage of use, whereas a feature that contains many broken rock fragments suggests that it was reused until the usefulness of the rocks was exhausted (Wilson and Roulette 1998:114).

The amount and type of FCR can indicate the duration of use as well as the function of a feature. Since FCR was used to retain and radiate heat, the quantity of FCR within a feature provides a clue as to the original function of that feature. That is, features that exhibit evidence for use of fire but contain little FCR were probably not processing facilities (or have had FCR removed from them). Likewise, a large quantity of FCR in a feature indicates that it may have functioned as an oven or other food processing facility. Interpretation of feature function is not always straightforward as the periodic maintenance of hearths, roasting ovens, and other thermal rock facilities by their users would likely have resulted in the removal of FCR produced during firings (Wilson and DeLyria 1996). At the same time, examining the percentage of small spalls and fragments versus larger, blocky fragments, can inform on the maintenance of thermal features as well as general site formation processes (Wilson and Roulette 1998:115).

Historical Artifact Analysis Methods

Historical or potentially historical artifacts in the collections were identified and separated into functional groups using South’s (1977) system as modified by Praetzellis and Praetzellis (1990, 1997) to account for later periods and western contexts. The functional groups serve as a method of organizing the historical artifact assemblage and group objects used in specific tasks or spheres of the home. Sources used to identify artifacts included ceramic and bottle collector’s catalogs, wholesale hardware catalogs, early-twentieth century mail order catalogs, and other standard historical archaeology texts.

Analyses performed on the historical artifact collection included dating all temporally diagnostic objects, calculating the minimum number of items (MNI) represented by complete and fragmentary objects with known function (mainly nails), and to the extent possible determining the former contents of glass bottles.

Other Analyses

Obsidian artifacts pieces larger than 1 cm in one dimension were sent to Northwest Research Obsidian Studies Laboratory to be analyzed for geochemical composition. This analysis links obsidian artifacts to geological source locales. Obsidian was very scarce at the site, however, and only two pieces were of sufficient size to be analyzed. Methods used by that laboratory are described on the laboratory website (http://www.obsidianlab.com). The results of the analysis are presented in Appendix D.

Six wood charcoal samples were submitted to Beta-Analytic, Inc. for standard radiometric assay. Samples were chosen to determine the beginning and end dates of midden deposition, and to date the intact features. The Procedures used by Beta-Analytic are described in Appendix E.

Curation

With the exception of the zoomorphic-decorated stone object which is to be retained by the Confederated Tribes of the Grand Ronde, all objects, samples, and records related to the project will be curated under Accession No. 1739 at the Oregon State Museum of Natural and Cultural History in Eugene.

CHAPTER 7
RESULTS

This chapter describes the results of the multiple phases of investigation at site 35TI90. In it, to the extent possible, the results from all of the phases are described together. This is possible because a consistent set of field methods was employed for all of the testing and data recovery investigations and because the cultural resource compliance issues were addressed on an on-going basis during the construction project. Thus, while this report satisfies compliance requirements, it is not necessary nor is there value in distinguishing between the results of the site evaluation phase and the results of the initial or subsequent data recovery phases. It is also made possible because the combined results of all phases of fieldwork indicate that the site contains a single uninterrupted record of use.

A combined total of 27.5 m2 of site area was excavated during all phases of fieldwork, and excluding the spoil processed following the inadvertent discovery, a little over 23 m3 of sediment were excavated and processed. The investigations resulted in the recovery of 12,340 pieces of lithic debitage, 369 stone artifacts (includes 20 items classified as manuports), eight bone tools, 6,760 pieces of animal bone, and nearly 12,000 pieces of FCR. Eight prehistoric cultural features or possible features were identified, two of which upon analysis were combined (see below). In addition, 23 items that are or may be historical were recovered during the excavations and 66 additional similar items were collected monitoring. Table 6 provides summary data for each excavation provenience that includes counts by unit for pieces of lithic debitage, stone and bone tools, pieces of faunal material, FCR, and historical or possible historical objects. The location of units and areas investigated during each phase of the fieldwork are depicted in Figures 11-13.

Description of Sediments and Stratification

Site 35TI90 covers parts of two river terraces. A distinct soil profile is associated with each landform. The south part of the site (South Area) is on the lower terrace and also on the riser between the two terraces. Soil profiles in units excavated within the developed and undeveloped parts of the original plant were mostly similar although the units placed in the lowest topographic positions featured sedimentary layer not observed in units in slightly more elevated locations. The north half of the site (North Area) is on the upper terrace. Units excavated in the staging and expansion areas exhibited a uniform soil profile that was truncated by grading.

Quillayute silt loam, 0 to 7 percent slopes, is mapped in both site areas (Bowlsby and Swanson 1964:49-50, sheet 13). It is a terrace soil found on upper and lower stream terraces; a landscape setting that describes the site area. The soil profile exposed in the North Area units conforms well to the typic pedon description for this soil while the one exposed in the South Area does not. The soil profile of Quillayute silt loam, 0 to 7 percent slopes, is described as the same on both upper and lower terraces but on the latter soil horizons are thinner and the overall soil body shallower. Compared to the typic pedon description for Quillayute silt loam, 0 to 7 percent slopes, soil profiles exposed in the South Area lack B1, B2, and B3 horizons. Instead they feature an A horizon over a C horizon. However, the A horizon is not derived from the C horizon and formed is sediment deposited long after the C horizon was in place.

<u>South Area</u>

The C horizon seen in the soil profiles in the South Area is composed of cobbles, gravels, and sand. The stratum was exposed at varying depths in all units excavated in the South Area. In its upper part it was unconsolidated. After about 20 cm, it became cemented and impenetrable. The basal stratum was deposited in a high-energy fluvial system, that is, before the formation of Tillamook Bay, which set the modern hydrologic regime of the area. It is a very old surface that underlies both parts of the site but which in the North Area is deeply buried. In that area it was not exposed in the archaeological

Table 6. Summary of Artifact Data by Excavation Provenience

Unit	Excavated		Cultural		Artifact Counts						Extrapolated Density/m^3			Features
	Depth (cmbs)	Vol. (m^3)	Depth (cmbs)	Vol. (m^3)	Debitage	Tools	Bone	Bone tools	FCR	Historical/ Possible Historical	Lithic Tools and Debitage	Bone	FCR	
North Area														
QTU1	90	0.23	70	0.175	4	-	7		9		23	40	51	
QTU2	150	0.26	80	0.200	395	10	206		507		2025	1030	2535	
QTU3	100	0.25	40	0.100	2	-	0		0		20	0	0	
QTU4	130	0.27	40	0.100	2	-	0		0		20	0	0	
QTU5	80	0.20	40	0.100	3	1	1		7		40	10	70	
QTU6	100	0.25	40	0.100	2	-	5		19		20	50	190	
QTU9	110	0.23	50	0.125	3	-	0		7		24	0	56	
QTU10	110	0.23	80	0.200	96	4	741		355		500	3705	1775	F1
QTU12	115	0.23	80	0.200	22	2	21		58		120	105	290	
QTU14	110	0.22	80	0.200	104	4	40		334		540	200	1670	F3
QTU17	140	0.25	30	0.075	-	-	3		5		0	40	67	
QTU20	110	0.20	50	0.125	1	-	7		6		8	56	48	
QTU25	80	0.20	80	0.200	92	10	14		123	2	510	70	615	F6
QTU26	90	0.23	60	0.150	59	6	34		144		433	227	960	
QTU27	90	0.23	80	0.200	139	17	39		218	1	780	195	1090	
QTU28	90	0.23	70	0.175	50	9	41		261	1	337	234	1491	F7
QTU29	80	0.20	70	0.175	18	6	11		121	4	137	63	691	
QTU30	80	0.20	80	0.200	79	6	30		240	1	425	150	1200	
QTU31	80	0.20	80	0.200	49	8	17		125		285	85	625	
QTU32	80	0.20	70	0.175	50	9	47		195	3	337	269	1114	
QTU33	90	0.23	90	0.225	86	9	66		181		422	293	804	
TU1/QTU8	100	1.00	60	0.600	253	10	570		552		438	950	920	F2/4
Subtotal		*5.69*		*4.000*	*1509*	*111*	*1900*		*3467*	*12*				
South Area														
QTU7	80	0.20	60	0.150	15	3	6		3		120	40	20	
QTU11	80	0.20	70	0.175	13	-	8		23		74	46	131	
QTU13	70	0.18	70	0.175	5	1	10		24		34	57	137	
QTU15	80	0.20	30	0.075	-	-	1		9		0	13	120	
QTU16	90	0.23	50	0.125	1	-	10		1		8	80	8	
QTU18	130	0.25	90	0.225	53	1	19		46		240	84	204	
QTU19	110	0.23	80	0.200	77	-	9		53		385	45	265	
QTU21	60	0.15	40	0.100	5	0	2		16		50	20	160	
QTU22	80	0.20	60	0.150	46	2	32		97	3	320	213	647	
QTU23	130	0.33	60	0.150	253	8	105		310	2	1740	700	2067	
QTU24	70	0.18	70	0.175	219	5	134		193	2	1280	766	1103	
QTU34	80	0.20	50	0.125	53	4	53		99		456	424	792	
QTU35	90	0.23	0	0.000	0	0	0		0		0	0	0	
TU2	80	0.80	80	0.800	822	15	260		832		1046	325	1040	
TU3	119	0.70	70	0.700	942	10	267	2	937		1360	381	1339	
EU4	75	0.70	60	0.600	916	24	311		370		1567	518	617	
EU5	80	0.80	50	0.500	728	13	240		348		1482	480	696	
EU6	110	0.80	60	0.600	692	17	218	1	377		1182	363	628	
EU7	120	1.20	80	0.800	816	20	438		367		1045	548	459	
EU8	70	0.60	50	0.500	82	2	38		94		168	76	188	
EU9	70	0.60	50	0.500	60	1	15		61		122	30	122	
EU10	100	0.90	80	0.800	105	2	53		408		134	66	510	F5
EU11	80	0.75	60	0.600	499	13	170		409		853	283	682	
EU12	80	0.75	70	0.700	497	13	213		330		729	304	471	
EU13	80	0.75	70	0.700	401	6	153		303		581	219	433	
EU14	120	1.10	60	0.600	636	19	337	1	360		1092	562	600	
EU15	90	0.90	80	0.800	1111	20	671	2	1004		1414	839	1255	
EU16	90	0.90	70	0.700	928	19	634	1	512		1353	906	731	
EU17	80	0.70	70	0.700	620	8	318	1	513		897	454	733	
EU18	80	0.70	60	0.600	195	4	76		293		332	127	488	
EU19	100	0.50	80	0.400	8	2	30		1	4	25	UA	3	
EU20	100	0.50	80	0.400	1	0	35				3	UA	0	
Surface					32	26	3			66				F8 (trench)
Subtotal		*17.40*		*13.825*	*10831*	*258*	*4869*	*8*	*8393*	*77*				
Total		**23.09**		**17.825**	**12340**	**369**	**6769**	**8**	**11860**	**89**				

excavations but it was exposed during mechanical excavations of deep pits for clarifiers and an aeration basin (Figure 22). Based on data from geotechnical probes excavated as part of the TWTP project, it extends to as much as 8 m below surface (Kelsey and Wurst 2005).

The basal stratum may represent a large point bar that formed on the inside of a broad curve in the river, or possibly an alluvial fan. It likely is a Pleistocene-age landform and may have been buried and exhumed repeatedly in response to various coastal and riverine processes including sea level fluctuations both following the Pleistocene and later in response to coseismic subduction of the continental shelf. Occupation of the site began in the late Holocene well after sea levels had achieved quasi-equilibrium. Because of that, the exposure of the surface seemingly reflects a lower-order (but high-energy) event like river downcutting.

The C horizon was directly overlain by an A horizon of very dark gray (10YR 3/1) to black (10YR 2/1) sandy clay loam that contained between 3 and 30 percent subrounded and angular pebbles and cobbles. The percentage of rock increases with depth. This layer was between 40 and 80 cm thick but most commonly was between 50 and 60 cm thick. The boundary between it and the C horizon was gradual. The layer exhibited no discernible bedding or internal divisions. It exhibited weak soil structure expressed as very fine granule structure that is very friable and high in organic carbon. Loss-on-ignition tests (see Methods, above) on samples of the stratum from EUs 5, 7, and 9 indicate that it contained between 9.13 and 9.95 percent organic material. Grain-size analysis showed that the sediments comprising this stratum are moderately to poorly sorted with very coarse and coarse sand constituting 28 and 36 percent of the matrix, respectively (Figure 23).

The A horizon was the main cultural deposit in the South Area and contained abundant charcoal, lithic artifacts, faunal remains, and FCR. In this report it characterized as a midden that was formed by the incorporation of cultural refuse from regular reuse of the site into the sediment deposited on an annual or at least regular basis.

In several units in the South Area the midden was overlain by a layer of dark gray brown (10YR 4/2, moist) to dark yellow brown (10YR 4/6) sandy loam that featured redoximorphic depletions and iron and iron-manganese concentrations. This stratum had a high percentage of fine sand and silt and lacked bedding. It had a low percentage of organic carbon (1.52% as measured on a sample from EU 7). It was of variable thickness and tended to be thickest in the lowest-lying units and to get thinner concomitant with increased elevation. With reference to the site topography as depicted on the 1946 pre-construction blueprint map, the sandy loam layer is not seen in units above the 8-foot contour line. It is identifiable in units below 7 ft amsl and in those between 7 and 8 ft amsl that are close to the Trask River. It was not observed in EUs at that elevation range at a distance from the river.

The upslope-thinning character of the stratum was clearly seen in soil profiles exposed in units comprising Trench 1. Plotted on the 1946 contour map, EU 16 was solidly below 7 ft amsl; EU 7, 4 m to the north, was closer to the 7-foot contour and EU 5, located 6 m north of EU 7 straddled the 8-foot contour line. In EU 16, the sandy loam layer was 60 cm thick. Moving upslope, it was 45 cm thick in EU 7 and 30 cm thick in EU 5. In Trench 1, the stratum was not observed north of EU 5. The sandy loam layer was seen in all of the units comprising Trench 2 including testing phase TU 2. It was thickest to the south in that unit, at 30 cm, and thinnest to the north, in EU 11, where it was 20 cm thick. It was slightly thicker toward the Trask River as seen in units comprising Trench 3. It was also present in the trench excavated for the installation of the outflow pipe (Figure 24). QTUs 21-24 excavated during the second round of data recovery were located a short distance to the north of Trench 2 and at about the same elevation. The sandy loam layer was identified in QTUs 23 and 24 but not the others. It likely was removed from the area where QTU 21 was placed as that unit was thoroughly disturbed by previous construction activity. It might also have been removed from the area where QTU 22 was placed. The soil profile exposed in that unit consisted of two layers of fill over the midden layer. The sandy loam layer

Figure 22. Sand and gravel stratum exposed beneath a thick B horizon in pit for aeration basin in the North Area. In the South Area the cultural layer directly overlays the sand and gravel. View is southeast.

Figure 23. West wall profile of EUs 8 and 9 showing midden directly over the sand and gravel layer. Fill was removed prior to excavation. Scale is in 10-cm increments.

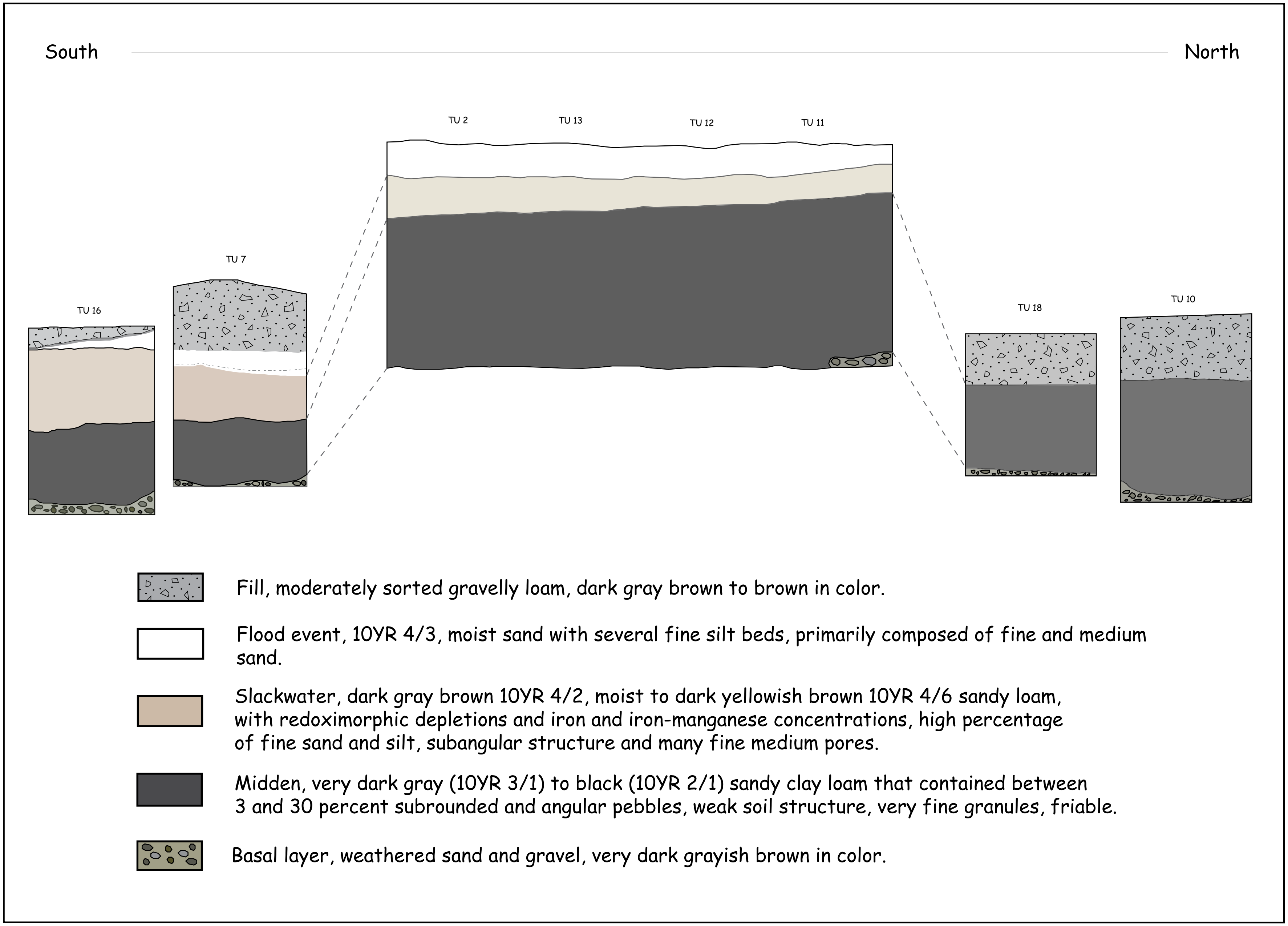


Figure 24. Schematic view of the soil profile exposed in excavation units in the South Area.

was not present in QTUs 7, 11, and 13 excavated in the southeast corner of the plant next to the Solids Processing Building. Those three QTUs were at elevations of between 8 and 10 ft amsl.

The fine sand and silt in this layer along with an absence of bedding, suggests that it is a massive slackwater deposit rather than a flood deposit. It developed into a weak soil with fine subangular structure and many fine and medium pores. This indicates that after it was deposited, and water receded from the land, it was an exposed and stable surface for a sufficient amount of time for soil formation processes to begin. The slackwater stratum mostly lacks cultural material. Artifacts in it are likely intrusive from below and introduced into the layer by non-cultural site formation processes. Charcoal from near the top of the underlying midden deposit in EU 13, where the slackwater deposit was present, yielded a one-sigma conventional radiocarbon date of 190 + 40 B.P. (Beta 242816). The raw radiocarbon date intersected the calibration curve in multiple locations providing alternate calendar date ranges of A.D. 1650 - 1700; A.D. 1720 - 1820; A.D. 1840 - 1880; and A.D. 1920 – 1950. The last date range and most probably the second to most recent one can be dismissed out-of-hand as representing fluctuations in the atmospheric carbon. The lack of trade goods in the underlying cultural layer further suggests that the slackwater deposit was in place prior to the rise of the maritime fur trade along Oregon coast in the 1780s. On that basis, the event that resulted in its deposition most likely occurred between A.D. 1650 and the 1770s.

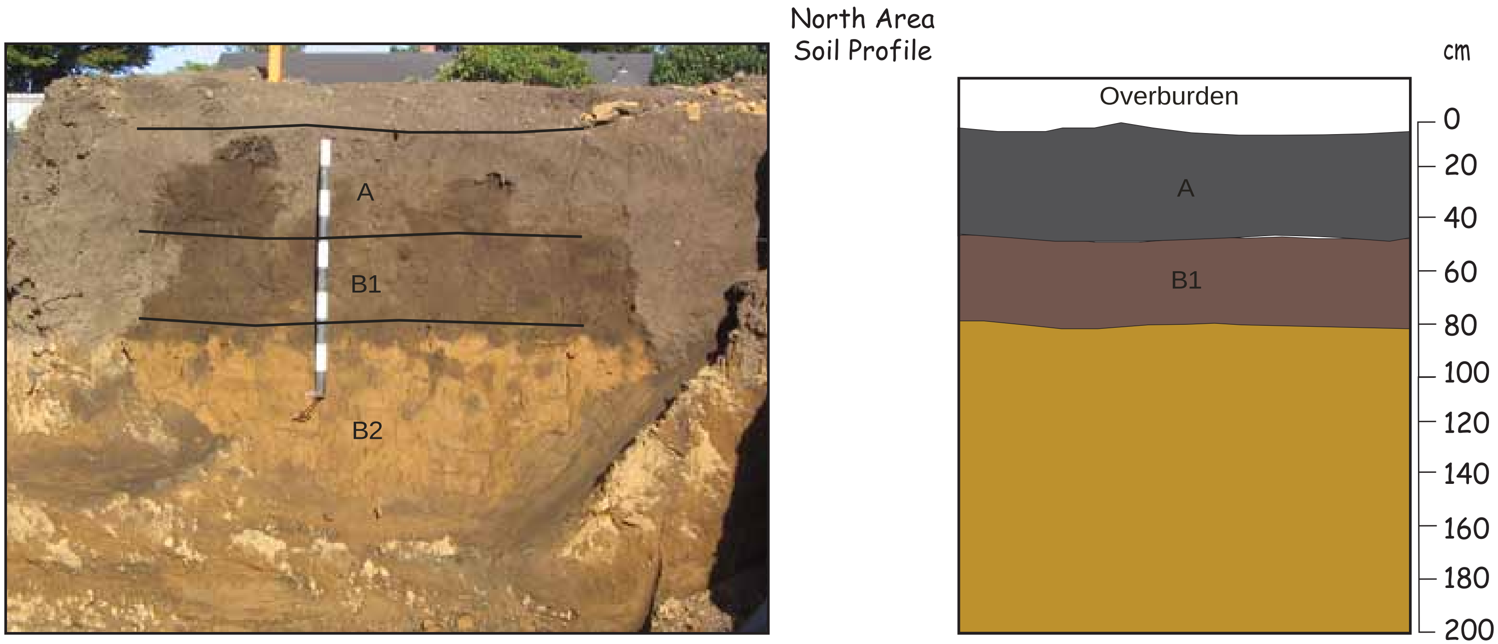
In the South Area, the surface of the slackwater deposit appears to have remained as the exposed ground surface into the late historic-era. In the lowest-lying units it was topped by a layer of brown (10YR 4/3, moist) sand with several fine silt beds. This stratum had roughly the same horizontal extent as the slackwater deposit. Grain-size analysis indicates that it is primarily composed of fine and medium sand. The consistency of this stratum suggests it represents a higher-energy depositional environment than the underlying slackwater stratum although the beds of silt within the stratum indicate quieter periods within the period that the sediment accumulated. The layer represents a flood event during which the water became ponded. The boundary between it and the underlying slackwater layer was abrupt and wavy and appeared erosional, which reflects the initial energy of the flood event. In the units in which it was observed (EUs 5-7, 11-17, TUs 2 and 3), and intact, it was thickest in the lowest-lying units and thinned northward and eastward. In Trench 2 it was thickest to the south in TU 2, at 30 cm, and thinnest to the north, in EU 11, where it was 18 cm thick.

In EU 12, the sandy flood stratum covered a trench excavated for the original TWTP outfall line. Thus, the event that deposited the sand and silt post-dates the construction of the original plant in the 1940s. Overlying the layer were two separate units of fill.

<u>North Area</u>

The North Area was graded before it could be investigated. None of the 20 units excavated in the staging and expansion areas (including 19 QTUs and one QTU that was converted into a TU) featured an intact soil profile. An intact soil profile was recorded in QTU 2 that was excavated outside of but next to the staging area in an ungraded part of the North Area. Based on a comparison between the profile in that unit and others, it was apparent that between 10 and 50 cm of sediment had been removed from the North Area prior to the stop work order issued by the Oregon SHPO. Lacking any information on the absolute elevation of the surface prior to the grading, it is not possible to determine with precision the amount of sediment removed from any specific locale.

As noted, Quillayute silt loam, 0 to 7 percent slopes, is mapped in the North Area and soil profiles in the area, while truncated in all units except QTU 2, closely conform to the description of the typical profile for this soil (Bowlsby and Swanson 1964:49-50, sheet 13) (Figure 25). The soil is described as having formed in “old alluvium” (Bowlsby and Swanson 1964:49) and it exhibits considerably stronger development than the soil in the South Area. The greater degree of soil formation implies a greater antiquity for the soil body in the North Area. From this it may be inferred that the upper



Black silt loam, 10YR 2/1 (moist), friable, moderate fine subangular blocky structure, charcoal common, occasional bisque, 2 to 5 percent subangular and rounded gravel, roots common

Very dark brown silt loam, 10YR 2/2 (moist), moderate subangular blocky structure, gradual upper boundary, numerous krotovina, some charcoal, 1 percent or less rounded to subangular gravel, roots common

Basal layer, dark yellowish brown silty clay loam, 10YR 3/6 (moist), slightly sticky consistency, moderate very fine subangular structure, gradual upper boundary, 2 percent or less rock, no roots

Figure 25. Photograph and drawing of the typical soil profile exposed in the North Area of site 35TI90. This view is of a cutbankat the site of the aeration basin in the east edge of the expansion area. In this profile the A horizon is truncated. Note the common krotovina at the B1/B2 boundary. View is east.

terrace has been stable and mostly been above flood events, although occasional depositional (or even scouring) events cannot be precluded.

The basal stratum in the excavations units in the North Area was a B2 horizon of dark yellowish brown (10YR 3/6, moist) silty clay loam. In QTU 2, the stratum was exposed at 130 cm below surface (cmbs) in an auger excavated into the base of the unit beginning at 90 cmbs. In other units with truncated soil profiles it was nearer the graded ground surface. The stratum contained little rock (2% or less) and no roots. It had a slightly sticky consistency and moderate, very fine subangular blocky structure. It had a gradual boundary with the overlying layer. It contained very sparse cultural material, all of which is interpreted as intrusive via non-cultural site formation processes.

The overlying B1 stratum was very dark brown (10YR 2/2, moist) silt loam that contained 1 percent or less rounded to subangular gravel. It had moderate subangular blocky structure but the peds readily broke into fine granules. The layer was riddled with rodent burrows and tunnels (krotovina). Roots were common and it contained small bits of charcoal. This layer was typically about 40 to 65 cm thick and had a gradual boundary with the overlying layer. Cultural material was present in this layer, especially at and near its upper boundary. Under the assumption that the upper terrace was a stable landform prior to occupation of the North Area, the artifacts are not in situ but rather have been displaced downward due to various sorts of turbation.

The topmost stratum A horizon contained the main cultural deposit. In QTU 2 it was about 50 cm thick. In other units, it was between 0 and 40 cm thick. It consisted of black (10YR 2/1, moist) friable silt loam that contained 2 to 5 percent subangular and rounded pebbles, common roots, common charcoal, and occasional bisque (fire-reddened earth) inclusions. It had moderate, fine subangular blocky structure but as with the layer below it, the peds crumbled into fine granules. When dry, the top layer had low bulk density (i.e., was “fluffy”) and was very porous. Like the layer below it, the upper stratum was crisscrossed with krotovina. Prior to the upgrade and expansion project, the North Area had been pasture. It is likely that it had been tilled at least occasionally. The typic pedon description for Quillayute silt loam, 0 to 7 percent slopes, includes a plowzone that is about 23 cm thick. A plowzone was not discerned in QTU 2 either visually or on the basis of difference in soil structure. This does not mean that one was not present. If only 23-cm thick, a plowzone would have been entirely within the A horizon and would not have been readily visible. Depending on the frequency of plowing and the technique used, it may not have resulted in noticeable structural changes to the A horizon.

The above sequence of strata characterized soil profiles in units excavated during testing, site damage assessment, and data recovery phases in the staging and expansion areas. The southernmost unit exhibiting this profile was QTU 32. In QTU 33, located 10 m south of QTU 32, the same sequence of strata was present but the soil body was thinner and overlay the sand and gravel basal layer underlying both areas of the site at a depth of 90 cmbs. The shallower soil profile in QTU 33 suggests that it may mark the former boundary between the upper and lower terraces. It could also mark the edge of where river downcutting removed sediment from atop the sand and gravel layer because in QTU 34, located just 10 m southeast of QTU 33, the B horizons characteristic of the Quillayute silt loam, 0 to 7 percent slopes, soil are lacking and the black midden layer directly overlay the sand and gravel layer at a depth of 75 cmbs.

Radiocarbon Dates

Six radiocarbon dates were obtained on wood charcoal collected from the cultural layer at site 35TI90. Sample selection was guided by the desire to obtain estimates of the span of site occupation. Radiocarbon dates were obtained for Features 2/4 and 7 in the North Area and from the top and bottom of the midden deposits in the South Area. The charcoal samples are assumed to be from wood burned as fuel by the site occupants. The charcoal pieces from the features in the North Area were directly associated with FCR and fire-reddened sediment. The pieces of charcoal from the South Area were collected from discrete areas within single excavation levels and were spatially associated with FCR, which was very common in the cultural matrix. It is likely that drift wood was used as a fuel source and the problems inherent in using old wood for fuel must be recognized. The results of radiocarbon dating are summarized in Table 7. Some of the dates have already been introduced in describing site stratification, above.

Table 7 shows the conventional radiocarbon age for each sample, expressed as a number of radiocarbon years before present, which by international convention is established as A.D. 1950. The radiocarbon age includes one standard deviation (+) which, when applied, provides a 68 percent probability that the conventional radiocarbon age is correct. Due to the fact that radiocarbon years do not match precisely with calendar years, it is necessary to calibrate radiocarbon assays, conventionally using a two-sigma date range(s), which translates the conventional dates into calendar years. With calibration and use of two-sigma ranges, there is a 95 percent probability that the expressed dates accurately measure the age of the sample material. Several dates are associated with multiple intercepts, or date ranges. These are the result of fluctuations in atmospheric 14C production over time (Struiver and Reimer 2004).

Three radiocarbon dates were obtained on charcoal collected from cultural features found in the North Area. Feature 2/4 contained charcoal that returned dates of 810 + 40 B.P., and 980 + 40 B.P. At two standard deviations, the two dates align and indicate a late tenth to thirteenth century A.D. age for the feature. Charcoal from Feature 7 was dated to 880 + 30 B.P. The date intercepted the calibration curve in two places but both calendar ages are entirely with the age range for Feature 2/4. The three dates form a tight grouping and suggest regular use of the site locale ca. A.D. 1000-1280.

