Supplemental Table 1. Stratigraphic Unit Descriptions and Interpretations.

TRENCH	STRATIGRAPHIC UNIT	DESCRIPTION AND INTERPRETATION (see Figs 5-12, Supplemental Figs. 4-31 and Supplemental Tables 2 and 3 for additional details).
East	1	Brown and light yellowish brown sand and sandy loam which may be part of a local tributary fan upon which Pueblo Bonito was built. We did not recover any artifacts from the exposed portion of this unit.
East	2	A complex of thick gray-brown sandy clay layers interpreted by Judd as an adobe bank, and which we conclude was constructed by mounding chunks of mud from valley floor overbank or flood deposits (Fig. 6). Judd used "adobe" to describe heavy clays that accumulated on the valley floor from overbank flooding, not in the sense of building material (Bryan 1954:24). The embankment contains very few artifacts and only minute amounts of charcoal, which seems consistent with water sources originating outside the canyon (see Love 1977, 1983). The feature began as a rough trapezoid ca. 5-6 m wide at the base, 2-3 m wide at the top, and 1.5 – 2 m high, then grew by additions (mainly on the south side) of short, thick layers until the base was 9-10 m wide and the top 4-5 m wide. It is possible that the embankment was raised as the channel on the north side filled in and water flows occurred at increasingly higher levels. A well-constructed masonry wall (ca. 1.0 m high) was built on top of the embankment, and water lain deposits (SU 4) on the north side accumulated against this stone barrier (Supplemental Fig. 4). A group of short, thick layers of sand, sandy loam, and sandy clay, some of which are yellow cross-bedded sands, and some of which are fine sands containing charcoal and scattered artifacts, comprise the south side of this unit (SU 2). The cross-bedded layers and abrupt vertical truncations in this part of the profile (between ca. 488N and 492N) indicate accumulation on the edge of an active stream, probably the edge of the aggrading Bonito paleo-channel, while other sediments suggest cultural deposition.
East	3	Thick structureless and cross-bedded sand layers and thin clay lenses. Judd (1964:Fig. 24) identified the edge of the "post-Bonito channel" in this unit (Supplemental Fig.29), although it is not clear whether Bryan (1954) agreed with this interpretation. A small channel containing large sandstone blocks near the top of the unit between ca. 488N and 490N is possibly a post-occupation feature, but unfortunately the upper portion of the trench in this area was heavily eroded after or during the NGS excavations, destroying vertical faces and leaving sloping deposits of backfill or slump, making it difficult to interpret this feature. Nevertheless, the cross-bedded layers are the result of flooding and we think this unit is most likely the northern edge of the aggrading Bonito paleo-channel.
East	4	Channel deposits north of the adobe embankment comprised of local yellow sands associated with relatively high energy flooding. On the basis of NGS maps (Judd 1964:Fig 24) we estimate the lowest elevation in the channel (which we did not reach) to be ca. 1865.35 mamsl. In the upper sections, a thick sand layer (ca. 80 cm) contains clasts (2-15 cm diam.) of laminated silts that were eroded and re-deposited from some other location, as well as clay chunks (1-10 cm diam.). This layer was produced by the last major flows confined to the upper south edge of what was originally a much larger channel (Supplemental Fig. 29). It is capped by a

		series of at least three sandy clay layers (ca. 10 cm thick each), fining upward, that rest against the masonry wall and mark a transition from channel deposition to the accumulation of unconsolidated midden. These uppermost layers contain clasts of silty clay (1-10 cm diam.) and sub-angular rocks (1-5 cm diam.) which may have been introduced with household debris while there was still moving water, resulting in fairly compact conformable contact boundaries. We did not observe any evidence in this part of the profile for an artificial surface or "cap," as suggested by Lekson (2007:39). A radiocarbon date of A.D. 1021 to 1048 (1 σ, calibrated) was obtained on a charred maize cob at the contact between midden and channel deposits (Supplemental Fig.4).
East	5	A mixture of fine sands containing high densities of charcoal and artifacts, including localized concentrations of burnt sandstone and building daub. Most of these layers were produced by discrete, repetitive dumping events that contained highly oxidized sediments exhibiting a range of vivid colors, particularly green, red and orange (Supplemental Fig. 7) that may be the byproduct of local ceramic production (see Kramer 1985). Boundaries between layers in this unit are undulating and deformed, reflecting a considerable amount of surface disturbance during or soon after deposition. The lowermost layers were introduced into standing or slow-moving water at the top of the canal fill. This is obviously the dense midden described by Judd for the upper portion (above the channels) of the East Mound (Supplemental Fig. 29).
East	6	Fine sand mixed with charcoal and artifacts. The unit is structureless and appears to be aeolian sediment and reworked midden that post-dates the 1920s excavation. In some parts of the profile, particularly at the south end of the trench, the original trench wall was so disturbed by cultural activity during or after the excavation that we were unable to discern any clear stratigraphic patterning and we simply recorded this section as an "Obscured Area" (Fig. 5).
Middle	1	Thick layers of brown sands and clays form a large and at least partially man-made bank. These jointed layers contained charcoal and small rocks (Supplemental Fig. 8), especially on the sloping south side, where the bank grades indistinctly into SU 4. The structure of the bank and constituent cultural material suggests human agency and therefore we infer that flood deposits were intentionally piled up to form an embankment.
Middle	2	Anthropogenic sediments with high densities of artifacts, charcoal, ash, burnt sandstone and intensely oxidized sediments that accumulated on the north side of SU 1 (Supplemental Fig. 9). These layers slope from the direction of Pueblo Bonito and were intentionally deposited in an active, though shallow channel.
Middle	3	Stratigraphic Unit 3 is a single thick layer of yellow sand containing abundant charcoal that originated on the upper part of SU 2 and covered the top of SU 1, sloping to the south where it forms a diffuse boundary with SU 4 (Supplemental Fig. 10). There are two ceramic types (Chaco Black-on-white and Hunter Corrugated) in this unit that point to a late 11th century or early 12th century A.D. date (Supplemental Table 5).
Middle	4	Sediments are similar or identical to Stratigraphic Unit 1, but have very few artifacts or charcoal. There is a