The three radiocarbon dates from the South Area were selected to provide a range of dates for the accumulation of the cultural layer. The charcoal sample from EU 12 in Trench 2 was collected from the base of the midden layer. It returned a date of 1290 + 40 B.P. (calibrated to A.D. 660-780). The samples from EU 13 (Trench 2) and EU 14 (Trench 1) were selected because of their location at the top of the cultural deposits just under the slackwater sediments. The sample from EU 13 returned a conventional date of 180 + 40 B.P. The one from EU 14 was dated to 190 + 40 B.P. These dates are statistically identical and were from EUs separated by approximately 13 m. In calibrating the conventional dates each intercepted the calibration curve in multiple locations resulting in probable calendar age ranges of A.D. 1650-1710, A.D. 1710-1880, and A.D. 1910-1950 for the sample from EU 13 and A.D. 1650 -1700, A.D. 1720-1820, A.D. 1840-1880, and A.D. 1920-1950 for the sample from EU 14.

The radiocarbon date from EU 12 suggests that the site was initially occupied about 1,200 years ago. The end date of site use is open to interpretation because of the way the most recent dates intercept the calibration curve. It is assumed that the late historical intercepts, between 1920 and 1950 (Beta 242816) and between 1910 and 1950 (Beta 242817) are anomalies associated with environmental carbon fluctuation. They can be discounted out-of-hand. The site does contain a historic-era component but it dates to the late nineteenth and early twentieth centuries, a time span that does not correspond with any of the possible carbon ages. No trade goods such as beads, metal objects, or gunflints were found at the site which suggests site abandonment before Euroamerican contact, which presumably occurred in the late eighteenth century. On that basis, the A.D. 1650 to 1710 and A.D. 1650 to 1700 intercepts are believed to most accurately date the period in which site use was discontinued, although a slightly later date, up to the 1770s cannot be precluded. The dated charcoal samples were selected for specific purposes and do not provide a fine-grained chronology for site use. However, combined with the apparent lack of internal stratification of cultural deposits in the South Area, it can be surmised that site occupation was recurrent and not episodic.

Description of Cultural Features

Eight feature numbers were assigned to sedimentary anomalies and FCR concentrations. Upon analysis of field data Features 2 and 4 were determined to be elements of a single feature that below is

Table 7. Radiocarbon Dates from Site 35TI90

Catalog No.	Beta No.	Radiocarbon Age	Calibrated Age Range (2 sigma)	Unit	Analytic Depth	Feature	Material
132	239537	810 ± 40 B.P.	1160-1280 A.D.	TU 1	2	2/4	Charcoal
276	239538	980 ± 40 B.P.	990-1160 A.D.	TU 1	2	2/4	Charcoal
650	242815	1290 ± 40 B.P.	660-780 A.D.	EU 12	7		Charcoal
661	242816	190 ± 40 B.P.	Cal A.D. 1650 -1700 and A.D. 1720-1820; and Cal A.D. 1840-1880 and A.D. 1920-1950	EU 13	1		Charcoal
684	242817	180 ± 40 B.P.	Cal A.D. 1650-1710 and A.D. 1710-1880; and Cal A.D. 1910-1950	EU 14	1		Charcoal
1160	303905	880 ± 30 B.P.	Cal A.D. 1040-1100 and A.D. 1120-1220	QTU 28	6	7	Charcoal

designated Feature 2/4. Five features, 1, 3, 5, 6, and 7, consisted solely of amorphous patches of burned earth (bisque) that were usually spatially associated with FCR. Other than obviously reflecting the thermal alteration of sediment, the origin of the patches of bisque is not clear. The ones identified in the North Area, Features 1, 3, 6, and 7, may marked where hearths were scraped away or mostly scraped away when that part of the site was graded. This possibility is suggested by Feature 2/4, which is a remnant of a graded hearth feature that is underlain by irregular patches of bisque presumably created by thermal alteration of B1 horizon sediment during use of the hearth. The patches below Feature 2/4 are similar to those designated Features 1, 3, 6, and 7, which in like fashion, may mark the locations of hearths, the upper parts of which were removed during grading.

The area beneath Feature 2/4 was crisscrossed with rodent burrows. As seen in the unit wall profile some of the rodent tunnels that were in proximity to the feature contained bisque, which almost certainly was displaced from the area below the feature. This suggests the possibility that some of the patches of bisque identified as features may be contained within rodent tunnels, which themselves were no longer discernible. A third possibility is that the patches of bisque were actually constituents of larger features that were not identified. Features 1, 3, 6, and 7 were exposed in QTUs. For different reasons, the QTUs were not expanded into larger units to more fully investigate the patches of bisque observed in them. It is entirely plausible that with a larger area of exposure, both in plan-view and in cross section, the bisque patches may have been seen to be elements of larger features. Features 1 and 3 were identified in the staging area during the testing phase, along with Features 2 and 4. The scope of that phase did not permit all cultural features or possible features to be fully exposed or exposed and the latter two were selected for more intensive investigation. This was because they were in the development footprint of the Blower and Standby Generator Building (which subsequently was moved northward to an area where sparser cultural deposit and no cultural features were found). Because no further developments were planned in the staging area, it was excluded from the first two rounds of data recovery investigations and thus Features 1 and 3 were not explored further. Later data recovery excavations were conducted in the staging area related to the construction of the security fence. Those excavations were limited QTUs placed next to where fence posts were to be installed. The very specific nature of the fieldwork did not allow the small units to be expanded into larger ones.

In support of the idea that the bisque patches were the identifiable parts of larger features that were not discerned it can be noted that in most cases, QTUs in which the patches were observed had high densities of FCR. Extrapolated FCR densities of more than 1,400 pieces/m3 were recorded for QTUs 10, 14, and 28 that contained Features 1, 3, and 7, respectively. This is more than twice the site-wide average of approximately 637 pieces/m3.

Feature 1

This feature was identified in QTU 10 at the base of the A horizon at 30 to 35 cm below the graded surface. It consisted of a linear patch of burned earth that was 45 cm long measured north and south with a maximum width of 20 cm. It was 5 cm thick. The burned sediment was collected and processed in the lab through 1-mm-mesh screen. It contained small fragments of bone, mainly of fish (n=617). It also contained a few pieces of mammal bone (n=2) bone and two pieces of lithic debitage. The matrix surrounding the burned sediment contained much less bone but substantially more cultural material and abundant FCR. Overall, the QTU in which Feature 1 was exposed yielded 355 pieces of FCR which represents the equivalent of 1,775 pieces /m3.

Feature 2/4

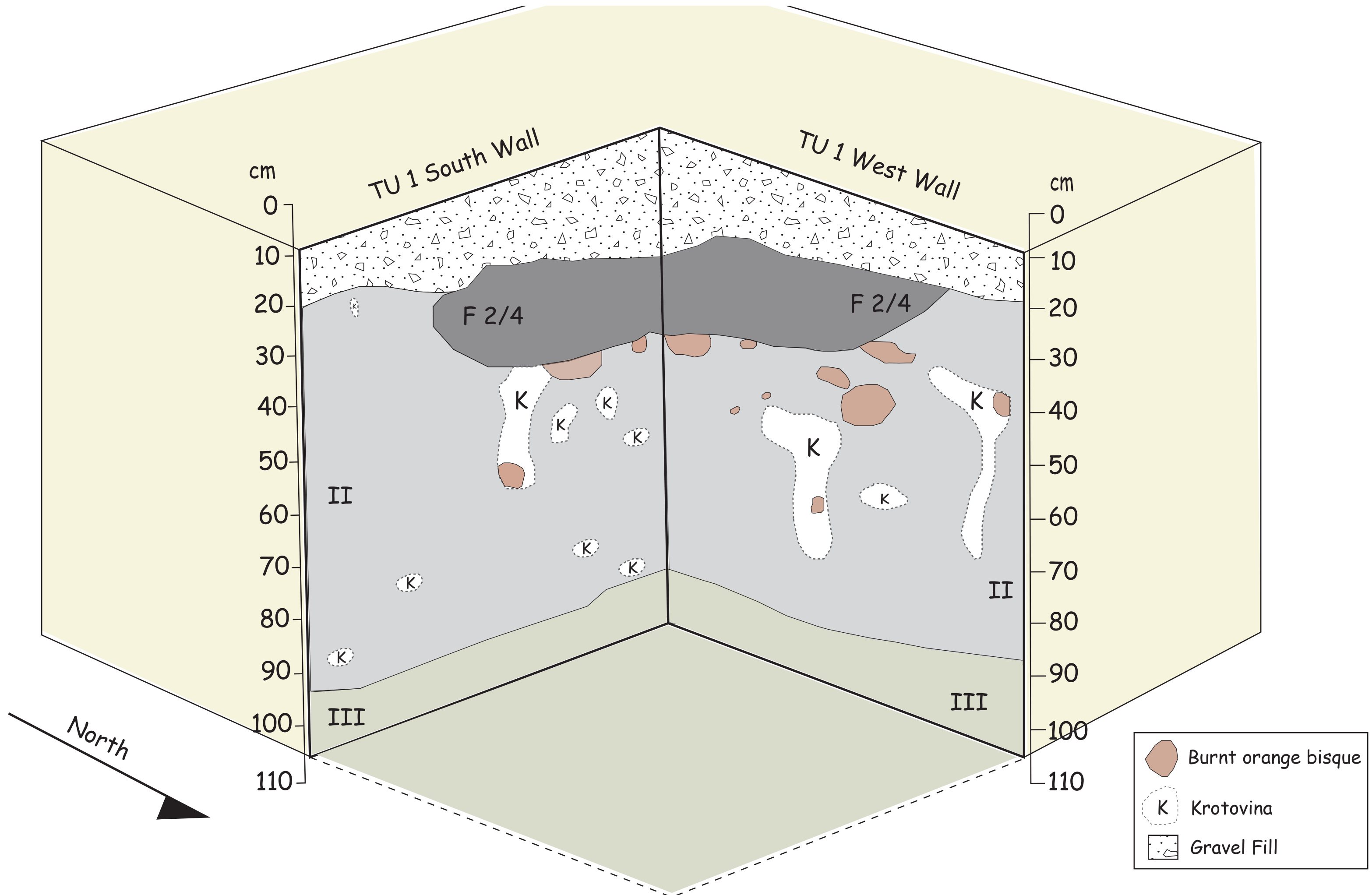
This feature was exposed in QTU 8/TU 1 (Figure 26). All of the A horizon was stripped from that unit and the feature was exposed at the top of the B1 horizon about 50 cm below the original ground surface. Feature 2 was first identified in QTU 8 as a poorly-defined patch of burned earth around which were finely crushed bone, FCR, and charcoal flecking. In the QTU it measured 30 cm north to south and 30 cm east to west and was no more than 10 cm thick. It extended into the west and south walls of the QTU. TU 1 was framed to incorporate QTU 8, which became its northeastern quarter. Feature 2 extended across most of the TU 1 and into its west and south walls. As exposed in QTU 8 and TU 1, Feature 2 appears to have been circular and about 1.6 m in diameter. Its approximate eastern half was contained in QTU 8/TU 1 and was excavated. As seen in the south and west wall profiles of TU 1, the feature had basin-shaped base that extended 25 cm into the B1 horizon. It contained black sediment which contained patches of burned earth (bisque), FCR, charcoal, small fragments of animal bone, and some lithic debitage. In the west wall profile, patches of bisque were seen to underlie the feature base. The B horizon beneath the base was riddled with krotovina and small patches of bisque were seen in some of the in-filled burrows.

The FCR counted as associated with Feature 2 (n=52) mainly consisted of blocky pieces and complete rocks and had an aggregate weigh of 1.5 kg. Spalls accounted for only 13 percent of the rock. As described above, charcoal collected from the feature fill was radiocarbon dated to 810 + 40 B.P. (Beta 239537).

Feature 4 was a concentration of 70 pieces of FCR and charcoal found within a 50-x-50-cm area in the southeast part of Feature 2. It was not immediately recognized that the FCR was inside the larger hearth feature and thus the rock received a separate feature number. The FCR attributed to Feature 4 consisted mostly of largish (5.1 to 10 cm in greatest dimension) blocky pieces or similarly-sized unbroken rocks. The FCR had an aggregate weight of 9.25 kg. Charcoal collected from between the FCR was radiocarbon dated to 980 + 40 BP (Beta 239538). As noted above, at two standard deviations, this date aligns with the other one from the feature.

Feature 3

Feature 3 was exposed in QTU 14 that was located in the staging area part of the North Area. About 20 to 30 cm of A horizon had been removed from the area where the unit was placed. The feature consisted of irregularly shaped, discontinuous patches of burned sediment exposed at the base of the A horizon at 30 cm below the graded surface. One patch extended 30 cm into the unit from its east and another extended 10 cm southward from its north wall. They were up to 10 cm thick. The bisque was screened separately (in the field). It contained two pieces of bird bone and 18 pieces of FCR (that together weighed .5 kg), while the remainder of level contained seven pieces of mammal bone and 45 pieces of FCR (with an aggregate weight of 1.25 kg). In total, QTU 14 contained 334 pieces of FCR which represents the equivalent of 1,670 pieces /m3. No cut line demarcating a pit profile was noted associated with the bisque in the QTU wall profiles.



F 2/4. Black 10YR 2/1, moist) friable silt loam.

II. Very dark brown (10YR 2/2, moist) silt loam, 1 percent or less rounded to subangular gravel, weak crumb structure, krotovina throughout, roots, charcoal inclusions, gradual boundary.

III. Basal stratum, dark yellowish brown (10YR 3/6, moist) silty clay loam, 2 percent rock, sticky consistency and moderate crumb structure, gradual boundary.

Figure 26. View of Feature 2/4 exposed in the south and west sidewalls of TU 1.

Feature 5

Feature 5 was identified at 10 cm below the surface of the midden deposit in EU 10 excavated in the South Area. In the EU, the midden was exposed beneath about 65 cm of fill. No slackwater or later flood deposits capped the midden in the part of the South Area containing EU 10.

Feature 5 consisted of several diffuse patches of burned earth that together covered an area measuring approximately 55 x 45 cm. The patches extended into the north and west walls of the EU and its feature's full extent could not be determined. Upon excavation, the patches were no more than 3 cm thick. They were excavated and processed separately from the surrounding un-burned matrix and contained one piece of mammal bone and four pieces of FCR that weighed approximately .5 kg. The un-burned matrix surrounding the feature contained 10 pieces of bone and 54 FCR.

The bisque occurs very near a former surface represented by the top of the midden deposit. It does not represent the bottommost portion of a truncated hearth as does Feature 2/4 and perhaps other features located in the staging area. It may represent the thermally altered sediment below a surface fire. Such fires might have been used when heat retention was not a goal, as with a simple warming fire.

Feature 6

This feature was exposed in QTU 25 that was excavated during the third round of data recovery. Like others identified in the staging area part of the North Area, it was observed at the base of the A horizon and consisted of multiple small patches of bisque associated on the horizontal plane with FCR (Figure 27). The patches were within an area that measured 25 x 20 cm. Upon excavation, they were only about 3 cm thick. One bisque patch extended into the west wall of the unit but no cut line demarcating a pit profile was noted associated with the bisque in the wall profile. The bisque was screened separate from the surrounding sediment. It did not contain cultural material whereas the surrounding matrix contained faunal remains and pieces of lithic debitage. Twenty-nine pieces of FCR (with an aggregate weight of 2 kg) were found throughout the excavation level that contained the feature but the pieces were not concentrated or otherwise form a collection recognizable as a heating element.

Feature 7

Feature 7 was exposed in QTU 28 in the North Area during the third round of data recovery. It was identified at the boundary between the B1 and B2 horizon at a depth of 50 cm below the graded surface (Figure 28). It consisted of patches of burned earth and a relative concentration of FCR (35 blocky pieces, mostly larger than 5 cm in greatest dimension, and six spalls). In plan-view, the bisque patches extended in a mostly continuous fashion along the entire east side of the unit. They extended from the east wall of the unit 10 to 15 cm toward its interior. The pieces of FCR were 15 to 20 cm westward of the west edge of the bisque patches.

The east wall profile preserves a cross section of the bisque. The patches are relatively level across most of the width of the feature but are clearly seen to rise as they approach the north wall of QTU 28. While speculative, based on the small part intersected in QTU 28, Feature 7 appears to be a pit the base of which is partly outlined by the bisque patches. It is likely that the pieces of FCR noted west of the bisque were within the pit. Charcoal found in direct association with FCR near the base of the feature was dated to 880 + 30 B.P. (Beta 303905).

The surface of the terrace landform in the North Area is believed to have been quasi-stable during the period of site occupation and is assumed to have been above most flood events such that it received minimal sedimentation. If this view is correct, it would indicate that in its construction Feature 7 was excavated through the A and B1 soil horizons, to a depth of at least 1.2 m. The depth to which it was excavated is roughly twice that of the other features identified in the North Area, which were excavated

Figure 27. View of Feature 6 exposed in QTU 25.

Figure 28. View of Feature 7 exposed in QTU 28.

through the A horizon and into the top of the B1 horizon. This could suggest that Feature 7 was a very different type of facility compared to the others features recorded in the staging area. This may also be suggested by the degree of thermal alteration of the sediment at its base or just below it which was greater than seen among the other bisque features. The patches of bisque in Feature 7 were thicker, larger, and firmer than those seen in other features. This suggests that the use of Feature 7 involved a more intense fire than was associated with the other features.

Feature 8

During monitoring of trenching related to the installation of the outflow pipe, a small deposit of highly fragmented mussel shell was noted at the top of the north trench wall. The patch of shell was designated Feature 8. The excavations were halted while the deposit was more closely investigated. The deposit was observed to extend approximately 30 cm east to west in the trench wall and to extend into the wall approximately 5-10 cm. They may have been within a shallow, basin-shaped pit. No artifacts were found associated with the shell and examination of the trench backdirt did not result in additional shell being found. A sample of the shell fragments and the matrix supporting the fragment was collected and examined in the lab. (Note that beyond their identification, the fragments were not formerly analyzed and are not included in the counts of faunal material recovered from the site.) The shell was highly fragmented and few valves were present to aid identification. Identified were mussel (Mytilus sp.), cockle (Clinocardium Nuttallii), and littleneck (Protothaca staminea). In addition to small pieces of shell, the matrix within the feature contained charcoal flecks, bone, and rocks. All of the approximately 20 pieces of bone were from fish. The rocks were small rounded pebbles and not FCR.

Lithic Artifact Description

The archaeological record of site 35TI90 contains no evidence for discernible breaks in occupation, until the site was abandoned, or shifts in artifact forms or technologies. For those reasons, the cultural material recovered from the site is considered a single analytical unit.

In total, 12,709 lithic artifacts were recovered from surface and subsurface contexts throughout all phases of work described in this report. Artifacts include 12,340 pieces of debitage and 369 tools (Table 6). Two tools recovered during the initial survey were re-analyzed for this report which brings to 371 the total of stone tools described in this section. The debitage from the survey phase was not re-analyzed.

Debitage from the limited 2007 data recovery (n=523) were tallied according to material but not further analyzed. The remaining sample of 11,817 pieces of debitage, collected during the initial testing and data recovery and the third round of data recovery were formally analyzed. Analysis began by dividing that sample into groups that were technologically diagnostic (n=4,119) and those that were not (n=7,698). The first group retained platforms. Its members were analyzed to identify technological attributes, size, evidence for heat treatment, heat damage, and cortex, and raw and material. The non-diagnostic debitage includes a variety of flake types, including flake fragments lacking intact platforms, shatter and potlids. These latter are counted as debitage even though they are an incidental by-product of the thermal alteration process. Attributes recorded for the members of this group were the same as for the first group excluding technological attributes.

Debitage

Raw Material

Lithic debitage from site 35TI90 is from several rock types including, CCS, petrified wood, obsidian, quartzite, and a variety of volcanics such as basalt, pumice, ignimbrite, and rhyolite, as well as miscellaneous sedimentary rock. CCS was by far the most common raw material in the assemblage, accounting for 85 percent (n=10,547) of the total. It was followed distantly by volcanics (10%, n=1,263), obsidian (<1%, n=48), quartzite (<1%, n=28), sedimentary rocks (<1%, n=19), and other materials such as petrified wood or unidentifiable types (4%, n=435) (Figure 29). Material type distribution was consistent across the North and South areas of the site.

Technology

Among the 11,817 analyzed pieces of debitage that retain platforms, CCS is overrepresented and volcanics are underrepresented (Table 8). CCS accounted for over 97 percent of the technologically diagnostic debitage, though it contributed only 85 percent to the overall total. In contrast, volcanic materials accounted for 10 percent of all debitage, but only 1 percent of the technologically diagnostic debitage. It seems likely that CCS debitage includes more platform flakes than those from volcanic materials because they are finer grained and more brittle (in the sense that they require less force for flake removal). It is also possible that different reduction strategies were employed for the different materials which resulted in differential preservation of diagnostic flake attributes in different materials.

When considered as a single assemblage, pressure flakes and biface thinning flakes dominate the technologically diagnostic debitage, representing 48 percent (n=1,997) and 45 percent (n=1,835) of the assemblage, respectively. Core reduction flakes (3%, n=133), notching flakes (2%, n=93), and bipolar flakes (1%, n=56) account for the remainder of the assemblage. Included in the diagnostic debitage are four CCS blades and one burin spall.

When considered by raw material, it is clear that the various types of toolstone were used in different ways. For technologically diagnostic CCS debitage (n=3,998), 49 percent are pressure flakes, 44 percent are biface thinning flakes, and 3 percent are core reduction flakes, with 1 percent bipolar flakes, and 2 percent notching flakes. In comparison, far fewer technologically diagnostic volcanic flakes (n=58) are byproducts from pressure flaking (7%), and far more are related to core reduction (35%). Like CCS, most debitage from the various volcanic materials (57%) are from biface thinning flakes. The two sets of raw materials have similar percentages of bipolar flakes (2% among the volcanics). There were no notching flakes included in the volcanic material debitage. Obsidian debitage (n=34) show a markedly different pattern than either CCS or volcanics, with 79 percent pressure flakes and 21 percent biface thinning flakes. Among the remaining materials, technologically diagnostic quartzite debitage (n=10) consists of 50 percent core reduction flakes and 50 percent biface thinning flakes and sedimentary material (n=19) consists of 63 percent biface thinning the flakes, 32 percent core reduction, and 5 percent pressure flakes.

When examined for differences in on-site reduction activity between the North and South areas some minor differences are apparent but not at the expense of overall similarity (Figures 30 and 31). The first and most obvious difference between the two site areas is the greater variety of raw material types present in the South Area debitage assemblage. However, given the difference in assemblage size between the two areas, 516 technologically diagnostic flakes from the North Area versus 2,598 from the South Area, it seems likely that the difference in raw material representation is a by-product of sample size, with the least common raw materials only occurring in the largest sample rather than being reflective of behavioral differences.

Of the three lithic materials represented in both site areas, CCS and obsidian show very similar technological flake type distributions. In both areas, CCS debitage is reflective of a complete reduction sequence but it is heavily dominated by later stage reduction flakes, from late stage biface thinning flakes through late stage pressure flakes. Obsidian is characterized in both areas exclusively by late stage reduction, but with a heavy emphasis on late stage pressure flakes. In contrast, volcanics from the North Area are represented exclusively by early stage reduction, with a heavy emphasis on early stage core reduction while in the South Area they exhibit a complete reduction sequence. Although early stage reduction activities contribute the most to the south area volcanics, early and late stage biface thinning

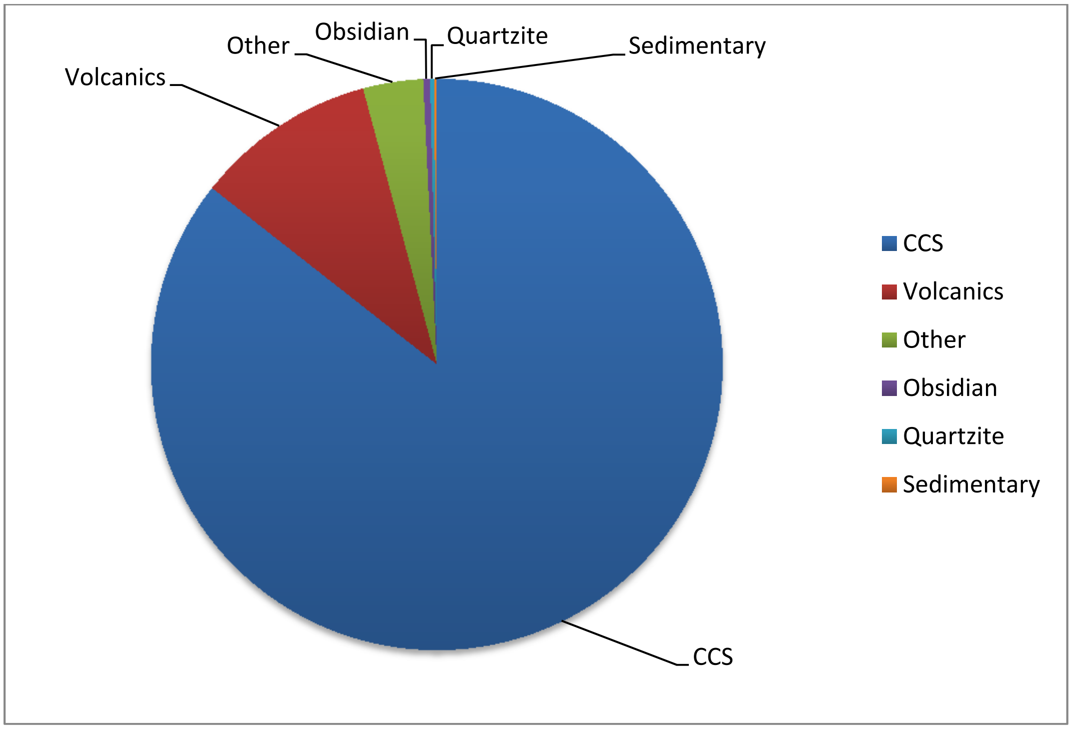


Figure 29. Debitage by material type at site 35TI90.

Table 8. Technologically Diagnostic Debitage from Site 35TI90 by Raw Material

Technology	CCS		Obsidian		Basalt		Quartzite		Sedimentary**		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Biface, early	443	10.80%	0	0.00%	18	0.40%	2	0.00%	7	0.20%	470	11.40%
Biface, late	1335	32.40%	7	0.20%	15	0.40%	3	0.10%	5	0.10%	1365	33.10%
Bipolar, early	10	0.20%	0	0.00%	1	0.00%	0	0.00%	0	0.00%	11	0.30%
Bipolar, late	45	1.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	45	1.10%
Core, early	34	0.80%	0	0.00%	13	0.30%	4	0.10%	6	0.10%	57	1.40%
Core, late	68	1.70%	0	0.00%	7	0.20%	1	0.00%	0	0.00%	76	1.80%
Pressure, early	788	19.10%	9	0.20%	3	0.00%	0	0.00%	1	0.00%	801	19.40%
Pressure, late*	1270	30.80%	18	0.40%	1	0.00%	0	0.00%	0	0.00%	1289	31.30%
Blades	4	0.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	4	0.10%
Burin Spalls	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.00%
Total	3998	97.10%	34	0.80%	58	1.40%	10	0.20%	19	0.50%	4119	100%

* Includes notching flakes
** Includes rhyolite

flakes are the two most common flake types. With that said, only six technologically diagnostic volcanic flakes were found in the North Area compared with 52 from the South Area, indicating that sample size is likely largely responsible for the apparent differences in volcanic material reduction strategies between the two areas.

Within this assemblage, three different reduction strategies can be identified based on raw material type. Use of obsidian was nearly exclusively reserved for later stage reduction, particularly pressure flaking, likely representing maintenance or resharpening of completed tools transported to the site. Use of CCS was heavily weighted towards later stage reduction but includes a significant proportion of biface thinning flakes which suggests this material was transported to the site as early stage bifaces or

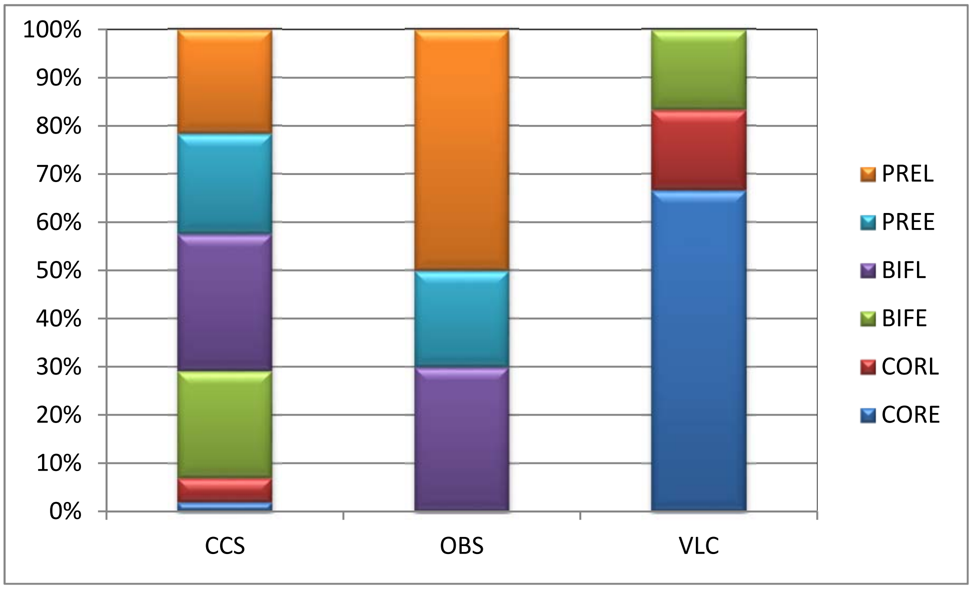


Figure 30. Technological flake type distributions by raw material for the North Area.

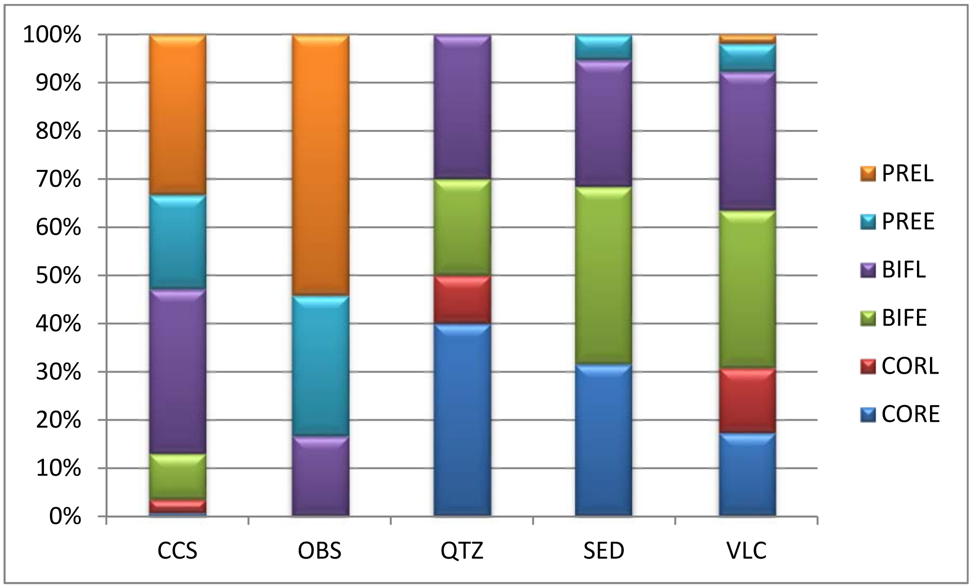


Figure 31. Technological flake type distributions by raw material for the South area.

blanks that were further reduced into finished tools onsite. The use of the various other materials including the volcanics, quartzite, and sedimentary rock types included early stage reduction in the form of core reduction flakes indicating that, unlike other raw materials, cores of these materials were reduced on site and made into tools, but were rarely subjected to finer levels of finishing represented by pressure flaking. This pattern is consistent with expectations for the exploitation of locally available raw materials (Andrefsky 1994).

Cortex and Thermal Alteration

Debitage recovered from evaluative testing and data recovery phases were analyzed for the presence of cortex (Table 9). Of the 11,817 pieces analyzed, only 3 percent (n=393) retain cortical surfaces. Each type of toolstone was represented among those flakes exhibiting cortical surfaces. A

Table 9. Cortical Types from all Debitage

Cortical Type	Platform-bearing Debitage	Non-Platform-bearing Debitage	Total
Incipient Cone	65	98	163 (41%)
Primary Geologic	72	147	219 (56%)
Weathered	11	0	11 (3%)
Total	148 (38%)	245 (62%)	393 (100%)

majority of the total (n=219, 56%) feature primary geologic cortices, followed closely by incipient cone cortices (n=161, 41%) and distantly by those materials with weathered cortical surfaces (n=11, 3%), and of indeterminate origin (n=2, 0%). Of the 393 pieces of debitage with cortex, CCS is underrepresented (n=241, 61%) and basalt is overrepresented (n=83, 21%) in relation to their overall percentage of the assemblage. Of the basalt with cortex, it is almost evenly split between primary geologic (n=42) and incipient cone (n=41). Of the CCS with cortex, the majority has primary geologic cortex (n=151, 63%), with the rest incipient cone (n=82, 34%) and weathered (n=8, 3%). These data, together with information from the technologically diagnostic debitage, indicate that decortication of raw material was not a principal activity at site 35TI90.

The technologically diagnostic debitage (n=4,119) was also analyzed for evidence of heat alteration, including differential luster, and heat damage which can cause crazing and potlidding. Over 80 percent of the CCS flakes exhibit some form of heat alteration, although none was observed on other material types. Differential luster is the dominant characteristic and is present on at least 3,303 (81%) of flakes belonging to this material class. Potlidding or crazing, which can be indicative of exposure to uncontrolled heat, is also fairly common (n=1,051, 26%).

Lithic Tools

Counting the two found during the initial survey, 371 stone tools were analyzed for this report. The tools constitute a diverse and complex assemblage and include 23 different descriptive classes (Table 10). Ten (n=10) of the tools were assigned to multiple descriptive classes as morphological and functional classes commonly cross-cut each other. For example, one drill may be a utilized flake, while another may be a biface or formed flake tool. Attributes for all tools are provided in Appendix B.

The majority of the tools are made of CCS (n=296, 80%), followed distantly by volcanics such as basalt, ignimbrite, andesite, and rhyolite (n=38, 10%); other (n=22, 6%); quartzite (n=7, 2%); obsidian (n=6, <2%); and sedimentary material (n=2, 1%) (Table 10).

Abraders and Abraded Stone Objects (ABR and ASO)

Five abraders and six abraded stone objects were identified. A selection of these items is depicted in Figure 32. Nine are fine-grained volcanic materials and two are of unidentifiable materials. The toolstones used for these tool types can be broadly described as ovoid, elongated, subrounded, tabular and discoidal pebbles and cobbles of soft, porphyritic pumice-like materials. Nine of the 11 objects retained incipient cone cortex. Most of the abraders exhibit striations or grooves on multiple faces and edges; two have battering due to secondary functions as hammerstones. The abraded stone objects are mainly of uncertain function but showed marked and regular abrasions. One is an edge-ground circular pebble with pecking in the center of one face and appears to represent a net weight blank (Artifact 394) (Figure 33). Another (Artifact 996) is a small rectangular stone used as an abrader. It also features battering on one edge from use as a hammerstone. Artifact 731 exhibits shallow grooves and striations on two faces and also battering wear from use as a hammerstone. Artifact 1278 was scored in a rectilinear pattern with crosshatches. The overlapping geometric v-shaped grooves extend over the edges.

Table 10. Tools Recovered from Site 35TI90 by Descriptive Class and Raw Material

Descriptive Class*	CCS	Volcanic	OTH	QTZ	OBS	SED	Total	Percent Total
Abrader		5					5	0.01
Abraded Stone Object		4	2				6	0.02
Battered Cobble		5	4			1	10	0.03
Biface	57	1			1		59	0.16
Bifacially Retouched Flake	6						6	0.02
Core	56	2					58	0.16
Edge Battered Pebble		1					1	0.00
Edge Ground Cobble				1			1	0.00
Flaked Cobble		4	1				5	0.01
Flaked Cobble Spall		2					2	0.01
Formed Flake Tool	64			1	1		66	0.18
Flaked Pebble		1					1	0.00
Flaked Tool Fragment	17						17	0.05
Incised Stone Object		1				1	2	0.01
Manuport	1	5	14	1			21	0.06
Metate		1					1	0.00
Net Weight			1				1	0.00
Oil Lamp		1					1	0.00
pièces esquillées	1						1	0.00
Pestle		1					1	0.00
Projectile Point	20			1	3		24	0.06
Stone Disk		2					2	0.01
Unifacially Retouched Flake	15	1					16	0.04
Utilized Flake	59	2		3	1		65	0.18
Total	296	39	22	7	6	2	372	1.00
Percent Total	0.80	0.11	0.06	0.02	0.02	0.01	1.00	

*Tools with multiple functions are shown tabulated by primary use.

Figure 32. Select abraders recovered from site 35TI90. Top row (l to r): Artifacts 331, 551, 724, 593, and 731. Bottom row (l to r): Artifacts 379, 996, 901, 394, 395, and 1278.

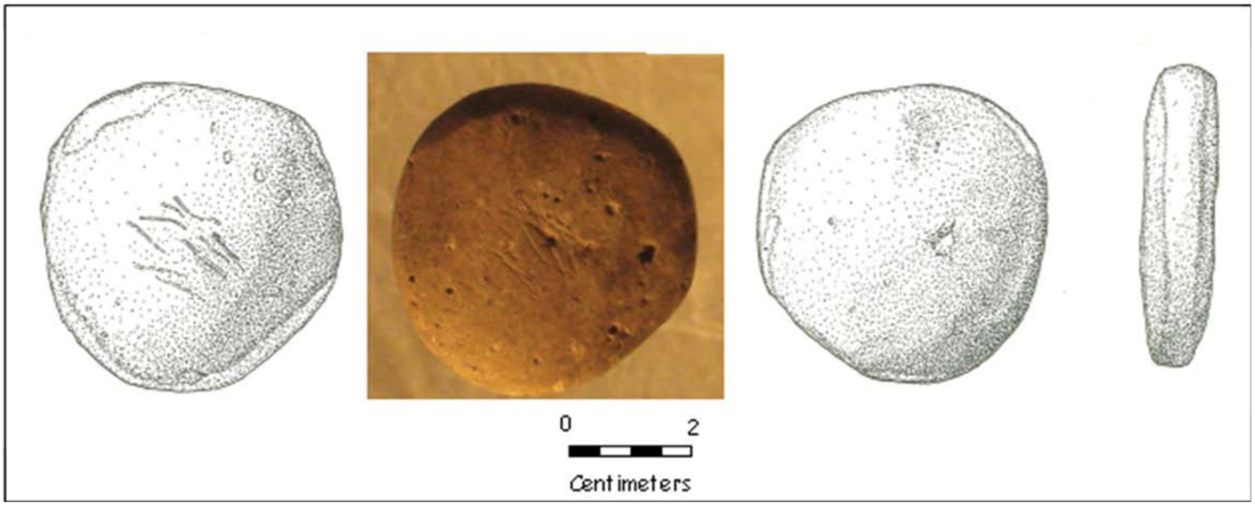


Figure 33. The net weight blank, artifact 394.

Battered Cobbles (BCOB)

Ten artifacts exhibit battering usewear with no other type of modification and two others exhibit battering usewear but which appear secondary to the tools' primary function. Battered cobbles were most typically of volcanic material (n=7) and other fine-grained unidentifiable materials (n=4). One is of a sedimentary rock type. All items showing battering usewear retain incipient cone cortex. Select battered cobbles are depicted in Figure 34.

Of the items with battering usewear only, nine were used as hammerstones and one as a wedge. Hammerstones are elongated or ovoid in shape. Three hammerstones are battered on one end or edge, four exhibit usewear on two ends, and two feature battering scars on various surfaces. Artifact 662 is an edge-ground cobble that secondarily was used for battering. It was ground on two faces and one edge but also exhibits battering scars on both ends and two edges.

Artifact 388 is rectangular. It exhibits polish, rounding, and step and hinge fractures on the working element; wear consistent with use as a wedge.

Bifaces (BIF)

This category includes a variety of tools that exhibit bifacial preparation (Figure 35). About half of the 59 objects in the category (n=29, 49%) are fragments from bifacial objects the original form of which cannot be determined or can only be surmised. Other morphological tool types included in this category include drills, pièces esquillées, scrapers, blanks, wedges, knives, burins, and a chopper. All but two are of CCS; the exceptions are obsidian and volcanic (rhyolite).

Most of the bifacial scrapers (n=20) are notably robust. Many of the larger scrapers include heavy usewear characterized by polishing, crushing, and multiple step and hinge fractures; damage that is consistent with working hard materials such as bone or dry wood. A few have multiple working elements. Many appear to have been discarded due to use-related damage. Differential luster is present on 15 of them, suggesting most were heat-treated. Four of the scrapers were rejuvenated. One (Artifact 884) was recycled into a burin using a specialized reduction technique employing a straight downward blow to the biface while it was supported on an anvil stone. Artifact 1241 is especially robust and was probably used as a planescraper. Stacked step fractures are present on the working element. The specimen is domed and was circumscribed with unidirectional percussion flakes. It was rejected or discarded due to a longitudinal compression fracture. One small specimen, Artifact 775, is spatulate

Figure 34. Select battered cobbles recovered from site 35TI90. Top row (l to r): Artifacts 1280, 1249, 1139, and 1173. Bottom row (l to r): Artifacts 388, 391, 1191, 1175, and 1223.

Figure 35. Select bifaces recovered from site 35TI90. Top row (l to r): Artifacts 386, 387, 759, 438, 504, and 306. Bottom row (l to r): Artifacts 642, 286, 762, 552, and 126.

shaped and has a hafting element. Another heavy scraper, Artifact 642, was intentionally crushed and blunted above one edge. The opposite working element exhibits usewear from moderate to hard materials. Artifact 697 is a very heavy, blocky, steep-faced scraper that features usewear such as crushing and step fractures consistent with a secondary use as a chopper. Artifact 616 was pressure flaked on three surfaces. It is willow-leaf in overall shape and tapers laterally. It was used as a sidescraper on soft materials.

Two artifacts (numbered 434 and 469) were classified as pièces esquillées. Each exhibits evidence for proximal battering and distal usewear which is consistent with use as a wedge on wood or bone. Another tool, Artifact 762, may have been used secondarily as a pièce esquillée.

Three bifaces functioned as drills (Figure 36). One of the drills (Artifact 921) was manufactured from a medial edge fragment of a biface of indeterminate original function. It exhibits heavy usewear on the bit (Artifact 921). The other two were nearly complete and made from flake blanks. One is trihedral in morphology.

Three of the bifaces are blanks, or Stage 3 bifaces. They are fragmentary. Each is plano-convex in cross section and were reduced with only percussion flaking.

Five knives were identified, including three backed knives (Artifacts 306, 438, and 504) that were made on thick, side-struck flakes (Figures 37 and 38). The knives were backed along the thick edge, which may have served as a handle. Usewear on each is located along the distal third of the thin edge opposite the backed edge. A complete lanceolate shaped knife (Artifact 387) was identified. Made from a late-stage decortication flake, it was utilized laterally and distally, and was reworked. The knife also exhibits multiple step fractures as well as heat damage in the form of differential luster and potlids. Artifact 1221 is a nearly complete knife or spear point, missing the distal tip. It was made on a heat treated flake bank with primary geologic cortex on both remnant ventral and dorsal surfaces. The blade is large and triangular. It appears to have been used as a spear or as a knife but lacks definitive usewear.

Twenty-nine bifaces are small fragments of indeterminate function. They include one probable projectile point tip, six possible projectile point or drill bases, and four possible knives or point fragments. Another is blocky and appears to have been shaped for hafting but retains no definitive usewear. The others cannot be assigned to a probable functional category. Five of the fragments are from objects made on flake blanks and 19 exhibit evidence of heat treatment or heat damage including differential luster, crazing or potlids. Four retain primary geologic cortex, one had incipient cone cortex, and two had indeterminate weathered surfaces.

Bifacially Retouched Flakes (BRTs)

Six CCS bifacially retouched flakes were found, half of which are complete or nearly complete and half of which are fragmentary. These tools retain a basic flake-blank form but feature patterned bifacial retouch on at least one margin. The tools were manufactured from a late-stage biface thinning flake, an early-stage biface thinning flake, a late-stage decortication flake and three indeterminate percussion flakes. Five were used as side or end scrapers, and one is too fragmentary to determine function. Usewear ranges from light to moderate. All exhibit differential luster; one also is potlidded and has crazing. One has incipient cone cortex and one has primary geologic cortex.

Cores and Core Fragments (COR and CORF)

Fifty-eight cores and core fragments were recovered, which constitutes nearly 16% of the tool assemblage. Nearly all of the cores (97%) are CCS, 35 of which exhibit heat alteration in the form of differential luster, potlidding, or crazing. Two other cores are basalt. Most are complete or nearly complete.

Figure 36. Select drills recovered from site 35TI90. Top row (l to r): Artifacts 446, 704, and 855. Bottom row (l to r): Artifacts 932, 921, and 890.

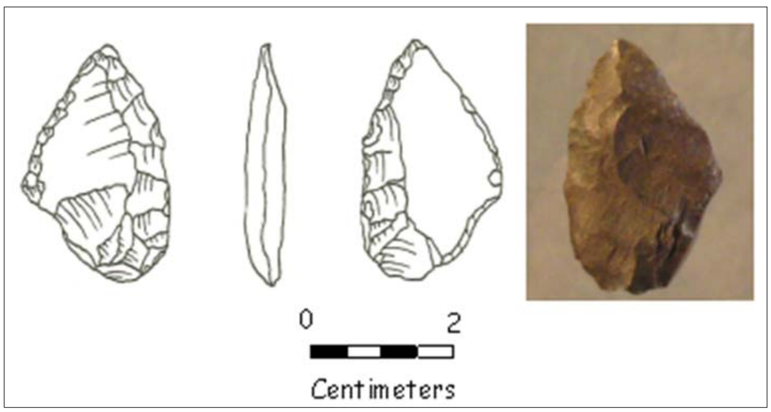


Figure 37. Backed knife, artifact 306.

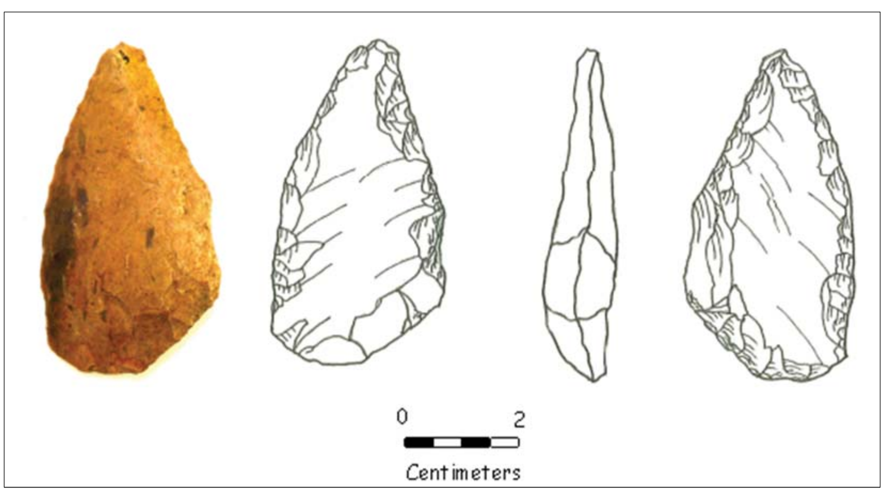


Figure 38. Backed knife, artifact 504.

Multiple types of cores are represented including bidirectional, unidirectional, bipolar, polyhedral, single platform, and tabular types. Three are only assayed and constitute raw material tests. Artifact 1320 exhibits burination in addition to typical flake scars indicating that the core was used to produce burin spalls as well as standard flake blanks. Most cores, however, are generalized and non-standardized. Several cores were used for alternate purposes and exhibit cutting or other functional edges. Four cores were used expediently as scrapers and one as a graver. Thirty-five cores (60%) retain cortical surfaces, including 22 primary geologic, nine incipient cone, and four that are weathered and of indeterminate origin.

Edge Battered Pebble (EBP) and Edge Ground Cobble (EGC)

Two edge-battered pebbles and two edge-ground cobbles were identified in the assemblage. In the first group is Artifact 391. It is of medium-grained volcanic material and exhibits slight usewear that includes crushing and a transverse crack related to its use for pounding. It is ovoid in shape and retains incipient cone cortex. Artifact 996 is classed as an EBP secondary to its principal class as an abraded stone object (see above, Figure 32). It showed minimal use as a hammerstone.

The edge-ground cobbles include Artifact 662 that was classified as a battered cobble (see above). Artifact 459 is a quartzite edge fragment with very slight evidence of grinding on the portion of the face remaining.

Flaked Cobbles, Flaked Cobble Spalls, and Flaked Pebbles (FC, FCS, and FP)

Tools in these three categories number eight. They include five flaked cobbles, two flaked cobble spalls, and one flaked pebble. All are complete and of various materials including basalt, fine-to medium-grained volcanic materials such as ignimbrite, and an unidentified fine-grained material. All retain incipient cone cortex except for one that has a weathered surface of indeterminate origin. Select flaked cobbles are depicted in Figure 39.

One of the cobble spalls, Artifact 851, was probably used as a scraper, but breakage has made a functional determination tentative. Minimal rounding is present on one edge. It was pressure flaked along its circumference, mainly unifacially, and is plano-convex in cross section. The other cobble spall was too damaged by heat to determine its possible use. It was partially circumscribed with percussion flaking.

Of the five flaked cobbles, two were used as scrapers, one as a chopper, one as a possible hammerstone, and one is of indeterminate function. Usewear on the possible hammerstone includes moderate battering along a single edge. It exhibits bifacial percussion flaking. The other flaked cobbles were modified unifacially or mostly unifacially. Artifact 609 is a subrounded alluvial cobble that has had one end flaked into a point. It most resembles Borden's (1968) "Ic symmetrically converging edges" type. This tool was used in a chopping action and shows evidence of rejuvenation. Artifact 1113 is consistent with Borden's "Id: asymmetrically converging edges" type. The working edge forms a 90-degree angle and was used as a scraper. Artifact 1082 was also used as a scraper. It was an elongated cobble modified with a single large detachment, creating a straight working element. Artifact 381 was made from a tabular alluvial cobble and exhibits partially circumscribed flaking yielding a nearly square outline. Slight pecking or crushing on the center of one face is associated with shallow striations. The tool appears to possess a dark, greasy patina. The function of this tool is unknown.

The flaked basalt pebble (Artifact 391) is complete and falls within Borden's (1968) "Ib: straight edge" type. This tool was used as a scraper and as an anvil. It exhibits bifacial and unilateral usewear. Anvil usewear consists of crushing and striations in the center of one face. Multiple striations on the surface and edge overlap.

Figure 39. Select flaked cobbles recovered from site 35TI90. Left to right: Artifacts 1082, 381, 1248, and 609.

Formed Flake Tools (FFTs)

Formed flake tools (FFTs) comprise the largest tool class (n=66, 18%). It includes a wide variety of small hand tools based on decortication and early stage biface thinning flakes. Morphologically, implements in this class can be classified as scrapers, burins, drills, gravers, spokeshaves, perforators, and a blank. Seven of the tools were used primarily as scrapers but had secondary functions. Sixty-four of the FFTs are CCS; the exceptions are quartzite and obsidian. Twenty-two (37%) retain cortical surfaces, with incipient cone and bedrock cortices being nearly equally represented. Fifty (78%) have been heat-treated or heat damaged.

Most FFTs functioned as scrapers (n=51, 77%) (Figure 40). They exhibit modification to an end or a side, or both. Six of the scrapers were reworked to create a burin bit or to rejuvenate an edge. Two scrapers appear to have been hafted, as was one FFT of indeterminate function. A few were backed to facilitate handling. Based on usewear, scrapers were used on both soft to moderate materials such as hides and wet wood as well as hard materials such as bone and dry wood. A few are steep-faced and were used to process hard materials. Artifact 756 is a very large hafted scraper with usewear consistent with working moderate to hard materials such as wood. It exhibits evidence of reshaping and was made from an early stage decortication flake with primary geologic cortex. The working element is unifacial and excurvate. Artifact 380 is a complete endscraper that was made on a heat-treated CCS early-stage biface-thinning flake using unifacial percussion and pressure flaking (Figure 41). The working element is convex and exhibits minimal usewear. Artifact 624 is very similar but was utilized along its edge as well as the distal end. Modification was mostly unifacial and employed percussion and pressure flaking along the circumference (Figure 42). The flake retains remnant ventral surface from the flake blank.

The seven scrapers with additional functions were also used for engraving, shaving, and perforating. Artifact 743 may have been used as a spokeshave. One corner is incurvate and exhibits slight usewear and polish. The opposite working edge is highly varied and indicates multiple uses as a scraper; the edge is excurvate, straight, pointed, notched, straight, and then pointed again. The tool was

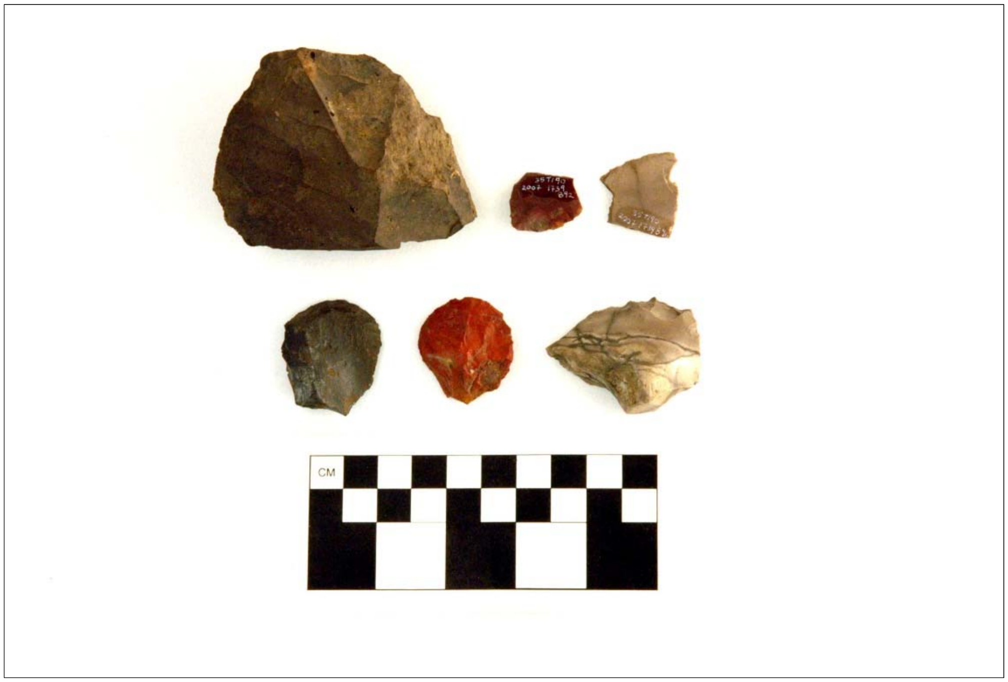


Figure 40. Select scrapers recovered from site 35TI90. Top row (l to r): Artifacts 697, 892, and 896. Bottom row (l to r): Artifacts 139, 380, and 267.

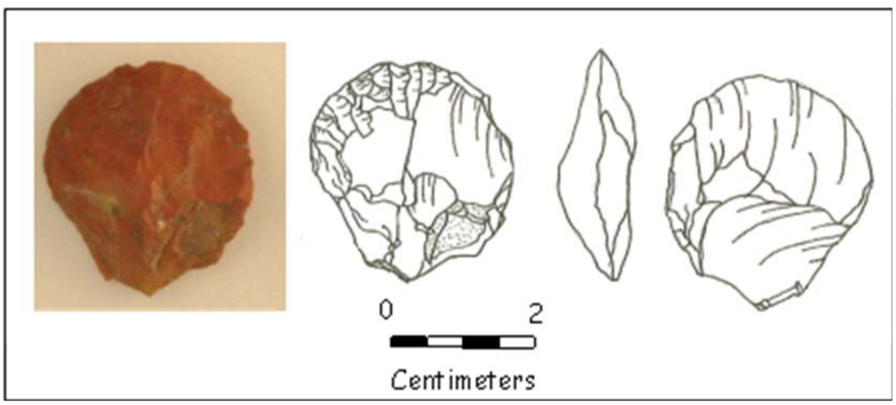


Figure 41. Endscraper, artifact 380.

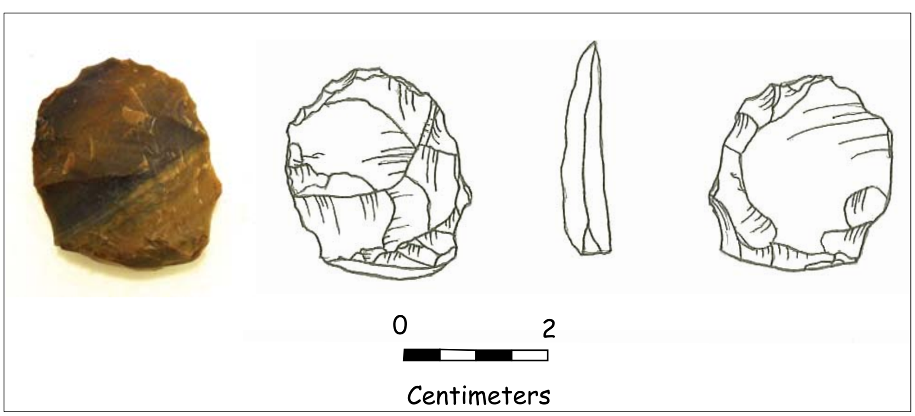


Figure 42. Scraper, artifact 624.

formed from an early stage biface thinning flake using pressure and percussion flaking in a unifacially alternating pattern. Artifact 783, a scraper and graver tool, is similar in that the working edge is variable and both percussion and pressure flaking were used. Artifact 838 is also a scraper and graver tool but is made of obsidian and exhibits only pressure flaking. The blank was an early stage core reduction flake that retains incipient cone cortex.

Two other FFTs were drills, three were gravers, two were perforators, one was a blank, and one was a spokeshave. One of the perforators is quartzite and all other of the aforementioned are CCS. The quartzite perforator (Artifact 839) exhibits usewear that indicates it was used to puncture soft to moderately hard materials, such as hides. The other perforator, Artifact 1285, is triangular and was made with bidirectional percussion and pressure flaking. It was used secondarily as a scraper. Artifact 1062 is a burin that was used for piercing. The flake blank was bilaterally burinated to a point. One of the drills exhibited usewear including rounding and polish. It was shaped using multidirectional flaking, while the other drill was shaped using bilateral pressure and bipolar flaking. It was made on a late-stage bipolar flake and rejected due to a compression fracture at the drill bit. The three tools with the primary function of graver were made with three different methods. Artifact 728 is a burinated decortication flake with usewear on the distal end of the negative burin flake scar. Artifact 916 was made using bifacial percussion flaking on an early-stage biface-thinning flake. The final graver, Artifact 934, also was made on an early-stage biface-thinning flake. It was shaped unifacially using alternating percussion and pressure flaking along the edge and the end creating straight and pointed working elements. The straight edge was used secondarily for scraping. Artifact 1294 appears to be a blank. It is a late-stage core reduction flake that was backed along the edge and the end with partially circumscribed percussion flaking. The tool exhibits no discernible usewear. The spokeshave, Artifact 85, was made on a late-stage biface thinning flake, using unifacial percussion and pressure flaking along one edge to form a very small notch.

Five FFTs are of indeterminate function. Four are incomplete and one is complete. The complete tool, Artifact 1228, is trihedral in shape and was created using multidirectional percussion flaking on two faces of a decortication flake. The working element appears to be the point but no usewear is evident. The others range in shape from rectangular, plan-convex, and flake-shaped. Artifact 942 is a rectangular tool that appears to be an endscraper with a broken working element. The plano-convex fragment appears to have been laterally blunted for hafting. It may be a base of a tool or possibly a shaver. The end features a pressure-flaked notch with some crushing.

Flaked Tool Fragments (FTF)

Seventeen tool fragments were identified that could not be ascribed to a definitive descriptive class, such as “biface,” due to their fragmentary nature. Most of these fragments consist of a small part of an edge. The methods of manufacture of several FTFs could be determined and most exhibit usewear that permit some speculation as to function. Based on usewear, eight FTFs appear to have been used in tasks that involved scraping, one likely functioned as a drill, and the others are of indeterminate function.

Four FTFs are burin spalls that have been utilized. Artifact 842 represents the second burination to a tool edge. One burin spall was initiated to rejuvenate a tool edge, probably a biface. This artifact represents the burination of that edge, resulting in a burin spall (which preserves the first burin spall) that was subsequently utilized. Artifact 865 is another burin spall from a tool edge. Used as an endscraper and graver, it exhibits usewear from soft to moderately hard materials on both ends. Artifacts 860 and 872 are burin spalls representing rejuvenated scraper edges that had been used on moderately hard to hard materials. They were not further utilized following burination.

Other FTFs are fragments of working edges of tools that have detached during use but do not show subsequent use. Two exhibit usewear indicating hard materials were worked. The distal tip of a drill was recovered (Artifact 890) exhibiting rounding, crushing, hinge fractures, and polish.

Incised Stone Object (ISO)

Two incised stone objects were recovered. Artifact 500 is a nearly complete tabular pebble composed of an alluvial fine-grained volcanic material. It has been scored unifacially. Four parallel v-shaped incisions occur on a flat face and are associated with additional light, perpendicular incisions. Also, many light parallel striations are present on the opposite end. The deepest incisions extend up to 2.1 cm in length before intersecting the broken edge.

The second incised artifact is notably unique. Artifact 1035 is a zoomorphic stone object made from a tabular sedimentary blank, probably shale (Figure 43). The object is 22.7 cm long, 4.9 cm wide at its widest point, and 1.9 cm thick. Magnified, the raw material is very fine-grained and includes clay-sized submicroscopic particles with sparsely dispersed silt-sized quartz crystals. It is flecked with very fine to fine dark purple-gray manganese oxide or hematite grains. Sparse small cavities occur, surrounded by oxidation and presumably once containing the manganese or hematite, which has since reduced. Common fine phenocrysts of purple-gray manganese or hematite minerals are unevenly dispersed, imparting a porphyritic texture; each is surrounded by a light gray ring, some of which exhibit oxidation. Fissures and pitting also exhibit increased oxidation independent of the presence of the oxide-rich minerals.

The blank was shaped by drilling, sawing, incising, pecking, polishing, and abrading into a form that approximates a small club. The handle or proximal end of the club has been modified into a zoomorphic form that resembles a seal or an otter (Figure 43). Because it is more stylistic than naturalistic, identification of the animal cannot be certain. Other than the face and neck, no other body parts are represented on the object. The handle of the object is in the general shape of a knob. Facial features include eyes, which have been drilled and incised lines to represent a mouth and nose. Incising and drilling have also been used to indicate what may be a collar around the neck. It is formed by two parallel lines that are nearly continuous on the left and right sides and on the top of the object. Drilled divots are between the two lines; three divots on each side and one on the top. Three parallel lines are incised proximal to the collar on one side of the body of the item. The lines are not matched on the opposite side. Instead, several shallow incised lines are present in the same relative location.

In all, nine divots were drilled into the surface of the object, including two for the eyes and seven around the neck. Under oblique light, faint equidistant score marks, seemingly unintentional, are visible around both eyes and appear to have been caused by part of the drill contacting the surface. The equidistant spacing of these scratches suggests the same drill was used for both eyes; these marks are not present around any of the other drilled divots, which may be due to the fact that the divots for the eyes are deeper than the others and the drill did not contact the surface during the drilling of the other divots.