		moderately distinctive “wedge” of sandy/silt loam/clay containing a few thin clay lenses between 485N and 488N that indicates deposition on a slope. We interpret SU 4 as overbank deposits, probably associated with the edge of the aggrading Bonito paleo-channel. A thin compaction zone (4.5 cm) at the top of this group extends over most of the east face of the trench profile (including the north wall) and may represent cultural activity and/or standing water, although this is also where there was an historical footpath and steel track for mining carts used during excavations (the compaction was not evident in the west profile face). The compacted sediments create a confusing stratigraphic picture but it is possible that flooding over the two masonry walls produced the sediment in the uppermost part of this unit.
Middle	5	Fluvial sediments in the Bonito paleo-channel. The layers in the channel fill are mainly brownish yellow or yellowish brown thick cross-bedded fine sands, fining upward and capped by thin clay layers. Strata are relatively flat-lying near the bottom of the profile but slope up to the north near the top. There are at least four layers that include many large sandstone blocks, some clearly modified by flaking and pecking, that were placed in the channel while water was flowing, as evidenced by deformed sediments around the rocks, possibly in an effort to retard lateral cutting along the channel edge (Supplemental Fig. 5). The NGS trench did not reach the bottom of the channel, or extend south to the opposite edge, and consequently we were able to document only a small section, but it appears that the edge of the Bonito paleo-channel was very steep at this location, possibly analogous to a section described by Bryan (1954: Fig. 3) near Kin Kletso (Supplemental Fig. 31). Two masonry walls were built on the north side of the channel while it was aggrading (Supplemental Fig. 12). Steeply dipping cross-bedded sand layers accumulated against the south side of the north (older) wall, indicating that the wall was adjacent to an active channel and possibly within it. The south wall was more substantial than the former (although just 50 cm high today, it might have been taller), with a heavy clay foundation set between upright juniper posts on both sides that had been pushed into the wet channel sides and a rectangular trench excavated between them for the foundation clay (Supplemental Fig. 13). Large stones were used for the first course and narrower stones for the rest of the wall, forming a ledge similar to the one on the outside of the East Trench south retaining wall. Aggrading channel sediments stacked up against the south side of the younger wall and eventually valley flood deposits (SU 4) covered both walls, although the original excavations removed most fill between the walls, especially near the top of the trench, making it difficult to conclusively reconstruct this part of the profile. The north edge of the paleo-channel is beneath the two walls (Supplemental Fig. 31). Some researchers have described these walls as a “gate” complex between the two mounds, possibly associated with a road or pathway linking Pueblo Bonito to Casa Rinconda on the south side of the canyon