The distal end of the object was snapped. Both sides of the tabular blank preserve scoring and sawing scars reflecting the cuts made to facilitate the snapping. Subsequent to that, one side was beveled. The beveled area appears to have been used to abrade soft to moderately hard fine-grained materials, such as wood or bone.

Each of the flat sides of the object has been abraded to achieve a smoothed appearance with most striations being very fine. Striations run in numerous directions though generally along the longest axis of each particular face or facet. One of the flat surfaces exhibits marked polishing. A part of that surface that is 14 cm long and 2.7 cm wide is depressed about 1 mm below the surrounding surface. The surface within the depression is more highly polished than other parts of the object. This surface appears to have been used as a whetstone or possibly a palette.

A spall was detached or exfoliated from the side opposite the depression. It is unclear whether this was the result of percussive pressure from the use of the object as club.

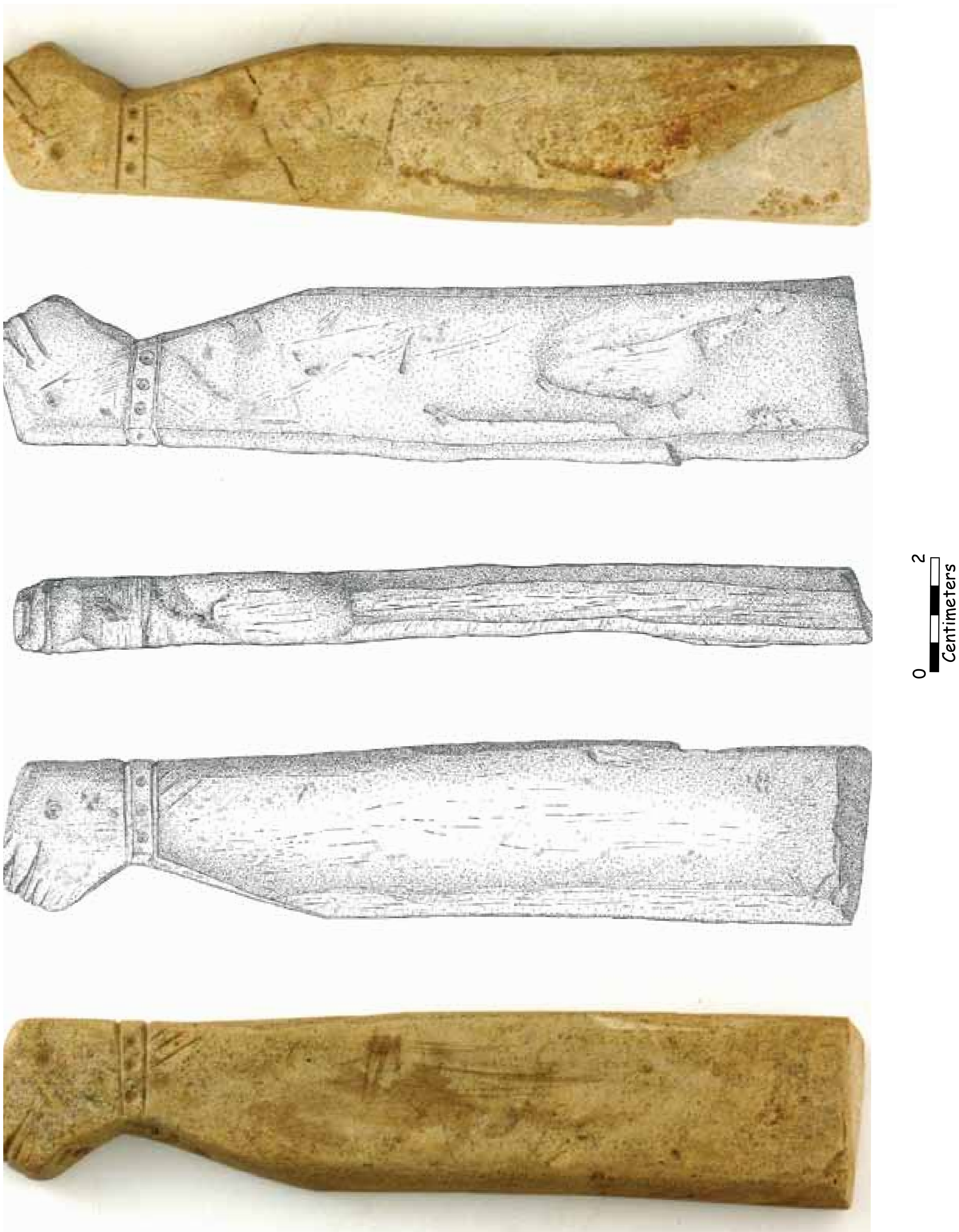


Figure 43. Detail of the zoomorphic-decorated stone object, artifact 1035.

Manuports

Twenty-one objects collected from the site are considered manuports (Figure 44). They are unmodified pebbles and cobbles in various shapes, mainly spherical and discoidal, that suggested that they could be blanks for a number of different types of tools such as net weights or flaked cobbles. Most (n=14) are of various types of fine to medium grained materials of uncertain petrology. Five others are volcanic, one is CCS, and one is quartzite.

Metate

A single complete metate (Artifact 721) was recovered (Figure 45). It is a natural flat, tabular andesitic cobble that has been shaped through bifacial grinding along its margins.

Net Weight

One net weight (Artifact 374) was found on the graded surface of the Staging Area (Figure 46). It is worked in four areas and exhibits polish on one end. It is notched bilaterally and has divots on each face. The notches and divots were formed by pecking and would have provided secure attachment points for the cord.

Oil Lamp

Artifact 1007 is a subrounded volcanic cobble with a natural depression on one face (Figure 47). The depression exhibits a dark stain suggesting the tool was used as an oil lamp. Half the item is present and the transverse break exhibits heat damage including spalls from fire cracking.

Pièces Esquilleés (PE)

Three tools crosscut the morphological class of pièce esquillé though only one (Artifact 898) fell within this category as a descriptive class. Artifact 898 is a nearly complete CCS tool and retains primary geologic cortex. Percussion flaking was used bidirectionally to create the wedge shape. The tool exhibits differential luster, as well as battering on the cortical surface. The working edge exfoliated during use, evidenced by step and hinge fractures. The two others (Artifacts 434 and 469) are probable pièces esquillées and are classed descriptively as bifaces, due to more extensive bifacial flaking and less certain function. They are made of CCS and appear to have been utilized as wedges.

Pestle (PES)

One complete pestle was recovered from the site (Figure 48). It is of basalt that contains CCS amygdules. Morphologically, it is classed as "rimmed, shaped, and cylindrical" after Schneider (1996). The handle is characterized by a constricted neck and a rounded, ovate flange. Usewear related to crushing and polish is evident on the distal end and the handle retains polish. A fracture is evident on one face, initiated at the distal shoulder. A shallow concavity is present over one face; it was ground, probably during manufacture or rejuvenation. Minor post-depositional damage occurs on the distal half. The method of manufacture for the pestle appears to have been pecking then grinding.

Projectile Points (PPT)

Twenty-four definitive projectile points were identified, including the one found during the survey (Figure 49). Most are complete or nearly complete. Twenty (83%) are CCS, three (13%) are obsidian, and one (4%) is quartzite. Of the 20 CCS points, 10 (50%) exhibit differential luster or heat damage. At least 19 (80%) of the points were made from flake blanks, exhibiting remnant platforms,

Figure 44. Selection of manuports.

Figure 45. The metate, artifact 721.

ventral surfaces, or dorsal surfaces. Five show evidence of reworking and three additional ones were resharpened.

A projectile point typology for the northern Oregon Coast has not been developed. In his comparison of the later prehistoric archaeological record of the Lower Columbia River valley, which as defined extends between The Dalles and the mouth of the Columbia River, with adjoining areas, Pettigrew (1981:125) notes the stylistic similarities between artifact assemblages found in the lower river valley and the northern Oregon Coast. Comparison of projectile points from site 35TI90 with those illustrated by Pettigrew (1981) for the Lower Columbia River valley confirms this observation. On that basis, the projectile points from the site were categorized using forms and size measurements into types defined by Pettigrew (1981).

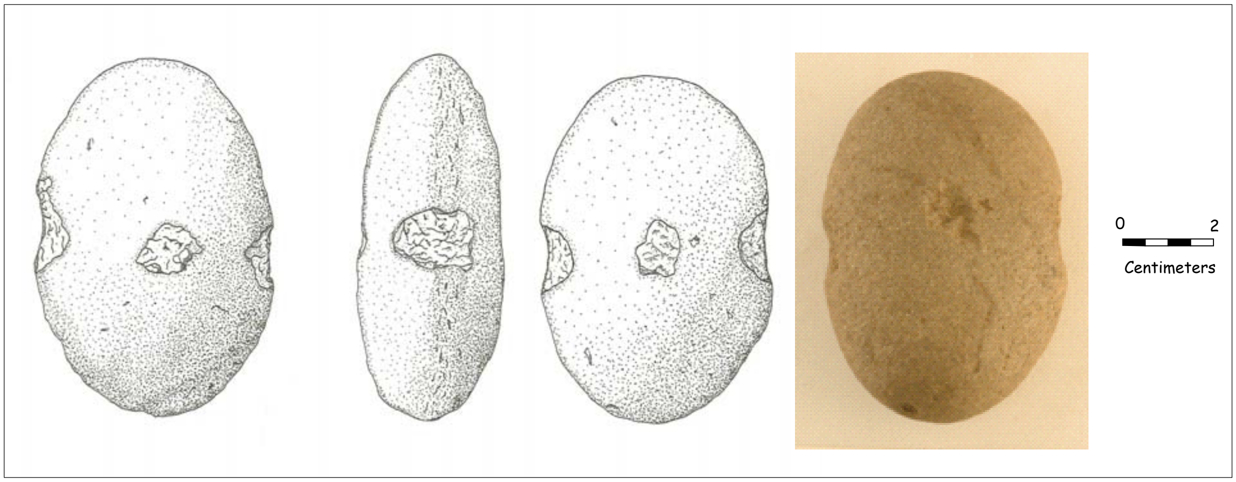


Figure 46. The net weight, artifact 374.

Figure 47. The oil lamp, artifact 1007.

In all, 17 of the 24 projectile points, or 71 percent, could be comfortably classified into Pettigrew's (1981) typology (Table 11). The seven (29%) unclassifiable projectile points include two point tips (Artifacts 547 and 953), four points classified only as dart-sized (Artifacts 309, 473, 689, and 701) (Figures 50 and 51), and one classified as a likely spear, or thrusting, point (Artifact 1221). The spear point is missing its distal end, likely due to impact damage as suggested by a transverse lateral fracture on the distal tip and a hinged basal fracture. There is possible hafting wear on the basal third of the blade margin, with light crushing along the edge and light polish on flake scar projections. No usewear is evident along the blade margins above the haft wear.

The 17 points classifiable to morphological types represented six varieties. With six examples, Type 16 (n=6, 25%) is most common (Figures 52, 53, 54, and 55). Type 16 is unusual due to its unmodified or only slightly retouched base. Known as the "Trojan points," they are unstemmed and markedly less worked than other types (Warner and Warner 1975). Although there is some variation within this assemblage, the Type 16 points all have a long, narrow shape. Such points are said to account for about half of all points found in Tillamook County by collectors (Sauter and Johnson 1974:72). Similar points are thought to have been used to tip fishing spears or fishing harpoons (Lyman et al. 1988).

Figure 48. The pestle, artifact 121.

Figure 49. Select projectile points recovered from site 35TI90. Top row (l to r): Artifacts 777, 853, 452, 515, 660, and 1073. Middle row (l to r): 517, 908, 869, 652, 509, 516, 313, and 1205. Bottom row (l to r): Artifacts 649, 715, 1221, 689, 473, 309, and 701.

Table 11. Projectile Point Frequency at site 35TI90 by Morphological Type (Pettigrew 1981)

Type (Pettigrew 1981)	Description	Count	Percent
5	Broad-necked, shouldered, non-diverging stem	1	4%
6b	Narrow, bipointed, unnotched, unstemmed	2	8%
9	Narrow-necked, barbed, non-diverging stem	2	8%
10	Narrow-necked, shouldered, non-diverging stem	3	13%
14	Triangular blade, unnotched and unstemmed, with a base that is not incurvate	3	13%
16	Unstemmed, unmodified or minimally modified base	6	25%
Dart	Dart sized point, undetermined typology	4	17%
Spear	Spear sized point, undetermined typology	1	4%
Indeterminate	Point tips	2	8%
Total		24	100%

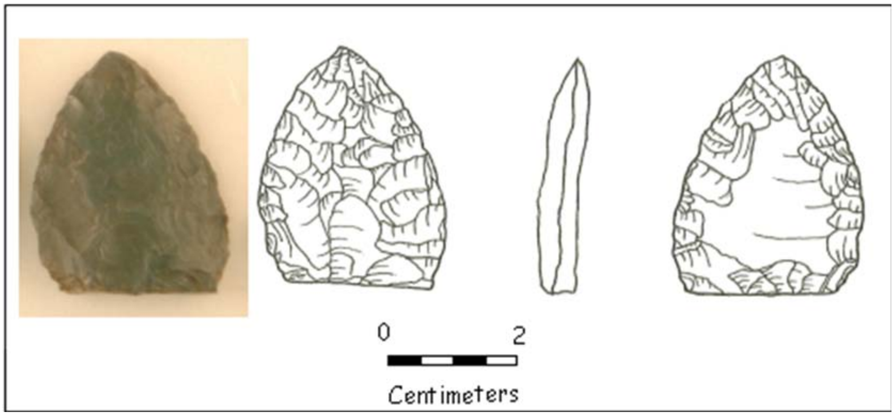


Figure 50. Projectile point, artifact 473.

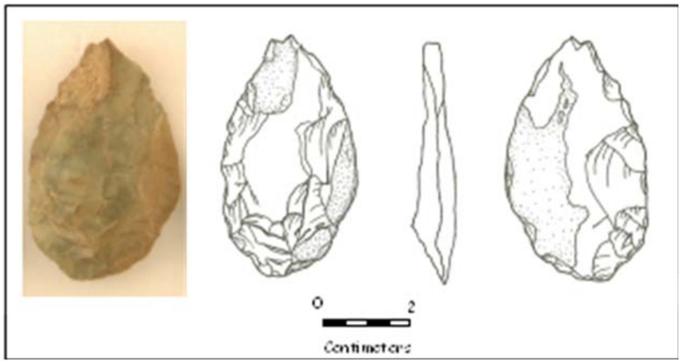


Figure 51. Projectile point, artifact 689.

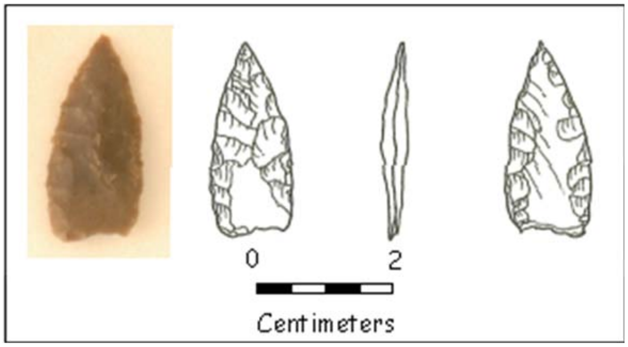


Figure 52. Type 16 projectile point, artifact 452.

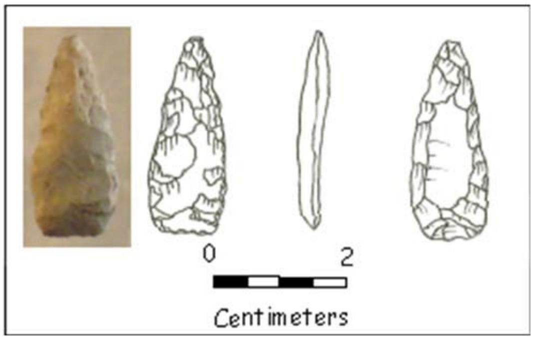


Figure 53. Type 16 projectile point, artifact 777.

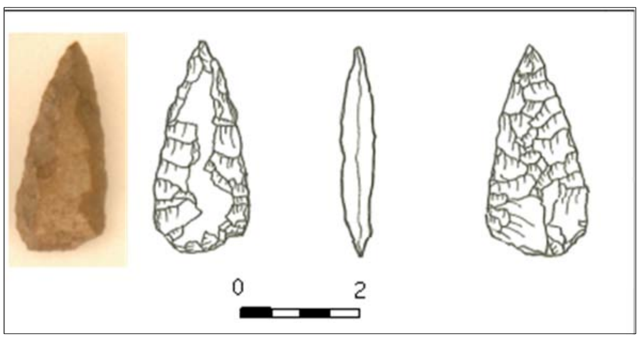


Figure 54. Type 16 projectile point, Artifact 660.

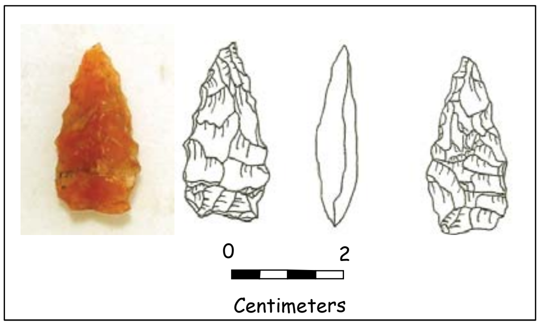


Figure 55. Type 16 projectile point, Projectile point, artifact 515.

Type 14 (n=3; 13%) projectile points are triangular, unnotched, unstemmed, and have a base that is not incurvate (Figure 56). Each point of this type is of CCS. One of the points (Artifact 516, Figure 57) is tentatively assigned to this type due to minor breakage at the base and the possibility that it was stemmed. Artifact 652 was reworked into the Type 14 form and appears to have originally been basally notched and stemmed (Figure 58).

Type 10 points (n=3, 15%) are narrow-necked, shouldered, and have non-diverging stems. The Type 10 points in the assemblage are each CCS. Two, Artifacts 517 (Figure 59) and 908, are complete and the third, Artifact 869, is represented by the point base, which may have been recycled as a graver. The two Type 9 points are similar in overall appearance to Type 10 points but are barbed. One (Artifact 509) is CCS and the other (Artifact 1205) is obsidian.

The Type 6 category includes ovate or bipointed, unnotched and unstemmed projectile points. The 6b type (n=2; 8%) is very narrow and nearly bipointed. Of the two of this subtype in the assemblage one is obsidian and one is CCS. Artifact 649 is an obsidian foliate dart, similar to a Cascade point, with a small remnant platform. It was resharpened at least once before discard (Figure 60). Artifact 715 (Figure 61) is CCS and may have originally been similar in shape to Artifact 649, but has had a complicated use life. It is a fully formed near foliate-shaped object. It retains no original cortex but displays surfaces of different ages. The older surface is highly polished and shiny and displays significant rounding of edges and flake scar ridges. This modification appears most consistent with water wear rather than usewear. The newer surface was created by the removal of the older surface via retouch along the lateral margins. These newer flake scars exhibit a duller less reflective surface and significantly sharper flake scar margins. There is no clear evidence for wear on the object, and its post-retouch function is unclear.

Stone Disks

Two stone disks were identified, both of which are made from a soft, fine-grained vesicular volcanic material, similar to ignimbrite (Figure 62). Artifact 520 is half of a small biconically drilled disk. It is 0.71 cm thick and when complete would have been less than 3 cm in diameter. Artifact 753 is complete (Figure 63). It is 0.89 cm thickness and close to 4 cm in diameter. Its edges might have been slightly modified as suggested by the presence of a small (7 mm) abraded area. Otherwise, besides the perforations, the objects are naturally circular. It is not known how these objects were used. They are of similar size and shape to artifacts Sauter and Johnson (1974:58) refer to as perforated stone net weights. More than sixty such disks were found at the Par-Tee site in the Seaside area. The smaller ones were associated with bone hook barbs, and larger disks were suggested to be used as part of a drilling toolkit (Phebus and Drucker 1979:30).

Unifacially Retouched Flakes (URTs)

Sixteen CCS unifacially retouched flakes were recovered from the site. Most are complete or nearly complete; six are fragmentary. These tools feature patterned unifacial retouch on at least one margin while maintaining the basic flake blank form. The flake blanks on which they were made include early and late stage biface thinning flakes, broken percussion flakes, and one decortication flake. The degree of retouch, the working edge shape, and usewear varies considerably within this class. Eight were retouched using only pressure flaking, three by percussion flaking, and five by a combination of both. The majority exhibit differential luster and two were also potlidded. Thirteen were used as scrapers, with one also used as a graver. Three are indeterminate in function, one of which was unfinished and had no usewear.

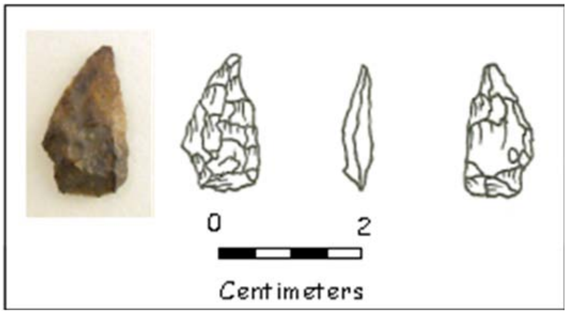


Figure 56. Type 14 projectile point, artifact 313.

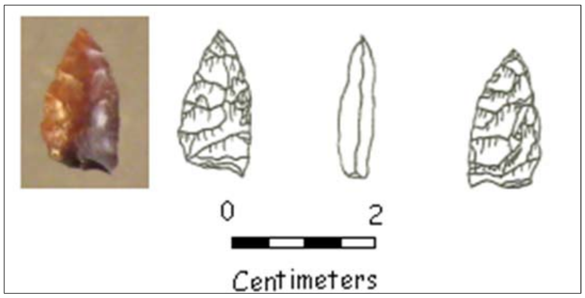


Figure 57. Projectile point, artifact 516.

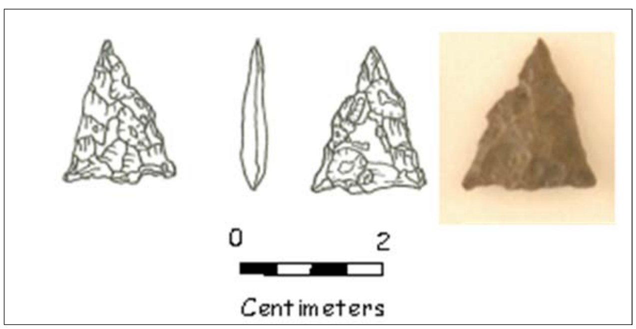


Figure 58. Projectile point, artifact 652.

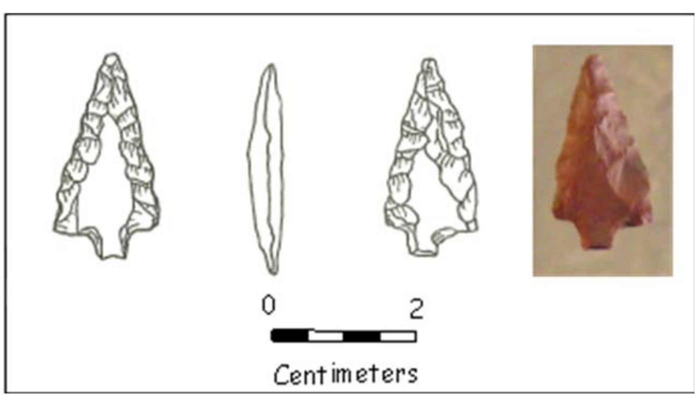


Figure 59. Projectile point, artifact 517.

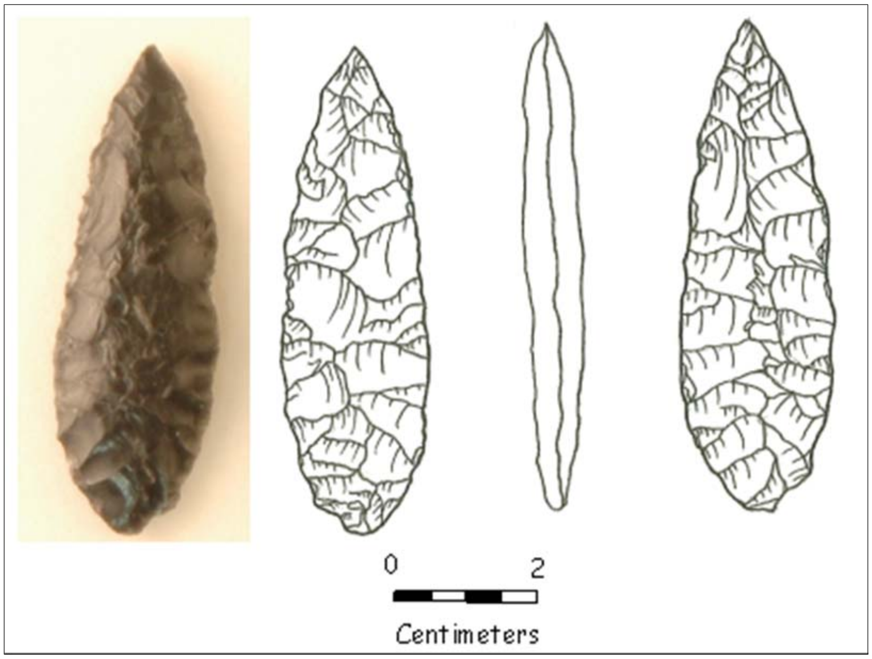


Figure 60. Projectile point, artifact 649.

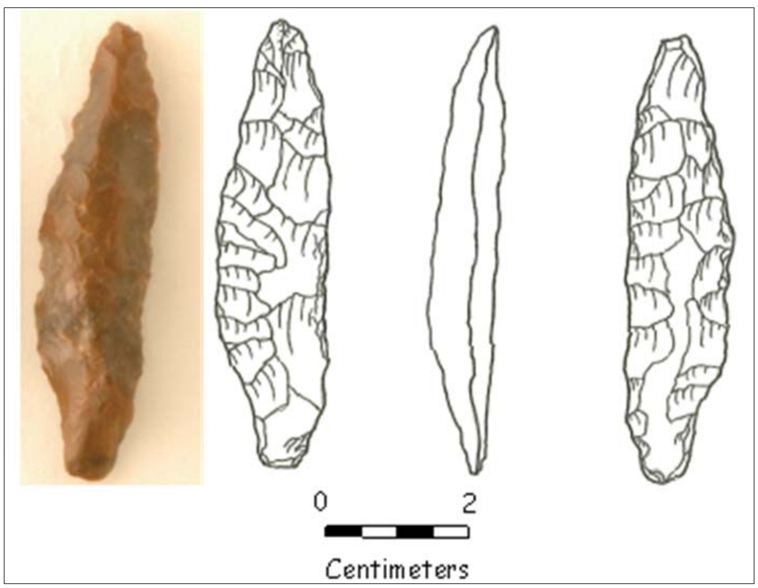


Figure 61. Projectile point, artifact 715.

Figure 62. The two stone disks.

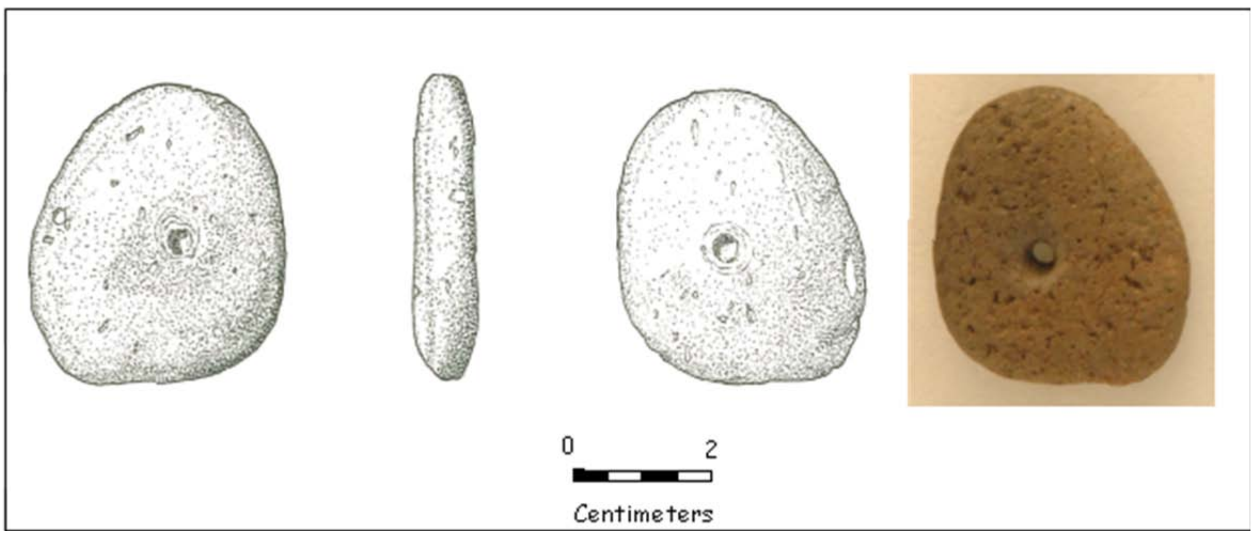


Figure 63. Detail of artifact 753, the complete stone disk.

Utilized Flakes (UTFs)

This category includes expedient tools that were not shaped but exhibit usewear indicating their use as tools. Sixty-four utilized flakes were found. Most all of them are complete or nearly complete and most are CCS (n=59, 92%), followed distantly by quartzite (n=2, 3%), volcanic (n=2, 3%), and obsidian (n=1, 2%). Flake types used as tools include early and late stage biface thinning flakes, early and late stage decortication flakes, nondiagnostic percussion flakes, and a blade. Fourteen (22%) retain cortical surfaces, including four with incipient cone cortices, seven with primary geologic cortices, and three with weathered cortices of uncertain origin. Thirty-eight (79%) of the CCS flakes exhibit evidence of heat alteration and several of these have potlids or crazing.

All of the UTFs functioned as scrapers, with six used for additional functions including drilling, cutting, and engraving. Artifact 849 exhibits usewear indicative of scraping, scoring, and graving and has multiple associated step and hinge fractures. The majority of UTFs were lightly to moderately used, with usewear suggesting materials worked ranged up to moderately hard. Artifact 435 is one of the larger UTFs. This tool is a decortication flake used unifacially along an edge to expediently work moderately hard materials such as bone or dry wood.

Cortex and Evidence for Heat Treatment on Stone Tools

Among the tools, 142 (38%) retain cortical surfaces. Of these incipient cone (n=75, 53%) and primary geologic (n=55, 39%) cortices are both well-represented, followed distantly by weathered cortical surfaces (n=12, 8%) of uncertain origin. Notably, nearly all the specimens with primary geologic cortex are composed of CCS (n=53, 96%), indicating procurement of CCS toolstone from terrestrial rather than fluvial sources. Of the 75 tools exhibiting incipient cone cortex, volcanics (n=29, 39%) comprised the highest number, with CCS (n=25, 33%) and other unidentifiable materials (n=17, 23%) accounting for most of the rest. This observation reflects the fact that tools from volcanic raw materials are based on cobbles or pebbles that feature minimal flaking and thus retained cortical surfaces. This is in contrast to tools made from CCS, such as bifaces, formed flake tools, and utilized flakes, which are flake-based and exhibit no cortex.

Reflecting its overall predominance as the material of choice for tool making, the majority of the tools retaining cortical surfaces are CCS (n=88, 62%), with volcanic (n=32, 23%), and unidentified other (n=18, 13%) accounting for most of the rest, and small numbers of quartzite (n=2), obsidian (n=1), and sedimentary (n=1). Proportional to their representation in the tool assemblage, volcanic raw materials (84%) and unidentified other (82%) are the most likely to retain cortex, whereas sedimentary (50%), CCS (30%), quartzite (29%) and obsidian (17%) are all less likely to retain cortex.

Prehistorically, toolstone with high silica content (except obsidian), such as CCS, was commonly subjected to intentional heat treatment in order to improve the flaking quality of the material. Heat treatment was usually applied to unmodified pieces or minimally modified flake blanks, though cores, preforms, and tools were also heat-treated. In total, 73 percent (n=216) of the CCS tools exhibit changes related to heat such as color change, increased luster, and glossy texture. Forty-nine (17%) of the total CCS tools show thermal damage in the form of potlids, crazing, and crenated fractures, attributes which introduce flaws into the material and so are considered to be undesirable results of thermal exposure.

<u>Bone tools</u>

Eight fragments from bone tools were recovered (Table 12). All are small, measuring between 7 and 12 mm in length with diameters measuring between 2 and 7 mm. All were made from mammal bone but due to the small size of the fragments and the lack of distinguishing characteristics none could be identified to genus or species. Robustness of bone wall can be used to infer that three of the fragments were from medium to large mammals. Two of the eight fragments could be identified as having been shaped from long bones. The bones used to produce the others could not be identified. Select bone tools are illustrated in Figure 64.

Most of the fragments were from tools shaped by abrading; fewer by carving and whittling. Five of the specimens are conical in shape and represent tips to some variety of objects (barbs, points, needles, awls, gorge, and pins, among others). The three remaining specimens include two small rectangular fragments with ground and polished tips and a fragment with polishing along one lateral edge.

In addition to the eight recognizable tool fragments, a single beaver or porcupine incisor tooth fragment was identified. In the Pacific Northwest beaver incisors were widely used as chisels for woodworking, as gambling dice, or other activities (Lyman and Zehr 2003, Stewart 1996). However, the specimen from site 35TI90 was too deteriorated to identify usewear or modification.

Table 12. Bone tools from site 35TI90

Catalog No.	Unit	Level	Taxa	Element	Portion	Work	Size (mm)	Notes
1029	EU 6	8	mammal (medium-large)	longbone	shaft	ground	25 x 5	Rectangular fragment with ground/polished tip
1034	EU 17	4	mammal	unidentified	unidentified	ground	7 x 2	Small ground point tip, conical
1033	EU 16	6	mammal	unidentified	unidentified	ground	15 x 4	Ground point tip, conical
1031	EU 15	5	mammal	unidentified	unidentified	ground	19 x 5	Flat rectangular fragment with ground/polished ed
1032	EU 15	6	mammal	longbone	unidentified	ground	16 x 8	Longbone w/ polished tapering edge
1030	EU 14	8	mammal (medium-large)	unidentified	unidentified	ground	12 x 7	Ground & polished point tip, conical
335	TU 3	2	mammal	unidentified	unidentified	shaped	9 x 4	Tip of point, conical
325	TU 3	1	mammal (medium-large)	unidentified	unidentified	shaped	10 x 6	Tip of point, conical

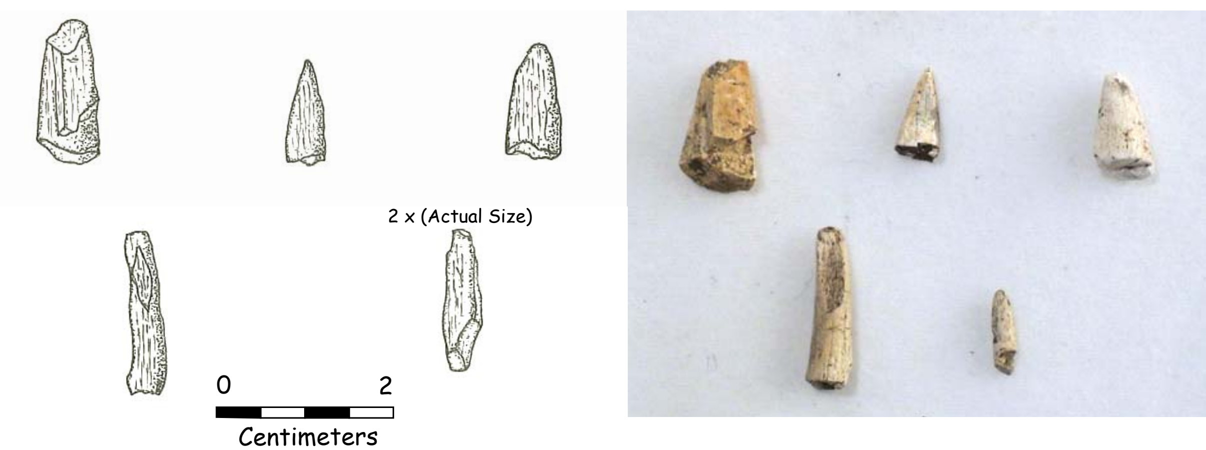


Figure 64. Select bone tools recovered from site 35TI90. Top row (l to r): Artifacts 1030, 335, and 325. Bottom row (l to r): Artifacts 1033 and 1034.

<u>Distribution of Tools</u>

When the distribution of tools is examined by functional type, no substantive differences are noted in tool category frequencies between the North and South areas (Figure 65). In both areas, implements used as scrapers are by far the most common tool types, accounting for approximately 50 percent of the total recovered tools in each. Next most common are cores that account for about 15 percent of recovered tools in each area. Among the more poorly represented tool types some variation is apparent, with the South Area have proportionally more projectile points and gravers and the North Area proportionally more hammerstones and preforms. All other tool types occur in extremely low frequencies. The variation present between these areas is most likely a product of chance related to low frequencies rather than being indicative of behavioral difference.

Artifact Density and Distribution

The quantity of cultural material, and its distribution horizontally and vertically at a site, can reflect patterns of human behavior in the structuring of everyday events, orientation toward a specific

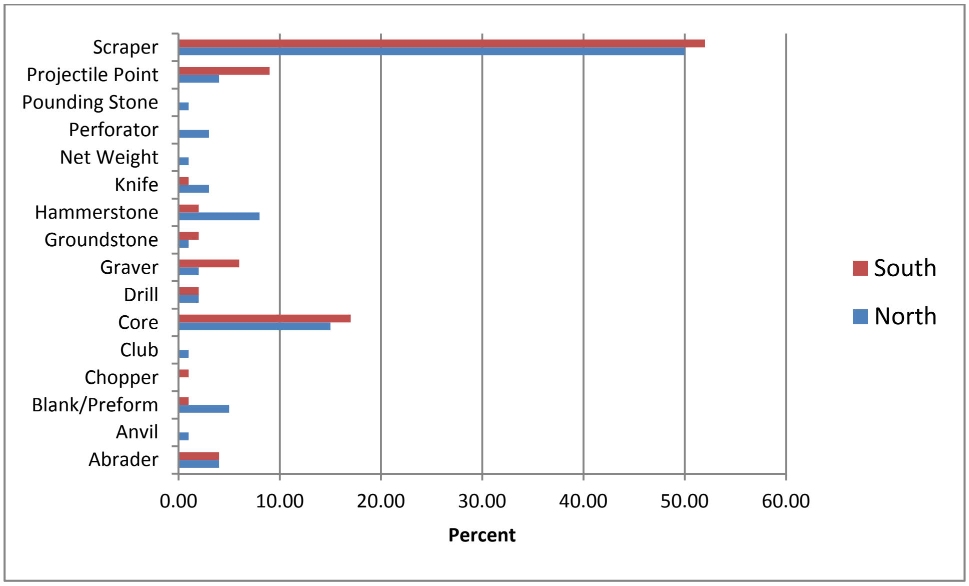


Figure 65. Tool types associated with the North and South excavation areas.

element of the site environment, continuity in occupation, and even refuse management and disposal practices. In this section, the horizontal and vertical distribution of artifacts is examined by site area. For the North Area, the analysis is incomplete because the cultural deposits were truncated during grading. Between 10 and 50 cm of the deposits were removed but the exact amount removed from any one spot could not be determined. As a result, only the coarsest patterns in artifact distribution can be identified. This is not the case for the South Area, where the cultural deposits were largely intact.

North Area

Artifact frequency per unit in the North Area ranged between 0 and 405 and artifact density per unit ranged between 0 artifacts/m³ and 2,025 artifacts/m³ (Table 13). Excluding QTU 2, 13 QTUs were excavated within 20 m of the Trask River bank and nine were excavated between 32 and 64 m from the river. Extrapolated artifact densities for the ones closest to the river were between 120 and 768 artifacts/m3 and the average was 406 artifacts/m3. The range for the ones farther from the river was between 0 and 96 artifacts/m3 and the average was 28/m3. If the amount of sediment removed from individual units in each group average out across the groups, the artifact counts and densities per unit show a clear trend of decreasing artifact frequency with increased distance from the Trask River. If the assumption is valid, the pattern reflects the actual, pre-grading distribution of cultural material in the northern part of the site.

Among North Area units, only QTU 2 contained an intact soil profile. It is the most useful for examining the vertical distribution of artifacts in the northern part of the site. The vertical distribution ofartifacts in other North Area units was analyzed but the distribution curves could not be calibrated to the one from QTU 2 because of uncertainty as to how much of the A horizon had been removed from any particular spot. Excavators' notes and soil profiles drawings were reviewed in an attempt to correlate excavation levels to soil strata but in the small units it was difficult to discern the difference between the black-silt-loam A horizon from the very-dark-brown silt loam B1 horizon. In the end, there was no definitive technique for determining with precision how much A horizon was missing from each unit and the analysis of the vertical artifact distribution in the North Area is based solely on QTU 2.

QTU 2 was excavated outside of the staging area within about 8 m of the riverbank. Plotted by 10-cm excavation levels, the vertical distribution of artifacts in the unit is bimodal. The first

Table 13. Artifact Recovery and Extrapolated Density for North Area Units

Distance to River	Unit	Cultural Deposits		Artifact Frequency		Extrapolated Density (Lithic Artifacts/m^3)
		Depth (cmbs)	Volume (m^3)	Debitage	Tools	
> 20 m	QTU1	70	0.175	4	-	23
> 20 m	QTU3	40	0.1	2	-	20
> 20 m	QTU4	40	0.1	2	-	20
> 20 m	QTU5	40	0.1	3	1	40
> 20 m	QTU6	40	0.1	2	-	20
> 20 m	QTU9	50	0.125	3	-	24
> 20 m	QTU17	30	0.075	-	-	-
> 20 m	QTU20	50	0.125	1	-	8
> 20 m	TU1/QTU8	60	0.6	253	10	438
< 20 m	QTU2	80	0.2	395	10	2025
< 20 m	QTU10	80	0.2	96	4	500
< 20 m	QTU12	80	0.2	22	2	120
< 20 m	QTU14	80	0.2	104	4	540
< 20 m	QTU25	80	0.2	92	10	510
< 20 m	QTU26	60	0.15	59	6	433
< 20 m	QTU27	80	0.2	139	17	780
< 20 m	QTU28	70	0.175	50	9	337
< 20 m	QTU29	70	0.175	18	6	137
< 20 m	QTU30	80	0.2	79	6	425
< 20 m	QTU31	80	0.2	49	8	285
< 20 m	QTU32	70	0.175	50	9	337
< 20 m	QTU33	90	0.225	86	9	422
< 20 m	QTU34	50	0.125	53	4	456

concentration in artifacts occurs in level 2 (10-20 cmbs) immediately below a sod zone. It is the weaker of the two modes and is followed by a decline in artifact frequency between 20 and 30 cmbs. The second mode is noted between 30 and 40 cm. After level 4 there is a steady decline in artifact counts per level. Correlating excavation levels to soil strata, the main cultural deposit is contained within the upper part of the horizon and the quantity of cultural material declines in a regular fashion as the B1 horizon is reached.

Artifacts continued to be found in increasingly small numbers in the B1 horizon. The degree of development exhibited by soil horizons in the North Area suggest that the upper terrace was quasi-stable for an extended period of time, almost certainly predating the site. If so, the artifacts in the B1 horizon are not in situ. Instead, it is expected that cultural material accumulated on what essentially is the modern ground surface and became incorporated into the underlying soil body through various cultural and natural site formation processes.

South Area

Artifact distribution in the South Area of the site was highly variable. Overall, artifact frequency per unit ranged between 0 and 1,131, and artifact density per unit ranged between 0-1,740 artifacts/m^3 (Table 14).

To explore the distribution of cultural material the 30 units excavated in the South Area were divided into two groups, one consisting of units located 16 m or farther from the riverbank (n=15), and

Table 14. Artifact Recovery and Extrapolated Density for South Area Units

Distance to River	Unit	Cultural Deposits		Artifact Frequency		Extrapolated Density (Lithic Artifacts/m^3)
		Depth (cmbs)	Volume (m^3)	Debitage	Tools	
> 16 m	QTU7	60	0.15	15	3	120
> 16 m	QTU11	70	0.175	13	-	74
> 16 m	QTU13	70	0.175	5	1	34
> 16 m	QTU15	30	0.075	-	-	-
> 16 m	QTU16	50	0.125	1	-	8
> 16 m	QTU18	90	0.225	53	1	240
> 16 m	QTU19	80	0.2	77	-	385
> 16 m	QTU21	40	0.1	5	-	50
> 16 m	QTU22	60	0.15	46	2	320
> 16 m	EU8	50	0.5	82	2	168
> 16 m	EU9	50	0.5	60	1	122
> 16 m	EU10	80	0.8	105	2	134
> 16 m	EU18	60	0.6	195	4	332
> 16 m	EU19	80	0.8	8	2	13
> 16 m	EU20	80	0.8	1	-	1
< 16 m	QTU23	60	0.15	253	8	1740
< 16 m	QTU24	70	0.175	219	5	1280
< 16 m	QTU35	-	-	-	-	-
< 16 m	TU2	80	0.8	822	15	1046
< 16 m	TU3	70	0.7	942	10	1360
< 16 m	EU11	60	0.6	499	13	853
< 16 m	EU12	70	0.7	497	13	729
< 16 m	EU13	70	0.7	401	6	581
< 16 m	EU15	80	0.8	1111	20	1414
< 16 m	EU17	70	0.7	620	8	897
< 16 m	EU4	60	0.6	916	24	1567
< 16 m	EU5	50	0.5	728	13	1482
< 16 m	EU6	60	0.6	692	17	1182
< 16 m	EU7	80	0.8	816	20	1045
< 16 m	EU14	60	0.6	636	19	1092
< 16 m	EU16	70	0.7	928	19	1353

another of units less than 16 m from the bank (n=15). Counting only excavation levels that contained artifacts, 5.275 m3 of sediment were excavated from the first group of units and 684 lithic artifacts were recovered. For the units comprising the second group, 9.125 m3 of sediments were excavated and 10,290 lithic artifacts were recovered. On average, about 130 artifacts were found per cubic meter among the units more than 16 m from the river bank and on average about 1,128 artifacts were found per cubic meter in the units nearest the river. Although the respective volumes of the two groups are quite different, in each case they are large enough to minimize the effects of sampling and an orientation of site occupation toward the riverbank is clear.

To examine the vertical distribution of artifacts in the South Area, artifact densities were calculated for 10-cm excavation levels that were exclusively composed or midden soil or midden soil and the underlying sand and gravel. The latter levels were excavated to remove the last bit of black sediment at the contact between the basal stratum and the midden and invariably contained a mixture of both matrices. Excluded were excavation levels composed of slackwater deposits that contained artifacts. This was done so that each level 1 for that analysis was unadulterated midden. Artifact density was used instead of simple frequency because of the varying thickness of the cultural layer.

The analysis focused on all of the units comprising Trenches 1, 2, and 3, as well as TU 3 and QTUs 23 and 24. This group includes units that were both more and less than 16 m from the river. Plotted by 10-cm levels, the vertical distribution of artifacts in the sample group is seen to be bimodal. The first mode is represented by levels 1 and 2 that contained very dense cultural deposit. The quantity of cultural material in the next level declined substantially (27% compared to level 2). It rises again in the next level to form the second mode that is weaker than the first one but reflects a substantial increase in artifacts compared to level 3. After level 4, the amount of cultural material per cubic meter steadily declines: level 5 contained only 60 percent of the quantity level 4 contained and level 6 contained only 56 percent of the amount that level 5 contained.

To explore if the gap in the two zones of artifact concentration reflects a random anomaly or a change in the way the lower terrace was used prehistorically, a series of chi square tests of goodness of fit were conducted using artifact densities per 10-cm excavation level. The tests initially examined levels 1 and 2 for similarity. The resulting chi square ($\chi^2 = 1.124$; df = 1; $p < .05$) indicated that the quantity of cultural material in the two levels comprising the upper mode was not significantly different. The analysis proceeded by adding the next sequential excavation level and calculating a new chi square. When level 3 was added, the resulting chi square ($\chi^2 = 102.732$; df = 2; $p < .05$) indicated that there was a statistically significant difference in the amount of cultural material in level 3 compared to levels 1 and 2. When level 4, which represents the second weaker mode in the distribution curve is compared to levels 1 and 2, the chi square test ($\chi^2 = 25.78$; df = 2; $p < .05$) indicates the quantity of cultural material in the two modes is significantly different. Likewise, when the second mode is compared to the gap between modes the chi square test ($\chi^2 = 11.502$; df = 1; $p < .05$) indicates a significant difference in the quantity of cultural material.

These chi square tests suggest that, everything else being equal, the decline in the amount of cultural disposed of during the time interval represented by the valley between the two modes is not related to sampling or randomness. Comparing the chi square results with the distribution curve, the lower mode represent a time of increased deposition of cultural material compared to preceding times. Basically it can be interpreted as reflecting an intensification of use of the lower terrace compared to earlier times. The initial period of intensified site use was followed by a period during which substantially less refuse accumulated. Following that interval, a second period of intensive use occurred that eclipsed the first period of such use.

Analysis of Fire-Cracked Rock

Fire-cracked rock (FCR), also known as cooking stone, fire-modified, fire-altered, or thermally-altered rock, can be generally defined as rock that has been heated by fire. Heated rocks were used in cultural features such as hearths, open-air grills, roasting or steam ovens, boiling pits, and sweat baths where they absorbed heat from fires and transferred it for cooking, warmth, bathing, and other common domestic activities (Thoms 2008, 2009; Wilson and Roulette 1998). FCR is commonly found at archaeological sites. It is sometimes found within cultural features where it forms intact heating rock elements but more often occurs as part of the general refuse generated by the dismantling, maintenance, and refurbishing of facilities.

FCR was nearly ubiquitous at site 35TI90 occurring in 50 of the 54 units excavated during testing/site damage assessment and the various phases of data recovery. In all, 11,860 pieces were found. No features with intact FCR elements were identified but the large number of pieces that were found suggests that such facilities had been present at the site (or were present in areas not investigated).

In aggregate, the FCR at the site weighed approximately 492 kg. Site wide, each piece weighed an average of 42 grams (Table 15). All of the FCR pieces were identified as basalt/volcanic. Overall FCR counts per unit ranged from 0 to 1,004, or in terms of extrapolated density, from 0 to 2,535/m3 per unit. For units that contained FCR, per unit weights ranged between 7 and 113 grams (g).

Fire-cracked rock was differentially distributed across the investigated part of the site. Paralleling the trend seen in the distribution of artifacts, units placed closest to the Trask River tended to contain the most and largest pieces of FCR. In the South Area these included TUs 2, 3, and 15 and in the North Area they included QTUs 2, 10, 14. In both areas, units only 10-20 m inland from the river contained many fewer pieces of FCR that on average were smaller than those in units closest to the river.

The relative frequency of FCR per cubic meter of excavated sediment was higher in the North Area than in the South Area, despite the fact that a part of the archaeological deposits in the North Area had been truncated. Also, the average size of pieces of FCR in the North Area was larger than in the South, as indicated by weight. In the former, units yielded the equivalent of 870 pieces of FCR/m3 and on average each piece weighed 55 g. In the South Area units contained the equivalent of 572 pierces of FCR/m3 and the average weight per piece was 36 g. The greater average weight of FCR pieces in the North Area correlates with a higher percentage of blocky pieces versus spalls in that area compared to the southern half of the site. In the north area blocky fragments account for 91 percent of the FCR and spalls 8 percent. In the South Area, 84 percent of the pieces of FCR are blocky and 15 percent are spalls. (IN both areas 1% of the FCR consist of complete rocks.)

The overall greater quantity of FCR in the North Area of the site likely reflects the presence of several features there that may originally have had heating rock elements. Feature 2/4 was the most extensively studied. It was interpreted as the base of a hearth, the top part of which had been stripped away when the staging area was graded. The hearth lacked an intact rock lining but it did contain a large number of pieces of FCR. Features 1, 3, and 6 were investigated in only a preliminary fashion, but each may have functioned in the same manner as Feature 2/4. None of the features contained intact heating rock elements but the first two were associated with much higher averages of FCR compared to other contexts in the North Area, while Feature 6 was somewhat below the average in terms of its FCR content. Feature 7 was much deeper than the other North Area features and may have functioned differently but it also contained a greater than average quantity of FCR.

The common occurrence of FCR in the South Area is not related to the presence of features that may originally have had rock heating elements as only one such feature (Feature 5) was found in that part of the site. Lacking a clear association with features, the FCR in the South Area can be characterized as general refuse. Its presence may reflect a particular pattern of refuse management in which once they became unusable due to breakage and loss of mass, heating and cooking rocks used in facilities located in the north part of the site were discarded in the South Area.

Obsidian Studies

Obsidian was rare at the site and is rare among coastal site in Oregon generally. The 54 pieces, including 48 flakes and six tools, represents less than one half of one percent of the lithic artifacts recovered from the site. The pieces were mostly small. Only nine were of adequate size to be analyzed for geochemical composition using X-ray fluorescence (XRF). These analyses determine the chemical composition and therefore the geological source areas for each sample (Appendix B). The pieces were identified as representing four and possibly five different obsidians: Inman Creeks A and B, Glass Buttes

Table 15. Geochemical Sources of Obsidian from Site 35TI90

Catalog	Unit	Level	Artifact Type	Geochemical Source
833	QTU 10	1	Debitage	Obsidian Cliffs
834	EU 7	8	Debitage	Glass Buttes 3
835	EU 7	8	Debitage	Glass Buttes 7?
836	EU 7	10	Debitage	Inman Creek A?
837	EU 12	2	Debitage	Glass Buttes 3
838	EU 15	7	FFT - graver scraper	Inman Creek A
547	EU 7	7	Projectile Point Tip	Inman Creek B
649	EU 12	7	Projectile Point	Obsidian Cliffs
705	EU 14	11	Biface	Inman Creek B

3, and Obsidian Cliffs. One piece was tentatively identified as Glass Buttes 7, but it was too small be positively sourced. All of the primary source locations for these varieties of obsidian are between range 100 and 230 air miles south and east of site 35TI90.

A biface, a projectile point tip, and a formed flake tool were manufactured from obsidian from the Inman Creek A and Inman Creek B sources. One other piece of debitage likely is from the Inman Creek A source. The Inman Creek A primary source is an obsidian flow located toward the southern base of Mount David Douglas. The source locale for Inman Creek B obsidian has not been located but is thought to be near the Inman Creek A source. Nodules and pebbles of the obsidian are found in the Willamette River and are believed to have been transported down locale drainages by lahars that dumped into the river (Skinner 2004). The pebbles and nodules are present in the river gravels and alluvial deposits along the river as far north as the falls at Oregon City. They also are known to occur in the Siuslaw River (Minor et al. 2000). These types of obsidian are commonly found at Willamette Valley archaeological sites. However, to date, 35TI90 is the only site on the northern Oregon coast documented to contain Inman Creek A and B obsidians. Those obsidian varieties have also been found at site 35LA25 located on the central Oregon coast (Minor et al. 2000).

A lanceolate dart point and a piece of debitage were determined to be of Obsidian Cliffs obsidian. The geological source locale for this type of obsidian is in the High Cascades near the Three Sisters. Secondary deposits, in the form of nodules and pebbles, are found in gravels on the Willamette River and some of its tributaries. Besides at 35TI90, this variety of obsidian has been found at the Palmrose and Avenue Q sites in Clatsop County (Connolly 1992) and at site 35LNC45 in Lincoln County (Tasa and Connolly 1995).

Two flakes were identified as Glass Buttes 3 obsidian and another might be from the Glass Buttes 7 locale. These obsidians are among nine geochemically distinct varieties included in the Glass Butte source complex in northeastern Lake, southeastern Deschutes, and northwester Harney counties in Oregon. Obsidian from the complex has not previously been identified on the northern Oregon coast.

Faunal Analysis

Over 6,300 pieces of animal bone were recovered from the site during the testing/site damage assessment phase and the first two rounds of data recovery. They are the subject of the following analysis. A few additional pieces of bone and shellfish were found during the third round of data recovery, the investigations following the inadvertent discovery, and during monitoring. Those materials were given a cursory examination and with one exception were determined to be similar in all regards to the analyzed sample and they were not analyzed further.

Condition of the Assemblage and Taphonomic Processes

As an assemblage, the 6,360 bone fragments that were formally analyzed are characterized by a high degree of fragmentation, small size, and poor preservation. Nearly 99 percent of the materials could be classified only to the most general of categories: bird, fish, and mammal. A sizable percentage of the fragments (n=1,223, 19% of the analyzed bone) could only be identifiable as bird/mammal because they could not positively be identified as one or the other categories, but could be positively identified as non-fish.

The interpretive potential of the faunal assemblage is directly related to its physical condition. The condition of the bone as found reflects various taphonomic processes, which includes a wide range of interrelated factors that affect the preservation of a bone assemblage. As a result of taphonomic processes bone may be partially or entirely decayed. The effects of taphonomic processes at site 35TI90 have greatly limited the ability to identify the recovered specimens in the faunal assemblage, particularly with regards to the attrition of identifiable attributes on recovered specimens.

Three overarching taphonomic processes or categories of processes have created the faunal assemblage as found at site 35TI90. First are the intrinsic factors of the bone such as size and robusticity, its mineral density, and its porosity. Second are the extrinsic biological factors including anthropogenic influences such as butchering, burning, cooking, trampling, and the biotic influences of gnawing, insects, roots, and bacteria. Third are geological factors such as soil pH and moisture.

Several intrinsic qualities of faunal remains, both within and between taxa, affect bone preservation. Bones that exhibit higher mineral density have a better chance of preservation than those with less mineral density (Lyman 1994). Among mammal remains, it is generally understood that the distal extremities are denser than those of the medial skeleton and are more likely to be preserved. Fish and bird bones, typically being thin and more fragile, generally do not preserve well under extreme conditions. However, fish bones are highly identifiable, even in very small fragments.

Prior to becoming part of the archaeological record, a number of cultural processes may occur that can affect preservation. These include breakage, cooking, burning, gnawing, and trampling. All of these actions weaken the bone structure, making them more susceptible to the post-depositional environment. With an average fragment size of 1 cm or less, it is apparent that the bone from site 35TI90 has been subjected to a high degree of fragmentation. In conjunction with the high degree of burning observed in the assemblage, this has resulted in very poor preservation.

Once in an environmental context, geological influences that can degrade bone include soil pH, moisture regimes, and the permeability of the soil to water and air, as well as insects and roots. Three soil samples obtained from the culture bearing strata were submitted to the Central Analytical Laboratory located at Oregon State University's Department of Crop Soil Science. Based on their results, the pH of the soil at the time of the excavation was 5.8, 5.6, and 4.9. According to archaeologically-based experimental data, soils more acidic than 6.0 will deteriorate bone at an accelerated rate (Knight 1985, reported by Lyman 1994). It has also been observed that burned bone deteriorates more rapidly in combination with acidic soils (Knight 1985, reported by Lyman 1994).

Moisture in the matrix containing bone also affects its preservation. Site 35TI90 is located adjacent to the Trask River, a tidally influenced tributary to Tillamook Bay. During much of the time the lower terrace (South Area) was used, it within the active river floodplain. Sediments in which cultural material was included were continuously wet and dry, a cycle that is destructive to bone. The site is also located in an area that receives an average of 65 to 90 inches of rainfall a year, and assuming a similar climactic pattern during the occupation of the site, it is likely that ground soil moisture has affected the faunal assemblage.

Taxa Identification

Of the 6,360 analyzed bones 43.1 percent (n=2,738) were identified as mammalian, 32 percent (n=2,035) as fish, 19.2 percent (n=1,223) as bird/mammal, and 4.3 percent (n=270) as bird, less than 1 percent (n=21) as shellfish, and 1.1 percent (n=73) were unidentifiable.

Beyond this basic assessment of taxonomic groups, three species of mammal, two families of fish, one species of bird, and one species of shellfish were positively identified. These include deer, elk, domestic cattle, salmonids, sturgeon, pied-billed grebe, and a species of cockle. Table 16 provides counts for all identified taxonomic categories, including size categories for the more basic taxonomic groupings such as mammal or bird. The following discussion provides a more in depth overview of the taxonomic groups identified in this assemblage.

Fish

A total of 2,035 specimens are identified as fish or likely fish (Table 17). Because of preservation issues 1,105 could not be classified to a further taxonomic level. All of these bones are small, highly fragmented, and calcined and/or badly deteriorated. Fish bones positively identified are limited to sturgeon (*Acipencer*) and salmon (Salmonidae).

A total of seven bones were positively identified as belonging to sturgeon with an additional seven bones identified as likely belonging to sturgeon. The bones were found in seven different units and all but one was found in the South Area. Elements identified include scutes, the bony plates that cover the backs of sturgeon. Because of the unique morphology of sturgeon bone, some fragments could be identified as belonging to sturgeon but not to element.

Two species of sturgeon are found in the Pacific Northwest: *A. medirostris*, the green sturgeon, and *A. transmontanus*, the white sturgeon. Both species are considered to be anadromous, although the species typically inhabit different waters. White sturgeon live primarily in fresh water whereas green sturgeon often occur in brackish waters and are more likely to be found in the ocean than white sturgeon. It is possible that either one of the species could be represented in the 35TI90 assemblage. Sturgeon is not presently known to inhabit the Trask River, but have been occasionally recorded in the Tillamook Bay tide waters (Snyder 2003).

Trout or salmon bones number 916. These include 846 positively identified as salmon with an additional 68 identified as likely salmon, and two identified as salmon-trout. Salmon bone was widely distributed at the site and at least one bone was found in 21 different units in the North and South areas. Overall, 260 (28%) were found in North Area units and 656 (72%) in South Area units. Elements identified as belonging to salmon include bones of the cranium as well as the vertebral column. Vertebrae fragments, often very small, represent the majority of the identified elements with 86 percent of the salmonid assemblage (Table 18).

Many of the salmon bones from the North Area came from two features. Feature 1 yielded 104 identified salmon bones and included bones of the cranium as well as vertebrae. Feature 2/4 contained 113 identified salmon bones. The vast majority of bones recovered from Feature 2/4 were vertebrae, with a few teeth representing bones of the cranium. Combined, these two features account for almost 24 percent of the identified salmon assemblage from the site, and 84 percent of the salmon assemblage from the North Area.

Five species of Pacific salmon run in Tillamook Bay and the Trask River and would have been present during the time that 35TI90 was occupied. These species include *Oncorhynchus gorbuscha* (pink), *O. Keta* (chum), *O. kisutch* (Coho), *O. nerka* (sockeye), and *O. tshawytscha* (Chinook). It is

Table 16. Count of Identified Taxonomic Categories

Taxonomy	Count	Taxonomy	Count
Acipenser	7	Fish-sm	7
Acipenser cf.	7	Mammal	1987
Aves	239	Mammal-lrg	10
Aves cf.	4	Mammal-med	14
Aves-large	1	Mammal-med-lrg	694
Aves-med	1	Mammal-sm	12
Aves-sm	2	Mammal-sm-med	6
Aves-sm cf.	1	Odocoileus cf.	3
Aves-sm-med	21	Pie-billed grebe cf.	1
Bird or mammal	1223	Rodent-large	1
Bos cf.	1	Salmonid	846
Cervus	1	Salmonid cf.	68
Cervus/Bos	3	Salmonid-trout cf.	2
Clinocardium	9	Selenodont	6
Clinocardium cf.	1	Shell	11
Fish	1098	Unidentified	73
Total: 6360			

Table 17. Count of Identified Fish Specimens

Taxa	Count
Acipenser	7
Acipenser cf.	7
Fish	1098
Fish-sm	7
Salmonid	846
Salmonid cf.	68
Salmonid-trout cf.	2
Total	2035

difficult if not impossible to differentiate between the species on the morphological attributes of their bones so the species represented in the faunal collection cannot be determined.

Mammals

The 3,961 pieces of mammal bones includes only 15 that can be identified to specific taxa. The remaining 3,946 included 2,723 bones identified only to the group mammal, and 1,223 identified as either mammal or bird, but not fish (Table 19). Few bones could be identified beyond the level of small to large mammal as a result of fragmentation, burning and weathering. Of the total of 15 positively identified mammal elements, one is an atlas vertebrae fragment from an elk (*Cervus elaphus*), one is a metapodial likely belonging to a cow (*Bos*), three are teeth from cow or elk, three are likely from deer (*Odocoileus*) and include a tooth, a phalange, and a vertebrae, six are teeth identified only as selenodont which includes cattle, elk, deer, or sheep, and a tooth fragment likely belonging to a beaver. The identified cow metapodial was identified during the monitoring of a trench excavation. The bone was identified at the interface of a clearly disturbed layer above the cultural bearing strata and likely represents an intrusive deposit from recent times, since cows are a historically introduced species. The remaining 2,723 bones

Table 18. Frequency of Salmonid Elements Identified

Element	Salmonid	Salmonid cf.	Salmonid-trout cf.	Total
angular	1	2		3
ceratohyal	1			1
cleithrum	1			1
cleithrum cf.		1		1
dentary	9	4		13
gill raker	1			1
palatine		1		1
premaxilla	1	1		2
prootic		1		1
tooth	45	56		101
tooth cf.	2			2
vertebrae-1st	1			1
vertebrae-abd.	6			6
vertebrae-caudal	38			38
vertebrae-indet.	740	2	2	744
Total	846	68	2	916

Table 19. Frequency of Mammal Bones by Element and Size

Element	Bird or mammal	Mammal	Mammal (large)	Mammal (medium)	Mammal (medium-large)	Mammal (small)	Mammal (small-medium)	Total
auditory bulla			2					2
carpal/tarsal			1	1				2
carpus/tarsus cf.				1				1
cranium			2		1			3
cranium cf.					2			2
epyphysis							2	2
femur				1				1
humerus cf.						1		1
innominate				1				1
longbone	7	1	2		22		2	34
longbone cf.			1		1			2
metapodial					1			1
pelvis						1		1
phalange		2		1	1	1	2	7
rib cf.	1			1	1			3
tibia						1		1
tooth cf.		1						1
unidentified	1215	1983	2	4	665	8		3877
vertebrae cf.				1				1
vertebrae-lumbar				1				1
vertebrae-lumbar cf.				2				2
Total	1223	1987	10	14	694	12	6	3946

primarily consist of small weathered and burned unidentifiable fragments. In a few cases, the element was identified but could not with any confidence be assigned to a specific animal.

A total of 1,987 bones could be identified only as mammal. Two phalanges, one longbone fragment, and a small fragment of tooth enamel represent the only identifiable elements. The remaining fragments were identified only as belonging to the class of mammal.

Ten bones were identified to the category of large mammal, including two weathered and fragile auditory bulla, two cranium fragments, longbone fragments, and one phalange fragment. Large mammal remains likely represent elk or bear.

Medium to large mammals are represented by 694 specimens. Animals in this category include those from deer to elk size. Only 29 fragments in this size category could be identified to element but not species of animal. They include three cranium fragments, and metapodial, phalange, rib and longbone fragments.

A total of 14 bones were confidently assigned to the medium mammal category and include an innominate, phalanges, ribs, vertebrae, and a fragment of the head of a femur. Deer are the most likely animals represented.

Six bones including two phalange fragments are roughly the size of a rabbit or small fox, two longbone fragments and two epiphyses fragments too small to identify, represent the small to medium mammal category. Each bone was recovered from a different excavation unit.

Twelve bones were identified as small mammal, including a tibia and humerus fragment and a pelvis fragment. These specimens fall into the size range of small to medium rodents such as small squirrels or small carnivores such as small weasels. Eight additional bones, all from a single excavation unit were identified only as small mammal.

Birds

In total, 270 bones were positively identified as belonging to the class of Aves. Of these bones only one, a tarsometatarsus of a pied-billed grebe (*Podilymbus podiceps*), could be identified to species. The remaining bone fragments were too fragmentary or deteriorated to confidently be assigned to a category more specific than size class. Bones from all parts of the skeleton are represented except for the cranium. Cranium fragments may have been present but due to the poor condition of the assemblage could not be identified. Table 20 shows the distribution of elements by category.

Shellfish

Shellfish remains were uncommon at the site. In total, 10 specimens could be identified as *Clinocardium nuttallii* or heart cockle. An additional 11 fragments are identified as shell but did not retain characteristics that allowed for positive identification. All positively identified hear cockle shell was found in a single excavation level in one unit. (Note that a small amount of shellfish was found during monitoring in Feature 8, including additional examples of heart cockle.) The heart cockle is commonly found in Tillamook, Netarts, Yaquina, and Coos bays (Jacobson et al. 1993). It inhabits quiet bays in sand or sand-mud habitats, or in beds of eelgrass that are growing on mud (Meinkoth, 1981).

Distribution of Faunal Material

By excavation volume more bone was found in the North Area (697 bones/m3) than in the South Area (369 bones/m3). In terms of taxonomic group representation, the areas have comparable proportions of bird (2.7% or n=43 in North Area versus 4.8%, or n=227 in the South Area) and shellfish (1.2% or

Table 20. Distribution of Aves Elements

Element	Aves	Aves cf.	Aves (large)	Aves (medium)	Aves (small)	Aves (small) cf.	Aves (small-medium)	Pie-billed grebe cf.	Total
carpal		1							1
coracoid	1								1
coracoid cf.	1								1
femur	1					1			2
longbone	205	2			2		17		226
phalange	1								1
phalange cf.	1								1
sacrum			1						1
scapholunar cf.	1								1
sternum cf.		1							1
tarsometatarsus								1	1
tibiotarsus	1								1
ulna cf.				1					1
unidentified	27						4		31
Total	239	4	1	1	2	1	21	1	270

n=20 in North Area versus < 1% or n=1 in South Area) remains. The two areas differ notably in the proportion of fish, mammal, and bird/mammal remains. Proportionally, the North Area has notably fewer bird/mammal (n=131; 8.2%) and mammal remains (n=299; 18.6%) than the South Area where bird/mammal remains account for 22.9 percent (n=1,092) and mammal remains 51.3 percent (n=2,439) of the total. In contrast, for the South Area fish remains account for only 19.4 percent (n=924) of the identified faunal remains whereas in the North Area fish accounts for 69.3 percent (n=1,111) of the identified total (Table 21, Figure 66).

The differences between these two areas are at least partly explained by sampling bias but it could also reflect the use of space for different activities. The use of fine mesh (ca. 1-mm gauge) to process sediment was limited to feature fill. Most features at the site were found in the North Area. Thus, more sediment from that part of the site was processed using fine mesh. Most of the fish bone from the entire site was recovered from sediment processed with fine mesh, particularly the sediment associated with Features 1 and 2/4, both in the North Area, which yielded 53 percent of all fish bone found at the site. Without a similarly processed sample from the South Area it is not possible to evaluate the effects of this potential bias on the resulting assemblage. In terms of site formation, differential preservation between the excavation areas cannot be ruled out as an influencing factor since the lower-lying South Area was more susceptible to the wet/dry cycle of river levels.

Evidence for Modification

Clear evidence of butchery in this assemblage is lacking. Two bones feature slice marks, including the longbone of a medium to large bird and a rib fragment of a medium mammal, likely a deer. Neither bone retained characteristics that allowed for identification beyond element. Both fragments had three slice marks perpendicular to the long axis of the bone. Although it is not possible, given the condition of the faunal assemblage, to determine with any accuracy the methods or purpose of the butchery and processing that took place at this site, the high degree of fragmentation and burning of the

Table 21. Count and Density of Taxa from Site 35TI90

Taxonomic Group	North Area (2.3 m^3)		South Area (12.9 m^3)		Total (15.2 m^3)	
	NISP	Density (m^3)	NISP	Density (m^3)	NISP	Density (m^3)
Bird	43	19	227	18	270	18
Bird or Mammal	131	57	1092	85	1223	80
Fish	1111	483	924	72	2035	134
Mammal	299	130	2439	189	2738	180
Shellfish	20	9	1	0	21	1
Unidentified	0	0	73	6	73	5
Total	1604	697	4756	369	6360	418

Figure 66. Ratio of recovered taxonomic groups in the North and South areas of site 35TI90.

faunal assemblage could suggest intensive processing of bone material, unless there are other factors that would have resulted in the high level of fragmentation such as a combination of burning, soil conditions, bioturbation, and or trampling.

Summary

Given the poor condition of the assemblage it is difficult to draw interpretations beyond the most basic levels. It is clear from the above data that both hunting and fishing were important activities at the site. Shellfish remains are present in small numbers but it is unclear whether the shells represent a resource brought to the site for food or as raw materials for tool manufacture. Also, although a few fragments of bone tools were found, and likely others are present but unrecognizable, there was no evidence for a major bone-tool industry at the site and the majority of the bone is interpreted as residue for processing and consumption.

Element represented within the mammal category include cranial, axial, and appendicular elements. This suggests that complete animals were butchered on-site which in turn suggests hunting activities within the immediate vicinity of the site since field processing of game in more distant locations is expected to be associated with the transport of selected skeletal elements (Binford 1978; Metcalfe and Jones 1988). Similarly, cranial and post-cranial fish elements were recovered, suggesting the harvesting and processing of fish on-site rather than the consumption of pre-processed fish, which would likely lack cranial elements (Butler 1993:17-23). Only post-cranial bird elements are represented, with a strong bias towards long bone fragments. While this pattern may be the result of taphonomic processes which could have destroyed the more fragile cranial bones, the low number of axial elements is suggestive of some form of cultural behavior that could be indicative of these bones having been brought to the site for processing.

Historic-Era Artifacts

Nearly 400 historical or probable historical artifacts were found during the original survey (Becker et al. 2007), all from the expansion area part of the North Area. Most of the objects recovered at that time consisted of construction debris (n=276); other items were characterized as domestic household materials. The only definitive historical artifacts were pieces of amethyst-tinted glass. Other than a nickel dated to the 1980s (exact date indecipherable), the recovered objects were not demonstrably modern and were dated to historic-era by association with the glass fragments.

Another 89 historical or possibly historical items were collected during different phases of the current project. Most (n=53) were found during monitoring of earthmoving for clarifiers and an aeration basin in the northeastern-most part of the site where all of the previously recovered historical or probable historical objects were found. Other items were found during archaeological excavations in the staging area and in the South Area (Table 22). In all, the 89 items represent an MNI of 58. By frequency and MNI, most consist of structural debris (n=32). Except where found on the surface, the items generally, the objects were found between 0 and 40 cmbs.

The historic-era or possibly historical items represent five functional groups: Domestic, Personal, Structural, Indefinite, and Undefined (Table 23). Domestic items account for 31 percent of the artifacts by MNI, with most of the artifacts related to food preparation and consumption. All but two of the objects in this functional group were found in the North Area and most were collected during monitoring. They include pieces to a minimum of ten objects: four plates, one saucer, three cups, one unidentified hollowware item, and one unidentified flatware item. Six vessels are white earthenware and four are porcelain. The decorated pieces vary in type and motif and do not represent parts of sets. A piece from a plate contains is decorated with a gold band at the rim. Another plate fragment is decorated with a floral decal print that includes pink, yellow, and green flowers. Another plate fragment is from a rim that is decorated with splotches of cobalt blue that was applied with a sponge. A rim fragment representing a cup is decorated in molded relief on top of which has been applied a green transfer-printed pattern. The fragment representing the hollowware vessel of undermined form is decorated with an unidentified brown transfer-printed floral pattern.

The six items related to Food Storage include a MNI of three canning jars, two canning jar lid liners, and one stoneware crock. One opaque glass lid liner, recovered from the surface, contains a partial trademark, "…NEW YORK…" Other Domestic items include two ceramic artifacts that are a part of the Furnishing category. Two fragments represent a porcelain plate with a decal print. The decal is a picture of three figurines walking. Beneath the figures is an incomplete caption. The part that is preserved on the fragment reads: "…Rosa on Their Way to the White House." The other artifact is a section of a decorative cup that contains a figurine in a molded relief.

Personal items make up approximately 10 percent of the assemblage and consist of artifacts related to Health, Social Drugs and Alcohol, and Toys. All Health-related artifacts were collected on the surface and include three medicine bottles hat contained either prescription or proprietary medicine products. A colorless prescription neck finish and French square base represent one bottle while a colorless prescription neck finish represents another bottle. An aqua neck and shoulder represents the third Health bottle.

Other items in the Personal group include two alcohol-related containers. One is represented by an amber neck finish and a partial oval base. It is embossed with "W.Mc[C. &]Co.," representing the William McCully and Company. The bottle was manufactured between 1874 and 1909 (Lockhart 2008; Whitten 2012). The other is represented by an amber glass fragment and likely was a beer bottle.

Table 22. Summary of Historic-era Artifacts Collected from Site 35TI90

Phase	Location	Level	Cultural Materials Collected	Count	MNI
Monitoring	Surface	-	Nail	9	8
Monitoring	Surface	-	Marble	1	1
Monitoring	Surface	-	Brick fragments	2	1
Monitoring	Surface	-	Ceramic tablewares	22	10
Monitoring	Surface	-	Stoneware base fragment	1	1
Monitoring	Surface	-	Bottle/canning jar fragments	17	11
Monitoring	Surface	-	Unidentifiable chalky material	1	1
Testing	QTU 8/TU 1	2	Nails	4	4
Testing	TU 2	2	Nails	2	2
Testing	TU 2	2	Alcohol bottle fragment	1	1
Testing	TU 3	2	Nails	6	6
Data Recovery 2008	QTU 22	1	Square nails	3	2
Data Recovery 2008	QTU 23	2	Unidentifiable WIE fragment	1	0
Data Recovery 2008	QTU 23	7	Square nail	1	1
Data Recovery 2008	QTU 24	1	Unidentifiable metal fragment	1	1
Data Recovery 2008	QTU 24	3	Unidentifiable porcelain fragment	1	1
Data Recovery 2009	QTU 25	1	Nail	1	1
Data Recovery 2009	QTU 25	1	Unidentifiable wood fragment	1	0
Data Recovery 2009	QTU 27	4	Flatware rim fragment	1	1
Data Recovery 2009	QTU 28	2	Holloware body fragment	1	1
Data Recovery 2009	QTU 29	2	Nail	1	1
Data Recovery 2009	QTU 29	3	Unidentifiable WIE fragment	1	0
Data Recovery 2009	QTU 29	3	Nail	1	0
Data Recovery 2009	QTU 29	5	Unidentifiable WIE fragment	1	0
Data Recovery 2009	QTU 30	2	Unidentifiable glass fragment	1	1
Data Recovery 2009	QTU 32	1	Nail	1	1
Data Recovery 2009	QTU 32	2	Amethyst bottle base fragment	1	0
Data Recovery 2009	QTU 32	2	Nail	1	1
Inadvertent Discovery	EU 19	1	Possible nails	4	0
Total				89	58

One ceramic marble, representing the Toy category, was collected on the surface. It is decorated with cobalt blue coloring.

By MNI, nearly half of all items are related to the Structural group and of those all but two are nails. This is consistent with the results of the original survey during which 274 of the 396 objects that were found were assigned to the Structural group (representing 69% of the historical or possibly historical items) of which 145 were nails or nail fragments. For the current analysis, nails were classified according to their manufacturing technique as deduced from their shape in cross section (round/wire versus square/cut), length, and implied primary function. As a group, the nails include a mixture of square, wire, modern machine cut, flooring nails, and large house framing nails (Table 24).

Table 23. Summary of Artifacts by Group and Category

Group	Category	Count	MNI	% MNI
Domestic	Food Prep/Consumption		10	17.20%
	Food Storage		6	10.30%
	Furnishing		2	3.40%
		35	*18*	*31.00%*
Indefinate	Miscellaneous Ceramic		1	1.70%
	Miscellaneous Glass		3	5.20%
	Miscellaneous Metal		1	1.70%
	Miscellaneous Wood		-	
		8	*5*	*8.60%*
Personal	Heath		3	5.20%
	Social Drugs – Alcohol		2	3.40%
	Toys		1	1.70%
		9	*6*	*10.30%*
Structural	Fastener		27	46.60%
	Materials		1	1.70%
		32	*28*	*48.30%*
Undefined	Miscellaneous Metal		-	
	Unknown		1	1.70%
		5	*1*	*1.70%*
Total		89	*58*	*100%*

Table 24. Summary of Nails Recovered from Site 35TI90

Location	Depth	Count	MNI	Description
Surface	-	2	2	Large 30d (house framing-large construction)
Surface	-	1	1	Common nail, 10d- medium construction
Surface	-	6	5	Modern machine cut- 12d-medium construction
QTU 8	0-10	1	1	Cut flooring nail, 6d-medium construction
QTU 8	10-20	1	1	Square nail head
QTU 22	0-10	3	2	Two square nail heads, 1 incomplete
QTU 23	60-70	1	1	incomplete square nail
QTU 25	0-10	1	1	Round nail; rusted
QTU 29	10-20	1	1	Square nail - 2" long
QTU 29	20-30	1	0	Square nail - 3 1/2 " long
QTU 32	0-10	1	1	appears to be square
QTU 32	10-20	1	1	very rusted - round
TU 1	10-20	2	2	Incomplete and unidentifiable-corroded
TU 2	10-20	2	2	Corroded with larger head
TU 3	10-20	6	6	Corroded, wire cut, incomplete

Two brick fragments were included in the Materials category. One of the fragments contains a partial trademark “"...G CO.   P". The partial mark may represent one of two brick manufacturers. One was the Pacific Clay Manufacturing Company that used trademark “PACIFIC CLAY MFG. CO.” in the 1930s (Gurcke 1987:278). The other was the Western Clay Mfg. Company that between 1897 and 1913 used the trademark “WESTERN CLAY/MFG. CO.” (Gurcke 1987:314).

Objects in the Indefinite and Undefined groups include an amethyst-tinted bottle fragment. The amethyst tinting that occurs in glass results from solarization of manganese that is present in glass that was originally manufactured clear or colorless. Manganese was added to glass beginning around 1880 and except for certain kinds of decorative glass items, was no longer used by glass manufacturers after approximately 1917 (Newman 1971; Lockhart 2006). None of the other items in these groups provide temporally information.

During all phases of archaeological investigations, most historical or possibly historical items were found in the northeastern part of the site located in the expansion area. No evidence was found during the background research to indicate that a home was ever located in that part of the site or the site area in general. A aerial photograph taken in 1939 (Figure 9) shows that a small outbuilding was located in the expansion area just south of 3rd Street but it may have been outside of the site boundary.

The character of the historic-era component as identified in the expansion area suggests that it consists of dumped refuse that apparently included demolition debris. Single items or small quantities of historical or possibly historical materials were found in units excavated elsewhere in the North and South areas. Most of the objects consist of nails at the site. They likely reflect incidental field scatter or in the South Area, objects associated with the construction and operation of the TWTP.

CHAPTER 8
DISCUSSION OF RESULTS

As outlined in Chapter 5, the main research objectives of the archaeological investigations at site 35TI90 were to determine its age, its function, its formation and structure, the character of lithic manufactures conducted there, the subsistence habits of its occupants, the times of the year it was occupied, the role it played in late prehistoric settlement, and how the occupants connected to regional and extra-regional trade networks. To address these questions, all tools were analyzed to identify their morphological forms but more importantly their function(s) by means of usewear analysis. A large sample of the recovered lithic debitage was also formally analyzed to gain insight into manufactures in stone that occurred on-site. To assess what the site occupants ate and the prey they sought at the site and its environs over 6,000 pieces of animal bone and shellfish fragments were identified to the most specific taxa possible. The animal remains were also studied as a source of the seasonality of site occupation. Radiocarbon dates were obtained on the top and bottom of the main cultural deposit in the southern part of the site and from the remnants of several features in the northern part of the site. The vertical and horizontal distribution of all varieties of cultural material and features was analyzed to identify patterns that could inform as to how the site occupants use space for different activities and soil profiles were studied to understand the formation of the archaeological record. To investigate possible causes of site abandonment, the effects that coseiesmic subsidence would have on the site environment were modeled. To infer the overall function of the site and its role in the settlement system of the ancestral Nehalem Tillamook, the archaeological evidence was compared to ethnographic information. Finally, all materials found during the investigations were examined to identify exotics that could indicate participation in regional and extra-regional trade networks.

To begin the discussion of results, the nature of the evidence must be qualified. The archaeological investigations were limited to select areas where project-related disturbance were to occur. This spatial limitation imposed upon the field research begs the question of the representativeness of the part of the site in the project APE relative to the overall site. That is, can the information recovered be used to generalize about the entire site? Or, do the data reflect a narrower range or some subset of activities compared to the site as a whole? Related to this issue is the question of what archaeological information was lost when the North Area was graded. At least along the west side of the staging area, the grading removed what likely were very rich archaeological deposits and truncated several cultural features. The loss of data from that part of the site confounded our efforts to understand the structure and formation of the archaeological record of the North Area. The preceding question cannot be answered with available data and the discussion to follow is based on the assumption that our investigations recovered a representative sample of the site's cultural deposits.

Interpretations regarding the site pivot on a collection of stone artifacts, a few bone artifacts, many small pieces of animal bone, and the sedimentary matrices in which these materials were found. The effects of taphonomic processes on bone were described in Chapter 7, above. The same processes would have affected all non-stone objects if present at the site including those made of antler, wood, feather, hide, fur, and plant materials. In the overall material cultural inventory of the site occupants, items of these materials and the debris from their manufacture, likely outnumbered the contributions of stone tools and lithic debitage to the archaeological record. The point is that many interpretations regarding the site structure and function are based on limited evidence.

The temporal scale for interpreting the site is the period of occupation. This is a very coarse level of analysis but it permits all of the site data to be employed, which would not be the case in an analysis with a more discrete temporal focus. The site-occupation-level of analysis does permit identification of the most durable and persistent cultural behaviors that can be inferred from the archaeological record.

Age of Site and History of Site Occupation

Radiocarbon dated charcoal from near the base of the cultural layer in the South Area indicates that the site was initially occupied around 1,200 years ago or a little earlier. Two dates on charcoal from the top of the cultural layer near its interface with the slackwater deposit, and other considerations, suggest that use of the site, at least its southern part, was discontinued sometime around A.D. 1650 to 1780. Based on its dates of occupation, the site can be included in Minor's (1983) Ilwaco Phase (A.D. 0 to 1775), and Ames and Maschner's (1999) Late Pacific Period (A.D. 200/500 to 1775), the period associated with the establishment of historically documented lifeways.

The site age as demonstrated by the radiocarbon dates is consistent with relative age estimates based on stylistically cross-dateable projectile points in so far as the projectile point styles found at 35TI90 are characteristically late prehistoric. Type 16 points are the single most common variety at the site. Pettigrew (1981:110) notes that in the Lower Columbia River valley this style was "apparently introduced and discontinued in a very short period of time around AD 700…. For a short time it becomes a major type, then disappears." Most of the other identifiable morphological types represented at 35TI90 (types 6b, 9, 10, and 14) are poor chronological indicators (Pettigrew 1981:109-110). It is perhaps noteworthy that several types that are typical of the latest period on prehistory in the Lower Columba River valley, from around A.D. 1250 to contact are not found at site 35TI90. These incudes types 12, 13, and 15 defined by Pettigrew (1981:110).

Two artifacts, Artifact 649 and 715, potentially suggest earlier use of the site. The first is a Cascade-like foliate point of a style that in western Oregon has been shown to generally predate 1750 B.P. (Toepel 1985). It was found near the base of the midden deposit in the South Area, a stratigraphic position that was radiocarbon dated 1290 + 40 B.P. (Beta 239538). This date suggests a much more recent age for the artifact but it cannot be precluded that it represents an earlier visit to the site area. The other potentially earlier point was found near the top of the cultural layer in the South Area. As found it is a near foliate-shaped biface but it has been extensively reworked. As was described above it may represent a found object that was recycled by the site occupants.

Although the exact timing for site abandonment is unclear, the cessation of use of the southern part of the site is clearly marked by a stratigraphic unit consisting of sediment deposited in a quiet water environment, which has been characterized as a slackwater deposit. No similar stratigraphic marker associated with site abandonment was noted in the North Area that is several feet in elevation above the South Area. To investigate possible sources for the slackwater sediment, AAR contracted Davis Geoarchaeological Research to examine the geological context of the site and model changes in the local hydrological environment related to earthquakes, coseismic subsidence, and tsunamis.

As described in Chapter 2, large earthquakes and subduction events have shaped and configured the Oregon coastline through differential subsidence, uplift, sedimentation, and erosion. One such event occurred in A.D. 1700 (Kelsey et al. 2006). The timing of the event is based on historical records from Japan where a tsunami came ashore in January of that year without an associated earthquake having traveled across the Pacific Ocean from the west coast of North America. The date falls within the date range for cessation of use of the southern part of the site as inferred from two radiocarbon dates and the lack of trade goods.

The A.D. 1700 tsunami was caused by an earthquake in the CSZ estimated at magnitude 8.7 to 9.2 (Atwater et al. 2005). With an accompanying subsidence of the local section of coastline on the order of .5 to 1 m related to this event (or other events), Tillamook Bay waters would have flowed inland as the bay moved to occupy the lowered ground (Davis and Jenevin 2008). With an expansion of Tillamook Bay, the point of entry of the Trask River into the bay would have been upstream from its historical location. As a result, the river would no longer be capable of moving its sediment load as far. Sediment would fall out of suspension farther upstream and aggrade to a point that ponding may have occurred as the river became less able to move the sediment through its channel.

Soil profiles in the South Area of the site exhibited no sedimentological features characteristic of tsunami deposits. However, in terms of its composition, the slackwater deposit is consistent with the type of sediment that would drop out of ponded water. The thickness of the deposit, up to 60 cm in places, indicates that it was not a transient event. The overall character of the slackwater deposit conforms well to one that would result from a submersion of part of the lower terrace related to coseimsic-related subsidence event. The chronological indicators from the South Area align well with the event known to have occurred in A.D. 1700.

The overrunning of parts of the site with water led to an immediate abandonment of those parts. It need not require abandonment of other parts that were elevated above the water. However, as a consequence of the bay becoming wider and deeper, established alluvial/estuarine relationship for Tillamook Bay would have been altered and existing ecosystems in and around the bay would have been disrupted. It can be speculated that the thickness of the slackwater deposits is an indication that the event was very disruptive to local environments. While the North Area was elevated above the effects of the marine transgression associated with the A.D. 1700 event, the habitats and microenvironments adjoining and near the site were severely disrupted and as a consequence use of the site for hunting, fishing and gathering activities likely became untenable. This appears to have resulted in abandonment of the entire site.

Over time, habitats recovered or new ones formed and biological communities became reestablished (Losey 2002:43-67). At some point, reoccupation of the site area may become viable but how soon after the water retreated from the lower terrace and how much before historical contact cannot be determined. In the South Area, there is no indication that the lower terrace was reoccupied after the slackwater deposit was laid down. No evidence for a proto-historic or early historical use of the site was noted in the North Area but the complete archaeological record in that part of the site was limited to a single QTU. Based on the available evidence, once the site was abandoned ca. A.D. 1700 it was not reoccupied.

The historical archaeological component at the site is not related to the Native American occupation and instead appears to represent a mixture of demolition debris and household refuse that most likely was dumped at the site but also a few items perhaps associated with the construction and operation of the original TWTP. The dateable objects included in the historic-era component were manufactured in the late nineteenth and the first three decades of the twentieth century. They do not date the disposal event.

Site Formation and Structure

This research topic is concerned with the cultural and non-cultural processes that formed the archaeological record at site 35TI90 and the patterns that can be elucidated from the distribution of artifacts and other cultural materials.

Formation Processes

In the most general terms, the archaeological record at site 35TI90 formed as a result of cultural deposition, a type of process that includes the disposal, abandonment, and loss of artifacts and other cultural materials. This process accounts for the movement of cultural materials from a systemic or behavioral context to an archaeological or environmental context (Schiffer 1982:47). The cultural deposition occurred within two environmental contexts and consequently, the cultural deposits in the South and North areas formed in quite different ways.

As suggested by sedimentological data, the archaeological deposits in the South Area formed as a result of regular and recurrent use of the lower terrace while it was still accreting. As indicted by the radiocarbon dates from that part of the site, the cultural deposits are stratified with the oldest deposit at the bottom of the cultural layer and the most recent deposits at its top. The earliest use of that part of the site appears to have been shortly after sediment began to accumulate on top of the sand and gravel layer, which is speculated to have been exhumed by river down cutting as might result from a shift in gradient or channel orientation. This was around 1,200 to 1,300 years ago. Following that, the lower terrace began to be used in a regular manner and the residues from occupation became incorporated into alluvium. The soil development in the A horizon indicates that at some point the lower terrace attained a height that was above the usual seasonal floods and sedimentation ceased or slowed dramatically so that soil development could begin. After that time, cultural refuse accumulated on the stable surface until part of the lower terrace was topped by slackwater.

The North Area of the site is on a second terrace that is several feet above the South Area. The upper terrace is presumed to have been stable for an extended period of time as suggested by the greater degree of soil development seen in soil profile there. The soil is described as having formed in “old alluvium” (Bowlsby and Swanson 1964:49). The relative age of the alluvium is not quantified, but the development of well-defined horizons in the sedimentary body suggests that the terrace tread was stable or mostly stable during the period of site occupation. Thus, while in the southern part of the site the cultural deposits are stratified with the oldest material at the base of the cultural deposit and the youngest at its top, in the North Area, refuse from all periods collected on a stable landsurface and in pits excavated into and below that surface. If the interpretation of the age of the North Area terrace is essentially correct, the cultural deposits there are a palimpsest formed by a combination of a very low rate of sedimentation and recurrent use of the locale.

In both areas, but more so in the North because of its longer period of stability, artifact transport by trampling and scuffage probably influenced the distribution of the artifacts, both horizontally and vertically. Trampling refers to the embedding of small artifacts in occupation surfaces as a result of foot traffic and scuffage refers to the horizontal displacement of discarded materials, usually larger objects, to peripheral areas of occupation surfaces by foot traffic (Schiffer 1988:126-129). In the North Area, the high porosity and low bulk density of the A horizon sediments would have facilitated the incorporation of objects discarded on the surface into the underlying sedimentary matrix. The same processes help to structure the archaeological record in the South Area, where the sediment was not as porous, but probably not to the same degree. In both areas other cultural processes, such as scavenging and recycling of older material by more recent site occupants might also have contributed to the mixing and redistribution of artifacts, but the effect of such events on the overall structure of the archaeological record was probably very minor.

Another cultural process that contributed to the formation of the archaeological record was plowing. Prior to the expansion and upgrade project, the North Area was an open pasture. While no distinct plowzone was noted in North Area soil profiles, it can reasonably be assumed that the fields were plowed in the past. Fields kept in pasture do not require tilling as often compared to those used for food crops. Tilling is mainly intended to aerate and loosen sediment and to control unwanted plant species. It also would have the effect of dislocating artifacts contained in the sediments. Studies of the effects of plowing on archaeological sites (Schiffer 1988:129-132) have shown that artifacts can be displaced and sorted by size from the surface to the depth of the plowing and displaced longitudinally (in the direction the plow is moving) but that side-to-side dispersion is typically minor. Before construction of the original TWTP, the South Area also was open pasture and may also have been plowed, although as in the north, no evidence for a plowzone was observed in soil profile. If the lower terrace was plowed in the past that activity probably had less an effect on the archaeological as in some parts of the South Area the cultural deposits were capped by a layer of slackwater deposits that was up to 60 cm thick. Where the slackwater deposit was absent or thin, the archaeological deposits would have been disturbed by plowing.

Once removed from the active cultural system and placed into the local environment, a wide variety of non-cultural site formation processes likely affected and shaped the archaeological record. Many of the processes occur and occurred at scales not visible to the investigators and have contributed to the formation of the archaeological record in ways that cannot readily be demonstrated. The most readily discernible process was the burrowing of fossorial mammals. Evidence for rodent burrowing was widespread in the North Area and that activity no doubt contributed to mixing of cultural deposits up and down in the soil body and to a lesser extent laterally. Rodent burrows were not commonly observed in the South Area.

Site Structure –Horizontal Patterning

The patterning discernible in the horizontal distribution of artifacts indicates that during the entire period of site use, the Trask River was the focal point of occupation. Archaeological material is concentrated within a zone about 20 m wide extending inland from the riverbank. Artifacts, other types of cultural material, and even features are found more than 20 m from the river, but overall, there is a substantial decrease in all data categories starting around 20 m from the river. Another pattern that persists in the archaeological record is the concentration of cultural features in the North Area. Excluding Feature 8 found during monitoring five of the six identified features were in the North Area (counting Features 2 and 4 as a single feature). Despite the exposure of more than twice the amount of site area, only one feature was found in the South Area during excavations. The distribution of features indicates that activities that involved hearths and possibly earth ovens were focused on the upper terrace. In turn, this may indicate that the North Area was the primary locus at the site for various domestic activities that involved fires that likely included basic cooking for everyday sustenance but also perhaps bulk processing or smoking of food resources for stores.

The concentration of the features at one end of the site can be used to infer that the upper terrace was the main occupation space. If this was the case, it can then be hypothesized that the South Area may represent where refuse from occupation accumulated. That is, if there was a formalized living space at the site, it may be matched with a formalized space for refuse disposal. Several lines of evidence were examined to test this hypothesis.

In each area, the cultural deposits can be considered a midden. Midden deposits are generally formed in one of two ways, either as incidental (de facto) refuse accumulated on an occupation surface, or as aggregates of secondary refuse that accumulated in specific areas of sites as a result of purposeful trash disposal away from the place of use (Schiffer 1987; Tani 1995; Wilson 1994). Aggregated secondary refuse middens indicate the presence of regularly maintained domestic spaces or activity areas that represent the source areas for the artifacts and other materials included in them. The aggregates also indicate a degree of refuse management that is suggestive of anticipated reuse of the site and also anticipated moderate- to long-term duration of site occupation (Kent 1992; Tani 1995).

De facto middens, on the other hand, represents incidental refuse that accumulated on an occupation surface rather than in specific areas located away from the place of use (Schiffer 1987; Tani 1995; Wilson 1994). De facto deposits suggest a low level of refuse management at the site. All things being equal, a low level of refuse management is more typical of short-term residential than long-term residential sites. At the latter, refuse accumulating underfoot becomes a hindrance and a higher degree of refuse management is expected in which middens, composed of secondary refuse aggregates, form outside of activity areas. At short-term residential sites, debris may be allowed to accumulate as long as it does not interfere with the job at hand.

All things being equal, middens composed of aggregated secondary refuse should include materials that hindered activities in occupation areas or were detrimental to the habitation environment. Such things might include the bulkier or larger debris from lithic manufactures, larger pieces of FCR, and waste parts from plant and animal resources used for every day subsistence and bulk processing.

To assess whether the South Area midden deposits represented a secondary refuse aggregate, the overall density of artifacts, of FCR, and of animal bone per cubic meter of excavated sediment was compared between the deposits and those in the North Area. The comparison did not support the hypotheses that the midden in the South Area contained aggregated secondary refuse. Instead, the cultural deposits in both areas of the site appear to represent de facto middens.

The comparison of overall artifact density was hampered by the incomplete archaeological recorded in the North Area owing to the removal of all or part of the A horizon during grading. Only QTU 2 contained a complete record of the cultural deposits in the North Area. The .25 m3 excavated from it is an exceedingly small sample to serve as the basis for making generalizations about the entire area. But on the basis of artifact recovery from the QTU, the North Area contained as many or more artifacts per cubic meter as did the South Area.

For the other comparisons, results from all unit excavations could be used although quantities of different classes of cultural materials are probably underestimated for the North Area. It was speculated that a secondary refuse aggregate would contain coarser debris compared to cultural deposits in regularly maintained activity areas. To compare the coarseness of cultural debris between the North and South areas, larger artifacts were identified. These included cores, choppers, hammerstones, net weight, pestle, and pounding stones. By volume, the North Area contained nearly twice as many of these types of artifacts than did the South Area. Thirty such objects were found in the North Area. Excluding the net weight collected from the graded surface, on average 7 such items were recovered per cubic meter of excavated sediment. In the South Area, 28 such items were recovered from 14.5 cubic meters of excavated cultural deposits, an average of 3.3 “large” artifacts/m3. The relative coarseness of debris between the two areas can also be assessed using FCR data. As reported above, not only did the North Area contain more FCR per cubic meter than the South Area, the average size of pieces of FCR in the former was larger than in the latter. Finally, the North Area contained more animal bone by volume than did the South Area.

The available data do not suggest that the midden in the South Area represents special use of that part of the site in a waste management system. Refuse appears to have accumulated in both site areas as a result of casual disposal practices. At the same time, the concentration of cultural features, FCR, and faunal material on the upper terrace do reflect differential use of space. At a minimum it appears that the North Area was the primary site locus for resource processing.

In considering how the South Area may have been used by the site occupants, it was hypothesized that because it was lower in elevation and allowed more direct access to the Trask River, the lower terrace may have been the central locus of fishing activities conducted at the site. Fish bone was well represented in the faunal assemblage and fishing appears to have been a major activity conducted at the site.

The evidence that the South Area was the main fishing locus at the site is weak. The one clear example of a net weight was found in the North Area and that same area contained much more fish bone that did the South Area, although this result may reflect a bias introduced by the processing of feature-related sediment through fine (ca. 1-mm) mesh. Also, the presence of more bone on the upper terrace does not preclude the lower terrace from having been the main fishing spot. In support of the hypothesis, it can be noted that all of the bone tools were found in the South Area. Five of the six bone artifacts are tips to objects that cannot be identified. It is very possible that they represent pieces of fishing equipment.

Although more FCR was found in the North Area it was also abundant in the South Area, where only one feature that may have been associated with the use of fire rocks was found. It seemed curious that if the FCR was not a byproduct of activities conducted on the lower terrace, that so much of it was found in that part of the site. It is possible that more fire-rock related features were present in the South Area but outside of the area investigated. While highly speculative, it is also possible that FCR was imported to that part of the site to be used to improve footing and to gain traction on the muddy riverbank. As the river was used for travel, for collecting drinking water, for personal grooming, and for fishing, it may have been desirable to have had an armored staging area for those activities.

Despite the obvious differences in use suggested by the concentration of features and other classes of cultural material in the North Area, in terms of function, the tool assemblages from the two site areas are substantially the same. In each area tools used in scraping tasks and cores are by far the most common tool types accounting for approximately 50 percent and 15 percent of the total recovered tools in each area, respectively. After this some variation is apparent, with the South Area having proportionally more projectile points and gravers and the North Area proportionally more hammerstones and preforms. All other tool types occur in extremely low frequencies. The differences among the less common artifact types is most likely a product of chance related to low frequencies rather than being indicative of behavioral difference.

Site Structure –Vertical Patterning

As suggested by the vertical distribution of artifacts in the South Area, use of the site through time appears to have waxed and waned. As was described above, the distribution curve for that part of the site is bimodal fashion with an extended right-hand tail. Everything else being equal, this suggests an initial period of low-intensity use during which a sparse amount of cultural material accumulated followed by a period of intense site use which was followed by an episode marked by a decrease in the amount of cultural refuse entering the archaeological record. Based on the stratigraphic position of the charcoal that produced the earliest radiocarbon date for the site, the decrease in refuse accumulation occurred after 1290 + 40 B.P. After the time during which refuse accumulated at a slower rate, intensive use of the lower terrace resumed and stayed that way until the site was abandoned. The stronger of the two distribution modes is at the top of the cultural deposit. This probably reflects the accumulation of cultural debris on the stable surface as opposed to the integration of debris within an accreting sedimentary body. A comparison of the cultural material above and below the valley between the two frequency spikes showed that the character of the archaeological deposits, in terms of raw material use, technologies represented by debitage, and functional tool forms, remains constant throughout, so whatever the cause of the break in refuse accumulation, it represented a minor event that appears to have had little effect on how the site was used.

Although the cultural deposits formed in very different ways, curiously, the vertical distribution of artifacts in the North Area is very similar to that in the South Area. In each area artifacts are concentrated in two places in the soil body separated by about 10 cm of sediment that contains noticeably fewer artifacts. In each area the second zone of artifact concentration begins in the same relative depth below surface as does the beginning of the decline in the quantity of cultural material. While this finding is curious it is believed to be fortuitous. The vertical artifact distribution curve in the North Area is based on the results of the excavation of one QTU and about .25 m3. It is not assumed that the extremely small sample would provide reliable results, even in the case that the upper terrace had an actively accreting surface. Given the sedimentological evidence that the upper terrace represented a stable surface, the similarity in the two distribution curves is not interpreted as meaningful.

Lithic Technological Systems

As noted in the research design presented in Chapter 5, aspects of lithic technology such as tool and toolkit design, manufacture staging, use, reuse, and discard are studied to gain insight into the human behaviors that produce the patterning in the archaeological record. These aspects of lithic technological systems are sensitive to and responsive to a wide variety of conditions including resource distribution, predictability and periodicity, mobility patterns, distance to raw material sources, and quality of raw material sources (Andrefsky 1994; Bamforth 1986, 1991; Kelly 1988; Knell 2004; Kuhn 1994; Nelson 1991; Pecora 2001; Shott 1986; Torrence 1983). Because of this, the information derived from the study of lithic artifacts can inform as to how on-site behaviors were linked to other aspects of the subsistence and settlement system of the site occupants. The discussion that follows is structured around the series of questions regarding technological organization outlined in Chapter 5.

A variety of lithic raw materials were recovered from site 35TI90. The most common was CCS, accounting for approximately 83 percent of the total recovered material. Volcanics contributed approximately 10 percent to the assemblage, obsidian and quartzite each less than two percent, sedimentary rock approximately one percent, and a variety of other, unidentified raw materials the remaining five percent. Cortical surfaces are present on approximately three percent of the recovered artifacts. CCS artifacts account for 61 percent of the cortical artifacts and exhibits both primary geological (64%) and incipient cone (36%) cortical surfaces, whereas volcanics account for 21 percent of the cortical artifacts among which incipient cone and primary geologic cortex are equally represented. This suggests that these materials were obtained from both alluvial and bedrock contexts. The low proportion of flakes or tools bearing cortical surfaces (ca. 3%), however, suggests that raw material, and CCS in particular, was likely transported to the site partially reduced rather than procured on-site or transported as unprepared nodules. Other raw materials, with the exception of obsidian, were likely obtained on-or near to the site.

Flintknapping activities represented in the 35TI90 debitage assemblage include all stages of reduction, from primary decortication to the completion or rejuvenation of formal tools. However, reduction activities appear to have varied by raw material with at least three identifiable strategies. The first is associated with obsidian for which technological debitage types are heavily weighted towards pressure flaking, likely associated with tool maintenance. This is a pattern commonly associated with high quality raw materials that have been transported long distances. Such is the case with obsidian, as discussed above. The second reduction strategy identified in the lithic debitage is associated with CCS and is strongly weighted towards later stage reduction, though with a significant proportion of biface thinning flakes. This signature is consistent with expectations for manufacture staging using a lithic material procured in the region but at some distance from the site. It is indicative of the transport of early stage bifaces or blanks to the site where they were further reduced into tools. The final reduction strategy is associated with the volcanics, quartzite, and sedimentary raw materials. These materials are associated with proportionally high early stage reduction flakes, particularly core reduction flakes. This indicates these materials were reduced from larger nodules or cores on site. Given the generally lower quality of these materials for chipped stone tool manufacture they likely represent materials obtained on site rather transported from another location. The inferences derived from these two reduction strategies are supported by the XRF results on the obsidian which indicated that the nearest source amongst the nine samples submitted is well over a hundred miles away in the Willamette Valley. No other known primary sources of obsidian or CCS occur locally in the area.

The debitage to tool ratio varied among the material types and tends to support the above findings. Quartzite, obsidian, and sedimentary materials had low ratios of 5.6:1, 6.3:1, and 8:1, respectively, and CCS and volcanics had ratios of 41:1 and 53:1, respectively. The low ratios for quartzite and sedimentary materials are likely due to the fact that these material types were not reduced to produce flake tools, whereas the low ratio for obsidian is likely due to the material being traded for and brought to the site as formed tools. The higher ratios for CCS and basalt suggest that these materials were being reduced on site for the manufacture and maintenance of tools. For the CCS, this ratio is similar to those from other sites in the region. But the ratio raises interesting questions for the volcanics. This toolstone category, which includes basalt, is represented in the tool assemblage by abraders, flaked cobbles, incised stone objects, metate, stone disks, edge pattered pebble, a utilized flake, and a piece esquille. Most of these tool categories are either not reductive, or minimally reductive, in manufacture. One interpretation is that the debitage represents the manufacture of tools that were used off site, or on another part of the site. The debitage could be from cobbles that were used for various purposes before being used as FCR, or perhaps the debitage represents spalls or other small, internal pieces of FCR that are difficult to distinguish from flakes.

The goal of lithic manufacturing activities appears to have been oriented towards the production of flakes intended for expedient on-site use, primarily for scraping wood or other hard material. Over half of all tools were used in tasks that involved scraping, either as a primary or secondary function (n=173, 51%). Implements used to scrape were found in several morphological-descriptive classes including bifaces, bifacially and unifacially marginally retouched flakes, utilized flakes, and cobble spalls. Many of the tools used in scraping tasks are notably heavy and bifacial but the majority of them are expedient flake tools formed on thin or relatively thin flakes. Based on morphological characteristics it is clear that some of these tools were hafted and others handheld. Within this latter category some tools would have been held with a power grip, utilizing the whole hand, while others would have been more suited to a precision grip utilizing primarily two to three fingers for tool manipulation. This is suggestive of a relatively wide range of scraping activities, from heavy duty manipulation of wood such as the shaping of stakes for weirs or drying racks to the manipulation of smaller elements of wood, bone, and antler such as would be incorporated into many forms of hunting and fishing gear. Usewear was consistent with working moderately hard to hard materials such as bone and wood, being characterized by multiple step and hinge fractures, heavy rounding, crushing, and polishing, as well as damage such as perverse fractures.

A second emphasis in lithic manufactures was the production of bifaces and other formed flake tools. A total of 51 non-projectile point bifaces were recovered from the site, 49 of which were made on CCS material. Of these, one was Stage 2, one Stage 2/3, 21 were Stage 3, 23 were stage 4, four were Stage 5, and one could not be classified. The prevalence of Stage 3 and Stage 4 bifaces is consistent with the CCS debitage assemblage, which indicates an emphasis on mid- to late stage tool production. However, a large number of cores (n = 58) were present on site, the vast majority of which were CCS. This is in contrast to a CCS assemblage which otherwise points to tool manufacture rather than core reduction. A total of 28 tools, a low overall incidence, showed signs of reworking or resharpening.

No specific observations were made regarding the occurrence of thermal alteration among technologically diagnostic flake types. However, thermal alteration was identified in expedient flake tools such as utilized flakes and marginally retouched tools, as well as cores and formally shaped bifaces and projectile points. This suggests that thermal alteration, assuming it represents intentional human behavior, occurred early in the reduction process, typically on cores or nodules of raw material rather than on blanks or preforms.

As regards on-site human activities, the tool assemblage is rich in terms of the diversity of tool types represented, but it is not very even. With the exception of cores and used flakes, which are numerous, most other tool types are represented by one or two examples. In terms of activity representation, lithic manufacturing is one of the most well represented activities in the stone tool assemblage, though it is overshadowed by a variety of scraping activities. These scraping activities range from the working of soft materials, possibly hide or soft woods, to the processing of harder wood, bone, and antler objects. There is a definite prevalence in the scraper assemblage for implements used in the working of these harder materials. These wood/bone scraping implements are complimented by a range of other tool types that are also indicative of wood and bone working. These include drills, piece esquilles, gravers, spokeshaves, and larger stone wedges. This range of tools is likely associated with the manufacture of gear required as part of the subsistence pursuits such as drying racks evidenced by other tool types. A variety of different primary subsistence activities are also represented, though mostly in small numbers. The metate and the pestle are both indicative of plant food processing while the net weight and possible net weight preform are indicative of fishing activities. The relatively numerous projectile points indicate that hunting was commonly conducted out of this site. The strong representation of arrowheads indicates bow and arrow technology was well established during the occupation of the site, however, no fragmentary arrow points were recovered that might indicate retooling after a hunting foray.

This tool assemblage is also noteworthy for certain categories of tools that are absent or present only in low numbers. For instance, relative to the amount of flintknapping debris, biface manufacturing rejects are rare. Similarly, notching flakes were well represented but few notched implements were found. Also, considering the abundance of fish and mammal remains recovered from the site, there are few tools such as knives that appear related to butchery or fish processing, although it may be that the bifaces/projectile points were used in these tasks. Sharp-edged flakes could have been the primary processing tools but no usewear was observed on flakes to suggest their use as knives. There are a couple possibilities that could explain this. First, with special regards to fish, it may be that soft fish flesh left minimal usewear on processing tools, thus they were not identified in the assemblage. Second, it may be that some other material such as shell was used to process fish.

In summary, the diverse lithic assemblage from site 35TI90 suggests lithic manufacturing activities were oriented primarily towards later stage reduction and the production of flakes for use as expedient tools. Both primary and secondary subsistence activities, including hunting, fishing, plant processing, and the manufacture of supporting gear were taking place based on the nature of the represented tool assemblage.

Subsistence and Season(s) of Site Use

Research questions related to the food quest and season(s) of site use were posed to consider the relative importance of terrestrial versus riverine food resources, the variety of resources captured or processed at the site, methods of processing and preparing foods, the seasons of the year the site was visited as part of subsistence practices and what the season(s) of use might tell us about late prehistoric settlement patterns.

Unfortunately, no strong indicators of season of site use were recovered. Season of use is commonly inferred from the remains of plants and animals found at a site. Only animal bone was found at 35TI90. Despite being common, the animal bone was in poor shape and identifiable only to the most general groupings. The bones provide few clues as to the time of year the site was used.

Over 900 bones from salmon or trout were found. Most species that the bone could represent are anadromous. Individuals of the species are born in fresh water, migrate to the sea, and return to fresh water to spawn. The timing of this cycle differs between species with major migrations occurring in each season of the year (Wydoski and Whitney 2003). Clara Pearson, a Nehalem Tillamook woman that was the source of most of the information from which Elizabeth Jacobs prepared her ethnography of that group (Jacobs 2003), mentions times of the years associated with major fisheries. Chinook were the focus of a fishery between August and September; “silvers” (coho) were caught in October, a run of chum salmon occurred in November, and steelhead were captured in December through April (Jacobs 2003:80). If the fish bone includes examples of each species mentioned, it would indicate use of the site during all of the months of the year except May, June, and July. Other fish remains were from a variety of sturgeon, a fish that was taken when encountered but which was not a targeted resource with a specific fishery.

A fragment of an atlas was identified as from an elk. Other bones unidentifiable to species or element are from elk-size mammals and tooth fragments may be from elk or other selendonts (deer, sheep, and cows). A tooth fragment, foot bone, and a vertebrae fragment are most likely from a deer and other bones unidentifiable to element exhibit a degree of robustness consistent with deer. Elk and deer were hunted year round but were in best condition in the fall. Ethnographic sources indicate that was the season of the main elk hunts (Jacobs 2003:75). At best, the deer and elk bones are other possible indicators of fall use of the site, although the animals may have been killed at other times of the year as well.

The one positively identified bird bone is from a pied-billed grebe, which is a permanent resident throughout Oregon wherever suitable water conditions are present. It could have been obtained during any season.

To summarize, no specific season of site use can be identified based on the faunal remains or any other class of cultural material recovered as part of the investigations. The archaeological evidence suggests that multiple subsistence-related activities occurred at the site that involved the capture and processing of riverine resources and terrestrial animals. Although details are lacking, the types of animals that were targeted were available at various time throughout the year. It is reasonable to assume that in obtaining the resources that the site likewise was used at different times of the year.

Site Function

Site function was inferred from the types of artifacts, faunal remains, and cultural features present at the site. The archaeological evidence suggests that the site was a resource procurement camp. Faunal remains indicate that the resources included at a minimum sturgeon, salmonids, elk, deer, pied-eye grebe, and heart cockle. Body part presentation indicates that for fish, deer, and elk, complete carcasses were processed at the site. The build-up of cultural debris at the site suggests that it was an important location and that it was used in a recurrent fashion over a period of perhaps 10 centuries.

The site dates to the period for which Tillamook ethnography provides suitable analogs for interpreting the archaeological record. Ethnographic sources indicates that after the breakup of the winter villages, families or other tasks groups moved about Tillamook territory to hunt, fish, gather, and process food to eat and to store for winter. The ethnographic sources do not provide detail on the accommodations used by the groups during these labors. Archaeological evidence suggests that many of the activities were centered on task-specific camps. This evidence in combination with ethnographic information has been used to develop regional models of late prehistoric settlement that were described in Chapter 4 (Lyman and Ross 1988; Minor 1983). Site 35TI90 is interpreted as a field camp but not a task-specific camp. It appears to have been used as a base of operations for fishing and hunting activities as well as for manufacturing industries in support of those activities.

In many regards, this interpretation of site function is not readily accounted for in the existing models of regional late prehistoric settlement. It does not compare well to any of the site types defined for Minor (1983) based on his work around the mouth of the Columbia River. It clearly is not a winter or summer village, as its lacks substantial architecture expected of a village site, and is just as clearly did not function as a shellfish gathering camp. A fourth site type defined by Minor (1983) included inland hunting and fishing camps. In functional terms the artifact assemblage from 35TI90 only partially overlaps with the characteristic one for that site type. Moreover, that variety of site is described as “temporary” and “occasionally occupied” (Minor 1983:206). Site 35TI90, in contrast, appears to have been regularly occupied, albeit most likely for short periods of time.

The site also does not particularly reflect any of the site types included in Lyman and Ross’ (1988:100-101) settlement model for their late littoral stage. Their model is ethnographic based and proposes a series of seasonal movements to resource camps focused on specific resources or sets of resources. It also does not describe a situation where a camp could be used for fishing and hunting of deer and elk, or for fishing at one time and hunting at another, as site 35TI90 appears to have been.

Our interpretation of the function of site 35TI90 is informed by the awareness that archaeological sites can serve different functions over time or at different times of the year (Binford 1983). In aggregate, the function of the site as a hunting and fishing base camp seems clear. However, over various temporal scales, site use may have been variable. At one time scale, such variability in site use may be related to shifts in settlement positioning or degradation of site environments. At a shorter time scale, shifts in site use could be related to convenience, proximity to resource patches, etc.

We imagine 35TI90 to have functioned in the manner of a secondary domestic site as that type of site is defined in the Portland Basin section of the Lower Columbia River valley (Dunnell et al. 1973). As described for the Portland Basin, secondary domestic sites were larger than task sites, and smaller than winter residential sites. They contain diverse artifact assemblages dominated by utilized or worked flake tools and abundant FCR (Dunnell et al. 1973:53); all traits shared by 35TI90. The appeal of this characterization is that it avoids pigeonholing the site into a static typology and it shifts attention from any specific inferred function or season of use and instead, emphasizes the domestic-residential nature of its use.

In terms of who resided the camp, it very probably was occupied by some segment of a nearby winter village. Two villages known from the ethnographic period were within a few miles of the site. The nearest one was located between Hoquarten Slough and the east bank of the Trask River and was called ‘Thu-qa-tən’ or ‘ Tow-er-quot-tons’ (Jacobs 2003:xxii; Sauter and Johnson 1974:iv).

Trade

The Tillamook participated in a wide ranging trade network and were included in the Greater Lower Columbia interaction sphere that connected peoples through economic and social ties that lived between the The Dalles in the Columbia River gorge to the Pacific Ocean, including the Oregon Coast from Alsea northward. Participation in the network facilitated marriage, gift exchange, socializing, resource sharing, conflict resolution, and trade (Hajda 1984; Seaburg and Miller 1990:561).

Little evidence for participation in trading networks was preserved at site 35TI90. This may be because many if not most items known ethnographically to have been traded into the region were food items or non-stone objects; goods that were not likely to be represented in the archaeological record, expect under very specific conditions promoting their preservation.

The only exotic objects found at the site were pieces of obsidian, which does not naturally occur anywhere along the northern Oregon coast. While direct procurement of obsidian cannot be ruled out, it seems unlikely. Therefore, all obsidian artifacts are considered to be indicative of trade. Interestingly, obsidian is not mentioned as a trade items in ethnohistorical or ethnographic sources (Hajda 1984; Jacobs 2003; Seaburg and Miller 1990) although archaeological data indicates that it flowed through exchange systems focused on the lower Columbia River for the past 9,000 years (Sobel 2006:165).

Obsidian at site 35TI90 was quite rare accounting for less than one half of one percent of the lithic artifact assemblage. The majority of the 45 pieces of obsidian (40 flakes and five tools) were under 1 cm in greatest dimension; only nine pieces were of adequate size to be analyzed to identify their geochemical source. As previously reported the pieces were identified as ultimately originating at the Glass Buttes 3 (n=2), Inman Creek A (n=2), Inman Creek B (n=2), and Obsidian Cliffs (n=2) sources areas. One other piece may have come from the Glass Buttes 7 source area.

The source areas suggest the occupants of site 35TI90 participated in a trade network with a reach that extended to the Western (Inman Creek A and B) and High Cascades (Obsidian Cliffs) and the High Lava Plains (Glass Buttes) of Oregon. However, pebbles and nodules of obsidian from the Western and High Cascades source areas are available closer to the site in the drainages of the Willamette and Siuslaw rivers. Acquisition of the secondarily deposited pebbles and nodules likely involved trade but the exchange was over shorter distances and may have included fewer intermediaries. If the obsidians were obtained at or nearer their source areas, an expanded trade system is expected. Likewise acquisition of the obsidian originating at the Glass Buttes 3 source and the piece that may be from the Glass Buttes 7 source involved movement over an extended distance and possibly many hands.

In both cases, the social and economic mechanisms facilitating trade were in place at least by the late prehistoric period. The main variables involving the acquisition of the obsidian include the direction of trade, the trade partners, and the number of intermediaries. If the Inman Creek and Obsidian Cliff obsidians used at the site were from secondary deposits in the Willamette Valley, they could have been obtained from Kalapuya groups that occupied the entire length of the Willamette Valley above the falls at modern-day Oregon City. Ethnohistoric sources describe that Tillamook and Kalpauya groups, specifically the Tualatin, were trading partners. The Tualatin resided in the northern part of the Willamette Valley due east of the Tillamook and are known to have traveled to the coast to trade and intermarry with the Tillamook (Seaburg and Miller 1990:560). These connections could provide a ready means of obtaining obsidian. If the Inman Creek and Obsidian Cliffs obsidians were obtained closer or at their geological source, it is likely that Kalapuyan groups were involved but the material may have exchanged several hands and may have been supplied by the Molala whose territory included the geological source areas.

The Inman Creek obsidians are also found in the Siuslaw River drainage (Minor et al. 2000) to the south of the site. If obtained from that area, their acquisitions may have involved the Alseans as intermediaries. The Alseans were the southern neighbors of the Tillamook. Their territory adjoined that of the Siuslaw to the south. The Alseans had close ties to both the Tillamook and Siuslaw as reflected in ethnographically-documented intermarriages and trading. The movement of obsidian northward along the coast could have been accommodated within the established social and economic ties.

The obsidian from Glass Buttes traveled a great distance from its source. In moving from the source area to site 35TI90 it was transported across physiographic provinces, mountain ranges, and language and cultural boundaries. Its acquisition almost certainly required several intermediaries or direct contact and interaction with people from outside the area.

There is no way with the available evidence to sort out whether acquisition of the varieties of obsidian found at the site involved local exchange with neighboring groups with whom the Tillamook had close relations, or participation in long-range trade networks that perhaps involved multiple exchanges. Its overall scarcity at the site suggests it was not strongly sought after or was very difficult to obtain.

Comparing the sources for obsidian recovered from 35TI90 with obsidian found at other coastal sites reveals an interesting, though not entirely unexpected, pattern. The results of the comparison are shown in Table 25. In the table, coastal or near-coast archaeological that have yielded obsidian that has been sourced are listed from north (top) to south (bottom) along the Y axis, while the identified obsidian sources are listed from north (left) to south (right) along the X axis. The table shows that the sites cluster into three nearly exclusive groups related to the varieties of obsidian at them. The northernmost sites predominantly contain obsidian from the northernmost source areas. Central coast sites tend to contain obsidians from centrally-located source areas and the southernmost sites mostly contain obsidian from the southernmost source areas, which include those in the Klamath Basin and in northern California.

This observation is based on a very small sample and does not control for time but it shows the proximal nature of obsidian use along the coast. That is, obsidian use in each part of the coast is strongly correlated with geographically parallel source areas. Interestingly, one of the more striking anomalies in the pattern is the presence of the Glass Buttes 3 obsidian at site 35TI90. It is the only north coast site at which the obsidian has been identified.

The zoomorphically shaped artifact was also considered as a possible imported object. Its provenance is difficult to assess. Its shape allows it to be characterized as stone sculpture and its size suggests portable art despite its apparent utilitarian function. Zoomorphic shaped or decorated stone objects, particularly clubs, have been fairly well-documented along the Pacific Coast (Ames 1991; Gould 1968; Leatherman and Krieger 1940; Keithahn 1962; Minor and Nelson 2004; Smith 1900). But in its decorative style, the piece from 35TI90 is unlike any club or other zoomorphic shaped or decorated objects documented for the lower Columbia River (Peterson 1978) and the Northwest Coast in general (Holm 1990). As such it is highly idiosyncratic. Nonetheless, it is made of local stone, thus, while it is certainly an exotic it does not necessary represent a trade item.

Table 25. Obsidian Sources found at Sites on the Oregon Coast

Site	Inman Creek	Obsidian Cliffs	Newberry Crater	Glass Buttes	Big Obsidian Flow	Silver Lake/ Sycan Marsh	N. California	Spodue Mountain	GF/LIW/RS	Grasshopper Group
Palmrose & Ave Q (Connolly 1992)		x								
35TI90 (this report)	x	x		x						
35LNC45 (Tasa and Connolly 1995)		x								
35LNC60 (Skinner and Rogers 1997)						x				
35LA25 (Minor et al. 1999)	x									
35DO130 (Skinner and Thatcher 2008)			x			x	x			
35DO83 (Skinner et al. 2008)				x		x				
35CU284 (Harris and Roulette 2011)								x	x	x
35CU268 (Roulette and McCormick 2011)					x	x		x		
35CU123 (Musil and Minor 1994)									x	

CHAPTER 9
SITE 35TI90 IN RELATION TO REGIONAL ARCHAEOLOGY

The intention of this chapter is to explore the significance of site 35TI90 in relation to regional archaeology. The role of 35TI90 in regional subsistence-settlement systems will be explored through a comparison to other known sites in the region, including those documented along Netarts, Nehalem, and Tillamook bays. Attention will be given to the presence/absence of feature types, to the species represented in faunal assemblages and their relative abundance, and to the ecological setting of sites to the extent that each of these variables is described in the archaeological literature. Tool data are excluded from this comparison because too few assemblages have been thoroughly analyzed and reported. The findings of these comparisons can then be used to establish similarities and differences between sites. This will help to establish the role of 35TI90 in regional settlement-subsistence systems and to evaluate settlement models presented in Chapter 4.

Comparison to Regional Archaeology

Quantitative comparisons between 35TI90 and other sites in the general vicinity including those on Tillamook, Nehalem, and Netarts bays and their respective tributaries are precluded for a variety of reasons. Foremost among these is the fact that very little professional work has been conducted in the region, resulting in nonsystematic sampling and artifact recovery and poor or incomplete documentation of recovered materials. The professional work that has been conducted has tended to focus efforts on detailed controlled excavation that result in high-quality data, but small overall excavated areas and resulting recovered assemblages (e.g., Losey 2002). Minor's (1991) work at the Nehalem Bay Dune site is an exception. Therefore, the following comparison is largely qualitative in nature and is based on the following sites: North Trail House site (35TI76), the Elk Meadow site (35TI77), Nehalem Bay Dune site (35TI57), and the Spruce Tree site (35TI75), all located on Nehalem Bay, the Netarts Sandspit Village (35TI1) located on Netarts Bay, and the Chishucks site (35TI2) and 35TI90, both located along tributary rivers of Tillamook Bay a short distance upstream from their confluences. Of these sites, North Trail House, Elk Meadow, Netarts Sandspit, and Chishucks have all been identified as village sites, while the remaining four sites have been identified as resource procurement sites. Due to a variety of sampling problems stemming from different excavation, analytic and reporting methodologies, not all of these sites can be used in each of the following comparisons. Current knowledge regarding these sites, with the exception of 35TI90 which is the subject of this report, is summarized in Chapter 4 and the data used in the following analyses are derived from the following sources: Collins (1953), Losey (2002), Minor (1991), Newman (1959), Sauter and Johnson (1974), and Woodward (1990).

Feature Comparison

A very basic examination of the types of features present at different sites in the region should provide important information regarding the nature of site occupations and the range of activities that were conducted at different site types. The assessment is clearly limited by a number of factors including the amount of excavation conducted at different sites, the sampling strategies employed, and differential visibility of features. For instance hearth features may be more readily identified than drying racks, which may only be preserved as several widely spaced postholes and thus be easily missed during excavation. Table 26 provides a summary of features identified at the seven sites in this comparison. Four basic types of features were identified at the seven sites in this comparison: house features, middens, hearths, and concentrations of FCR. Based on the presence and/or absence of feature types, the primary distinguishing difference between sites identified as villages and those identified as resource procurement camps is the presence of house structures in village sites.

Concentrations of FCR are present at all sites and even though hearth features are not identified at all sites, the presence of FCR is taken as indicative of the presence of hearths or similar features such as earth ovens which either went unidentified during excavation, were located outside of excavated portions

Table 26. Summary of Features Identified at Northern Oregon Sites

Site name	Site Type	FCR	Hearth	Midden	House Features
North Trail House	Village	X		X-NS	X
Elk Meadow	Village	X			X
Netarts Sandspit Village	Village	X	X	X	X
Chishucks	Village	X	X	X-S/NS	X
Nehalem Bay Dune	Resource camp	X		X-NS	
Spruce Tree	Resource camp	X			
35TI90	Resource camp	X	X	X-NS	

X = present; NS = Non-shell; S = shell; S/NS = stratified shell and non-shell.

of the sites, or which may have been eroded away such as appears to be the case with the Cronin Point site (see Losey 2002), not used in this comparison. Similarly, most of these sites have documented midden deposits, suggesting long-term repeated use of a location. By implication this indicates stability in landuse patterns over time.

Midden deposits were not identified at either the Elk Meadow site or the Spruce Tree site (Losey 2002; Woodward 1990). The absence of identified midden accumulation at the Elk Meadow house site is unusual since village or habitations tend to be associated with refuse build up. However, it is possible than any associated midden at this site has been eroded, given the documented proximity of the house feature to the zone of intertidal erosion (Woodward 1990). It is also possible that the site was not occupied long enough for substantial midden deposits to accumulate. The absence of identified midden deposits at the Spruce Tree site is also potentially related to the heavy erosional forces (Losey 2002). However, it does also suggest the possibility of a different kind of resource procurement site, one used less intensively or possibly for a shorter period of time, though this seems unlikely given the density of cultural materials recovered from the site.

Faunal Assemblage Comparison

The types and relative proportions of faunal species represented in the assemblages from these different sites can be expected to exhibit different characteristics based on site function and ecological setting. For instance, resource procurement sites are expected to have a narrow range of species represented with a clear focus on one or a few taxa which were targeted by human foragers. In contrast, village sites are expected to have a much broader array or possibly a more even representation of resources than resource procurement sites since many of the resources harvested at various locations throughout the year were transported to the village sites for consumption during the cold season. The specific species represented at each site should vary according to ecological setting as structured by variation in available habitat. This analysis is hindered to a certain degree by different levels of analysis which site assemblages have been subjected to, by differential preservation which limits the level of identification which can occur with some assemblages, and by methods of reporting which range from quantitative breakdowns to qualitative summaries. Due to limitations of available published data for many sites, faunal assemblage diversity will be limited to evaluating gross categories of taxa (i.e., ocean fishes, anadromous fishes, terrestrial mammal, sea mammals, birds, and shellfish) and abundances examined as relative proportions based on observations of the original excavators rather than as exact numerical counts. This is less than desirable for evaluating differences between village sites and resource procurement sites, where numerical abundances and differences in the range of specific species may be more important than general classes and relative proportions for understanding variations in settlement-subsistence systems. However, it is hoped that some insight can still be gained.

Before moving into comparative analysis of site assemblages, it is useful to examine basic underlying ecological conditions associated with Tillamook Bay, Nehalem Bay, and Netarts Bay as summarized by Losey (2002). Netarts Bay has no major freshwater tributaries. As a consequence of lacking freshwater tributaries, anadromous fish are rare in this bay. Being primarily ocean fed, Netarts Bay has an overall higher saline content than other bays in the region which promotes higher proportions of small marine fish such as surf perches and permits more saline tolerant invertebrate species to inhabit the bay waters. Netarts Bay has one of the most diverse invertebrate populations in northern Oregon. In contrast, Nehalem Bay is fed by a large river system. Consequently, the salinity levels in the bay are lower than at Netarts, discouraging large populations of marine fish and limiting the range of invertebrate species that can inhabit the bay. In fact, the only invertebrate species to occupy Nehalem Bay in any quantity is the soft shelled clam, which is an introduced species. The river system, however, provides necessary habitat for anadromous fish such as salmon. Tillamook Bay is similar to Nehalem Bay in that it is fed by extensive river systems, promoting anadromous fish habitat while depressing conditions favored by marine fishes. Invertebrates in Tillamook, however, are more common and diverse than those found in Nehalem Bay; though they are less diverse than those from Netarts Bay. Common species include cockles, butter clam, and gaper clam. Table 27 provides a summary of the availability of basic categories of aquatic resources at these three bays.

Based on this information, it is expected that faunal assemblages from archaeological sites on or near these bays should primarily reflect basic ecological conditions of their associated bay, but with diversity in taxa categories largely controlled by site type. Table 28 presents faunal assemblage information by site according to relative abundance ("+" indicates high abundance, "-" indicates low abundance) as presented in Losey (2002) and Woodward (1990). The Elk Meadow site is excluded from this analysis due to the presence of only a single identifiable bone. The data in this table indicate general support for the expectations outlined above. Beginning with issues of ecological constraints, the one site in this sample located on Netarts Bay, the Netarts Sandspit village, lacks salmon but has high proportions of ocean fish remains and shell species (Losey 2002). This resource pattern is consistent with observations on the ecology of Netarts bay outlined above.

Nehalem Bay sites, including North Trail House, Nehalem Bay Dune, and the Spruce Tree site, all exhibit high proportions of salmon bone in relation to other taxa, and very little to no shellfish or ocean fish (Losey 2002). Small amounts of mammal and bird also occur in these assemblages. Again, this pattern is consistent with the presence of fresh water tributaries on this bay that create habitat for anadromous fish coupled with the presence of poor shellfish and marine fish habitat.

Sites located in relation to Tillamook Bay include the Chishucks village site which, at the time of its occupation, was located at the confluence of the Wilson River and Tillamook Bay, and 35TI90 which is located on the banks of the Trask River upstream from its confluence with the bay. The Chishucks sites contains a stratified midden deposit that appears to document changing resource conditions at that location during the last 1,000 years (Woodward 1990). Though no quantitative information has been presented for this site, midden layer composition shifts over time from an early dominance of basket cockles, to heavy reliance on sea mussels, salmon, and both sea and land mammals, to an absence of shellfish entirely and an assemblage with high proportions of terrestrial mammal, bird, and salmon, and finally back to a resource profile indicative of estuarine conditions with high proportions of cockle, gaper clam, and butter clam and lesser amounts of salmon. In particular, this most recent layer is consistent with expectations for resource availability in Tillamook Bay outlined above with exploitation of shellfish and salmon and a lack of ocean fish. Despite the apparent changes in resource availability at or near this village, the location itself appears to have had more or less continuous use over approximately the last 600 years (Woodward 1990), suggesting very stable land use practices. It is unclear from currently available data whether the function of the site changed over time from a resource procurement camp to a village site or if it was maintained as a village site throughout its history.

Site 35TI90 has a faunal assemblage heavily weighted towards the exploitation of terrestrial mammals and salmonids. Birds and shellfish are extremely minor components to the assemblage. This resource profile is perhaps most indicative of the site location, upstream from the bay. Shellfish are not

Table 27. Common Resources in Netarts, Nehalem, and Tillamook Bays

Resource	Netarts	Nehalem	Tillamook
Marine fish	+	-	-
Anadromous fish	-	+	+
Invertebrates	+	-	+

+ = common/abundant; - = absent/uncommon

Table 28. Summary of Faunal Assemblages from Six Northern Oregon Sites

Site Name	Bay	Salmon	Ocean Fish	Shellfish	Deer/Elk	Bird
North Trail House	Nehalem	+	-	-	-	-
Netarts Sandspit Village	Netarts		+	+	-	-
Chishucks : Layer 4	Tillamook	-		+		
Chishucks : Layer 3	Tillamook	+			+	+
Chishucks : Layer 2	Tillamook	+		+	+	
Chishucks : Layer 1	Tillamook			+		
Nehalem Bay Dune	Nehalem	+		-	-	-
Spruce Tree	Nehalem	+			-	-
35TI90	Tillamook	+			+	-

+ = present in high proportions; - = present in low proportions; blank = absent or no mention in report

*Data derived from Losey (2002), Minor (1991), and Woodward (1990).

expected to have been abundant in this upstream location, but its position along the river would have provided access to salmon and deer and elk habitat.

The above findings demonstrate that ecological setting has a strong influence on the types of resources encountered in archaeological sites in the bay environments of northern Oregon. The next question is whether it is possible to effectively evaluate the effect of site type on faunal assemblage diversity against this backdrop of environmental constraint, with the expectation that village sites will have more diverse assemblages than resource procurement camps. In order to do this, we need to recognize that the different suite of resources available in each bay will affect the effective potential diversity of the faunal assemblages associated with sites in these different locations. For instance, Netarts Bay has a wide variety of ocean fishes available, whereas Nehalem and Tillamook Bays support large populations of anadromous fish, of which there are notably fewer species which are often simply identified as “salmon.” Similarly, the different bays support different shellfish populations, with Netarts Bay known for supporting one of the most diverse invertebrate faunal communities in the region and Nehalem Bay one of the most impoverished. This suggests that evaluation of faunal assemblage diversity between sites should occur between sites located within the same bay environment, since what constitutes a diverse assemblage in one ecological context may represent a comparatively impoverished assemblage in another ecological context. The ability to compare faunal assemblage diversity between sites is also hampered by differential preservation conditions between sites as well as different levels of analysis conducted on the assemblages. The best sites for use in this study include the North Trail House site, Netarts Sandspit village, Nehalem Bay Dune site, the Spruce Tree site, and 35TI90. Of these sites, the first two are village sites and the latter three resource procurement sites.

Table 29 provides a presence/absence account of identified species in the faunal assemblages from these five sites based on findings presented in Losey (2002) and Woodward (1990). Among the sites being compared there is a clear distinction between sites with a narrow resource spectrum (Spruce Tree and 35TI90) which have six or seven identified taxa and sites with much more diverse resource

Table 29. Presence/Absence of Identified Species from Select Northern Oregon Sites

Identified Species		Site				
		Netarts Sandspit	North Trail House	Nehalem Bay Dune	Spruce Tree	35TI90
Birds	Bird				x	
	Cormorant	X				
	Ducks	X	X	X		x
	Goose		X			
	Gulls	X				
Land Mammals	Land mammal				x	
	Beaver	X	X			X*
	Brown Bear		X			
	Canid	X				
	Deer	X	X	X		X
	Elk	X	X	X		X
	Hare	X		X		
	Mountain beaver		X			
	Mustelids	X		X		
Sea Mammals	Gray whale	X	X			
	Harbor seal	X				
	Land otter	X				
	Pinnipeds			X		
	Porpoise	X				
	Sea otter	X				
	Sea lion	X	X			
Fishes	Cod	X		X		
	Flatfishes	X		X		
	Hake	X				
	Herrings	X		X		
	Mackerals	X				
	Perches	X				
	Rockfishes	X				
	Salmonid	X	X	X	x	X
	Sculpins	X		X		
	Sturgeon					X
Shellfish	Barnacle		X	X	x	
	Bent nose clam	X	X			
	Blue clam	X				
	Butter clam	X				
	Cockle	X	X	X		X
	Crab				x	
	Gaper clam		X	X		
	Limpet		X			
	Littleneck clam		X			
	Mussel		X	X	x	
	Smooth WA clam		X			
	Thais snails		X			
Total		28	19	15	6	7

*species identification tentative

spectra, ranging between 15 and 28 identified taxa. Not surprisingly, perhaps, the Netarts Sandspit village has the most diverse faunal assemblage, with 28 identified taxa. This is clearly related to the ability of site occupants to utilize the wide array of ocean fishes and marine mammals. Surprisingly, given the known diversity of invertebrate species that inhabit Netarts Bay, only four shellfish taxa were identified. This site also has a fairly diverse array of terrestrial mammalian species which are likely indicative of off-site procurement at seasonal camps.

Three sites are represented from Nehalem Bay: the North Trail House village site and the Nehalem Bay Dune and Spruce Tree resource procurement sites. In a general sense, the North Trail House village site contains the most diverse faunal assemblage associated with Nehalem Bay (19 identified taxa), however, the Nehalem Bay Dune site is not notably different in terms of diversity with 15 identified taxa. This is surprising since this latter site is believed to represent a resource procurement site. In comparison, the North Trail House site has a greater than expected number of shellfish taxa whereas the Nehalem Bay Dune site has a greater than expected number of ocean fish taxa. This is possibly related to micro-environmental differences around Nehalem Bay. Spruce Tree site has only 6 identified taxa, clearly showing the narrow resource spectrum expected for a resource procurement camp. All of these sites, however, showed a clear emphasis on salmon (Table 28 above), the diversity in assemblage content relating primarily to supplementary resources.

The only site associated with Tillamook Bay for which data were sufficient for incorporation into this analysis is 35TI90, the Chishucks site being inadequately reported on. Site 35TI90 has a faunal assemblage reflective of utilization of a narrow resource spectrum, being dominated by salmon and deer/elk, with small amounts of bird and negligible amounts of shellfish. The high proportion of mammalian remains is unique among the resource procurement sites reviewed in this chapter, as most sites are dominated almost exclusively by salmon. This may be an attribute of resource procurement sites in up-river locations reflecting a zonal gradation of resource availability. More work in riverine settings is needed to evaluate this proposition. As a whole, this pattern fits expectations for a resource procurement camp set off the bay itself. If this site were on the bay a higher proportion of shellfish might be expected.

This comparison has also shown, based on the small sample available, that faunal assemblage diversity must be understood as a relative concept since different bay environments naturally produce different ranges of species. In keeping with this, the Netarts Sandspit village has a much higher faunal diversity than village sites located on other bays. Additionally, the data presented above tend to support the idea that different site types are associated with different ranges of diversity in faunal resources, with villages have the greatest species diversity and resource procurement sites the lowest. The Nehalem Bay Dune site is an exception to this pattern as it is interpreted as a resource procurement site but has a diversity of faunal material comparable to the North Trail House village site. One possible explanation for this is that this site is actually a village but was misidentified as a resource procurement site because no house structure features were encountered during excavation. It is also possible, if not more likely, that the data point to a variety of resource procurement camp types. Sites such as Spruce Tree may have only been occupied for a few weeks in the fall, during the salmon runs, whereas a site such as Nehalem Bay Dune may have been occupied multiple times throughout the year for the purpose of targeting different resources from that location as they became available. Regardless, this analysis has been based on extremely limited data and these findings should be considered tentative at best. Future work in the region should be designed to address some of these issues.

Models of Settlement Organization

Each of the archaeological sites compared above date within the last 1,000 years. Sites 35TI90 and Chishucks village (Woodward 1990) have occupations which appear to span this period, whereas the Nehalem Bay Dune site and the Netarts Sandspit village appear to have occupations concentrated between ca. 700 and 300 B.P. (Losey 2002; Minor 1991). The Spruce Tree site, North Trail House, and Elk

Meadows all appear to have been in use for relatively short periods before and after ca. 300 B.P. (Losey 2002). Archaeological findings for the Oregon coast, as well as for the Pacific Northwest Coast more broadly, indicate these site occupations fall within the period during which ethnographically described lifeways had been fundamentally established and that these sites all represent different aspects of a subsistence-settlement system which employed semi-permanent seasonal villages and a series of resource procurement sites located in different ecological contexts and which were occupied for short periods for the purpose of harvesting specific resources as they came into season. Two different models of human settlement organization based on ethnographic descriptions were presented in Chapter 4. These two models can be used to understand the role of site 35TI90 in local cultural systems.

The first model was proposed by Minor (1983). This model was intended to describe cultural systems operative in the Lower Columbia region, some 60 miles to the north of the Tillamook Bay area. The settlement system he described included four site types – winter villages, summer villages, shellfish-gathering camps, and hunting and fishing camps. Winter plank house villages were located in sheltered areas away from the Columbia River, and summer plank house villages were located along the mainstem Columbia River. Shellfish gathering camps were located near shellfish habitat, usually along the outer coast or along estuary margins, and were primarily occupied during the summer. Hunting and fishing camps were located in a variety of environments, often along small tributaries, and may have been used at any time of year. These sites may have served secondary functions for root/berry/plant gathering.

The second model, offered by Lyman and Ross (1988), was designed to explain settlement patterns specifically along the northern Oregon coast during the period from approximately 1500-300 B.P. This model also identifies four basic site types but differs from Minor’s in that only one type of village (winter) is recognized and resource procurement camps are typed according to season of use and resource targeted. Resource procurement sites in this model include spring/early summer hunting camps, spring/early summer shell midden camps, and late summer/fall salmon fishing camps. Winter villages were located along estuary or bay margins anywhere from the mouth to tidewater. By spring, the winter village population split up, and headed to smaller resource procurement camps, many on the outer coast at shell midden sites, or at hunting camps in the uplands. By mid to late summer, groups reassembled at fishing camps, where fish were caught, processed, and moved to the winter village for later consumption. These fishing camps may have been located very near to winter villages, but not necessarily.

Of these two models, Minor’s (1983) model for the Lower Columbia region appears to have the least relevance. To date all village sites that have been identified in the study region are located in areas predicted by Lyman and Ross’ (1988) model, being positioned along bay/estuary margins, rather than in riverine contexts. Similarly, there is no evidence currently available which indicates the use of both winter and summer village sites in the study region. It is recognized that the limited amount of archaeological work in the region may not have yet discovered alternate village locations; however it seems most likely that the bi-seasonal settlement pattern in use along the Lower Columbia was unique to that area. The Tillamook people who resided in the area of 35TI90 historically practiced a subsistence-settlement pattern that was more consistent with Lyman and Ross’ model. Therefore, Minor’s model will not be considered further here.

Regarding the village sites there is little to say except that they tend to support expectations from Lyman and Ross’ model. These sites are all located on bay margins and have preserved house features and deep midden deposits indicative of intensive use and reuse of these locations. These sites also tend to have more diverse faunal assemblages than resource procurement sites and exhibit a tendency towards greater evenness in species representation in so far as multiple species are noted as being abundant instead of being exclusively dominated by single taxa. This is consistent with a pattern of transporting resources harvested in other locations to a central village site. In this latter regard, the most recent midden layers at the Chishucks site are described as having large quantities of salmon, deer/elk, and birds and the Netarts Sandspit village has abundant ocean fish and shellfish remains. The North Trail House site, however, has a diverse assemblage but is recorded as being heavily dominated by salmon.

Regarding resource procurement sites, Lyman and Ross (1988) predicted three basic site types: spring/early summer hunting camps located in the uplands, spring/early summer shellfish camps located on the outer coast, and late summer/fall fishing camps on bays and lower stretches of rivers. In comparison to available ethnographic data, these site types do not necessarily encompass the full range of potential resource procurement site types produced by people living in the Tillamook Bay area. For instance, Jacobs (2003) documents among the Nehalem Tillamook early spring berry and plant shoot harvesting by small family groups, activities unlikely to leave a strong archaeological signature. In fact, if these camps occurred as independent site types they may not appear as anything more than a hearth and lithic scatter. During the late spring and early summer camas and other root harvesting camps were established in the uplands and fishing camps were established along rivers to take advantage of lamprey eel runs. In both cases, these activities are expected to be fairly visible archaeologically with root harvest grounds associated with numerous earth ovens and fishing camps with midden development related to fish processing. Mid- to late summer berrying camps could occur in just about any location from the sea shore to river and stream margins to upland forest meadows depending on the type of berry sought. These camps, as with the early spring plant harvesting camps are not expected to leave a prominent archaeological signature. The late summer and fall salmon fishing camps were common along bays and rivers. Jacobs (2003) also mentions larger organized elk hunting parties in the fall. Although no mention is made of the location of these hunts, elk habitually migrate to lower elevations during the fall and winter, thus it seems likely that these hunting camps would have been established on the coastal plain near freshwater sources such as streams or rivers.

The combined perspectives offered by Lyman and Ross (1988) and Jacobs (2003) suggest quite a diversity of potential resource procurement camp types associated with ethnographic Tillamook landuse practices ranging from exploitation of outer coast shellfish (and likely sea mammals) to exploitation of upland resources such as camas and ungulates. Clearly, the archaeological sites discussed above are not representative of the full range of these practices, but rather are more indicative of activities such as hunting and fishing that were centered on bays and rivers, the areas where archaeological research has focused to date. No evidence exists that would clearly associate any of these sites with targeted exploitation of plant resources.

The Nehalem Bay Dune site appears to represent resource procurement site located in a bay context. It differs from a village site in that it lacks identified residential structures. Similarly, the faunal assemblage from this site is diverse, containing salmon, deer, elk, pinniped, and a variety of small ocean fish and shellfish. However, there is a clear dominance of salmon in the assemblage, suggesting that the primary function of this site was as a late summer or fall salmon fishing camp. The other resources may indicate species taken on an encounter basis during the fishing season, or they may indicate shorter-term use of the site for different purposes during different seasons.

The Spruce Tree site, also located on Nehalem Bay, was more clearly a resource procurement camp targeted at the exploitation of salmon. The recovered faunal assemblage from this site was quite narrowly focused on salmon, though very small amounts of land mammal, bird, and shellfish were present. In this regard, the Spruce Tree site and the Nehalem Bay Dune site appear to have filled similar roles in the subsistence-settlement system of the area, being primarily salmon fishing camps in bay locations. The major difference between these sites is that the Nehalem Bay Dune site appears to have been better situated for the exploitation of additional resources, potentially leading to its use at other times of the year.

Site 35TI90 represents a different kind of procurement site from either of these other two sites. Located in a riverine context this site is outside of the expected range of village sites and the resource profile is extremely narrow. Both its location and resource profile are consistent with a procurement camp. However, the faunal assemblage contains significant quantities of both salmon and deer/elk bone, suggesting that the site functioned in multiple capacities; first as a fishing camp and later in the season as a hunting camp or that multiple activities were based out of this site simultaneously. In Chapter 8, 35TI90 was characterized as a secondary domestic site. This characterization facilitates the interpretation of the site as a base of operations for various hunting activities in a way that the Lyman and Ross (1988) model does not permit. It acknowledges that the activities represented archaeologically at the site may have been conducted simultaneously or consecutively, or during seasons or even different eras.

CHAPTER 10
SUMMARY AND CONCLUSIONS

The archaeological investigations described in this report were designed to assist the city of Tillamook in complying with the cultural resource protection requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulation 36 CFR 800, as they pertained to the TWTP expansion and upgrade project. The investigations included several phases of fieldwork conducted between 2007 and 2009 under three different archaeological excavation permits issued by the Oregon SHPO. Each phase of investigation was designed for a specific compliance purpose. The various phases and the specific purpose of each were summarized in Chapter 1. They followed an initial survey (Becker et al. 2007) that led to the identification of site 35TI90 in the expansion and upgrade project area. The first phases of fieldwork described in this report were conducted while a stop work order was in effect and later phases took place concurrent with expansion and upgrade construction activities.

Based on the results of the testing phase of investigation, site 35TI90 was recommended to be eligible for listing on the NRHP. Fieldwork showed that some parts of the site contained rich and dense cultural deposits, including features, that contributed to its NRHP eligibility, and that other parts contained sparse, non-contributory cultural deposits. The richest and densest cultural deposits were found within 20 m or so of the Trask River. The density and richness of the cultural deposits declined with increased distance from the river. A part of the site was used for staging activities during the expansion and upgrade project. It was graded and rocked before it was investigated. Removed were cultural deposits that likely would have contributed to the site's NRHP eligibility but also cultural deposits that likely would not have been contributory.

Three rounds of data recovery followed the evaluation/site damage assessment phase. The multiple phases of data recovery were necessitated by changes to the design of the expansion and upgrade project and the addition of new elements. Overlapping with the third round of data recovery was fieldwork conducted after a zoomorphic-decorated stone artifact was found during the excavation of a trench on the fully developed grounds of the TWTP. Construction-related earthmoving was monitored in between and overlapping with the other field investigations.

In all, 27.5 m^2 of site area were exposed and 23.09 m^3 of sediment were excavated during all phases of investigation (excluding monitoring the trench spoil processed following the inadvertent discovery). The investigations resulted in the recovery of 12,340 pieces of lithic debitage, 369 stone artifacts (includes 20 items classified as manuports), eight bone tools, 6,760 pieces of animal bone, and nearly 12,000 pieces of FCR. Eight prehistoric cultural features or possible features were identified, two of which upon analysis were combined. In addition, 23 items that are or may be historical were recovered during the excavations and 66 additional similar items were collected during monitoring.

As described in Chapter 7 and discussed in Chapter 8, the site contains fairly thick cultural deposits that suggest recurrent use of the locale over many centuries. Radiocarbon dates place the period of site use to between ca. 1300 and 250 B.P. The southern part of the site is located on a low terrace and the cultural deposits there were deposited concomitant with the accumulation of alluvium. The northern part of the site, in contrast, is located on a higher terrace that appears to have already been a stable landsurface when the site began to be used. In the southern part of the site the cultural deposits are stratified. In the northern part of the site they are not and instead the archaeological record is composed of a palimpsest representing multiple occupations. Despite the differences in formation, the cultural deposits in each part of the site are very similar in content and overall character with the most prominent difference being the concentration of cultural features in its northern part.

In Chapter 8 evidence was presented that suggests the site was abandoned following an earthquake and tsunami event known from historical sources to have occurred A.D. 1700. A layer of sediment that was deposited in a slackwater environment caps the cultural deposits in the lowest-lying parts of the site. The slackwater environment is interpreted as having been formed by the transgression of Tillamook Bay waters inland following coastal subsidence on the order of .5 to 1 m associated with a coseismic event. The timing of site abandonment as suggested by radiocarbon dates and the lack of European trade goods aligns fairly well with the known timing of the A.D. 1700 event. Once abandoned, the site does not seem to have been reused by the Tillamook. A historical component dates to the late nineteenth or early twentieth century and consists of demolition debris mixed with some household refuse that likely was dumped at the site and is not associated with its earlier occupation.

The quantity and quality of prehistoric cultural debris at the site suggests a strong pattern of persistence in landuse and basic economic systems over approximately 10 centuries. Preservation was generally poor and most recovered cultural material is of stone. Various types of stone were used in manufacturing of tools but most recovered artifacts are of various types of CCS rocks. The debitage from those materials represent all stages of manufacturing from primary decortication to the completion or rejuvenation of formal tools. Obsidian was rare at the site and reduction activities associated with that raw material were heavily weighted towards pressure flaking, likely associated with tool maintenance.

The goal of lithic manufacturing activities appears to have been the production of flakes intended for expedient on-site use, primarily for scraping activities. Based on usewear analyses, these activities involved all sorts of media, from soft materials, possibly hide or soft woods, to harder materials like wood, bone, and antler. Most scraping implements seem to have been used on the harder materials. The scraping tools were likely used in the manufacture of gear that supported the subsistence pursuits of the site occupants, which included primarily the hunting of land mammals and fishing. The processing of plant foods seems not to have been a major pursuit of the occupants while at the site.

The most unusual artifact found at the site was recovered by a backhoe operator while excavating a trench within the fully-developed grounds of the existing TWTP. It is a multi-use zoomorphic stone object made from a tabular sedimentary blank, probably shale. The object is in the shape of a club with a knob handle. The handle has been fashioned into the face and neck of some variety of animal, possibly a seal or an otter. Usewear analysis of all of the object’s surfaces suggest that one end and one side were used to abrade soft to moderately hard fine-grained materials, such as wood or bone. The object is unlike other zoomorphic shaped or decorated objects documented for the lower Columbia River (Peterson 1978) and the Northwest Coast in general (Holm 1990).

Due to project-related restrictions, most of the cultural features at the site could not be fully explored. Six of the seven identified features (this number counts Features 2 and 4 as a single feature) exhibited thermally altered sediment and relative concentrations of FCR and are interpreted as hearths or in one case a possible earth oven. These types of features would have been used for everyday cooking, heating, and lighting and also perhaps the bulk processing of meat or other food products.

Some clue as to the animals sought as prey by the site occupants is provided by the 6,000-plus pieces of animal bone found during the investigations. Fragments from fish and mammal bone dominate the faunal assemblage, which also include some bird bone and a few pieces of marine shellfish. Most of the bone could not be identified to the species level. Those that were identified represent sturgeon, elk, deer, and pied-billed grebe. Some shellfish was identified as from cockle. In addition, a few cow bones were found during monitoring but were not part of the archaeological deposit and shell from mussel and little neck clam were identified in Feature 8 but not formally analyzed as part of the faunal assemblage. Neither the faunal material, nor any other class of cultural material, permitted the season(s) of site use to be identified.

Based on all of the recovered evidence, site 35TI90 is interpreted as having functioned as a base camp for fishing and hunting activities and for the manufacture of equipment that supported those activities. As noted in Chapters 8 and 9, in many regards, this interpretation of site function is not readily accounted for in the existing models of regional late prehistoric settlement. In Chapter 8, 35TI90 is described as having functioned in the manner of a secondary domestic site as that type of site is defined by Dunnell et al. (1973). The appeal of this characterization is that it shifts attention from any specific inferred function or season of use, the basic building blocks of existing late prehistoric settlement and landuse models, and instead, emphasizes the domestic-residential nature of its use. This approach is preferred to avoid pigeonholing the site into a static typology and acknowledges that it likely served different functions over time or at different times of the year.

With this report and the placement of the artifacts, records and associated materials at the Oregon State Museum of Natural and Cultural History, and the zoomorphic-decorated artifact with the Confederated Tribes of Grand Ronde, the city of Tillamook has fulfilled the requirements of Section 106 as they relate to TWTP expansion and upgrade project. The investigations described in this report were spatially limited to the APE for that project. Much of site 35TI90 remains, especially along the bank of the Trask River. The remaining part of the site should be protected and not disturbed. Any future developments at the TWTP should be should be reviewed for their potential to disturb the site.

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