		(e.g., Stein, et al. 2007). This interpretation is inconsistent with stratigraphic data, as the walls were built in the aggrading edge of the paleo-channel and there is no indication in the channel fill for a "road" (there are also no signs of a road bed in banks of the modern Chaco Wash). In our view these masonry features were built in response to the paleo-channel, after it had destroyed part of the canal, either to retard further erosion and/or to divert overbank flooding away from the great house. The fact that the canal was intercepted by the paleo-channel in this location means that the canal was older.
Middle	6	A mix of churned and compacted aeolian sediments that cannot be dated but almost certainly represent reworking during the past century.
Middle	7	Fill in a shallow channel that probably formed late in the prehistoric occupation or during the historical period, with flows moving from east to west in front of Pueblo Bonito. This channel follows the same course as the earlier channel associated with SU 2, but is separated by SU 4 (Fig. 8).
Middle	8	A mix of churned and compacted aeolian sediment that cannot be dated but almost certainly represent reworking during the past century.
West	1	Brownish yellow sand capped by fine sands and clay layers. The color and texture of these alternating sand and clay strata indicate local sources and while there are trace amounts of charcoal, no artifacts were observed. This unit appears to be very similar to SU 1 in the East Mound trench (Fig. 5) and both appear to be have been truncated by north-sloping erosion before overlying units were deposited.
West	2	A series of sandy clay and sandy loam layers separated by thin clay layers that accumulated directly on SU 1. The uppermost section consisted of sandy loam reworked by wind. The strata slope down to the north and did not contain any visible cultural material or charcoal.
West	3	An entirely anthropogenic stack of thick layers of mixed clay and construction debris (rocks, sand lenses, large and small clumps of clay), charcoal and artifacts. We recognized a lower midden below ca. 97.0 m characterized by 20-30% rock by volume, and an upper midden exhibiting lower densities of rock, but higher densities of clay nodules (dense balls or large clumps formed by hand or dumped as basket loads) and artifacts (Supplemental Figs. 26, 27). There are discontinuous pockets of midden in SU 6 along the north edge, which seem to be a combination of sections slumping into the channel and digging by residents, possibly for construction material (Supplemental Figs. 22, 23).
West	4	Stratigraphic Unit 4 also rests directly on SU 1 and was exposed mainly between 468N and 470N, but extends further in each direction (Fig. 10). This group consists of yellowish brown sand clay loam and fine loam sand sediments in a well-consolidated matrix containing large clay nodules. Bedding forms platy structures that appear "muddy," much like (or even identical to) the adobe embankment in the East Trench. Artifacts and trace charcoal are present but there are no distinctive anthropogenic lenses. An intrusive pit contained a mix of small rocks, charcoal and sherds in a loose, brownish sandy loam that was capped with a thin layer of laminated sand. In his field notes, Judd referred to this pit as a "patch," suggesting an intentional repair but

		we found nothing to indicate a function for this feature, which nevertheless was certainly cultural. The ceramic assemblage is solidly 11th century A.D. (Supplemental Table 5). Based on Judd's more complete exposure of these layers (Supplemental Fig. 30), we think this is an artificial embankment, roughly trapezoidal, 4-5 m at the base and ca. 2 m high.
West	5	A group of a very thick, poorly-sorted layers comprised of fine and coarse sands containing lenses of gravel, moderately large rocks and distinctive "pockets" of laminated fine sand and silt on the south side of the embankment. These isolated pockets of bedded sand appear to be re-deposited remnants of flood deposits that were eroded by subsequent flows. Although the chunks of laminated sandy silt match similar isolates in the uppermost channel fill in the East Trench, the surrounding matrix is not well sorted and appears to be overbank deposition from the main floodplain and probably results from the same flooding that produced Stratigraphic Units 1 and 5 in the Middle Trench (which also contain some isolated pockets of laminated sand).
West	6a	There are least two channel fills and an un-used small canal in SU 6. The oldest channel fill (SU 6a) contains a series of alternating layers of laminated sands and finely laminated clay that reflect repeated flow events. The channel sequence contains anthropogenic layers of mostly brownish gray fine sands containing charcoal and artifacts. A radiocarbon date on a charred maize cob provides a terminus post quem date of AD 992 – 1043 (calibrated) at the base of these layers, which is consistent with the 11th century AD date range for ceramics in overlying layers that suggest deposition in the late AD 1000s (Supplemental Table 5). A concentration of rock near the top of these truncated layers appears to have been material introduced to the original channel by residents, possibly as armor for the base of the channel at that level (Supplemental Fig. 15). Judd described this rock layer as a fallen wall but it is sandwiched between low energy flood events and was originally placed in wet clay (sediments are visibly deformed around the individual rocks) and we believe it is similar to introduced rock layers in the East and Middle trenches. Stratigraphic Unit 6a was truncated by a later channel (SU 6b), and is therefore analogous to a buried terrace in a stream system. The lowest elevation in SU 6a is 1865.35 mamsl.
West	6b	Stratigraphic Unit 6b was confined to the northern half of the older channel. The base was lined with a considerable amount of cultural material, including large sandstone blocks (some worked), fragments of burnt daub, clay "nodules" and artifacts. Water flowed over and around this material, as indicated by finely laminated silts and clays encasing the uppermost rocks, but many of the sherds were still sooted and ashy, with sharp edges, and therefore had not been transported very far by water. The ceramics are distinctively stained orange, probably a result of iron oxides produced by stagnant water (see Huckleberry, Hayashida and Johnson 2012:501). Above this anthropogenic layer were a series of alternating fine sand and clay layers, the sand layers fining upward (Supplemental Figs. 17-23). Among these alternating layers were several thick strata of unconsolidated chunks of clay with distinctive rust coatings that were re-deposited by floods

		that eroded older clay beds somewhere upstream, similar to some deposits in SU 5 in the Middle Trench. Ceramics from SU 6b indicate the 11th century A.D., possibly the early 12th century given the presence of Nava Black-on-white in the rubble layer at the base of the channel (Supplemental Table 5).
West	6c	Stratigraphic Unit 6c encompasses a distinctive, carefully constructed U-shaped feature that may have been an un-utilized canal. The lowest stratum in this feature consists of mottled yellow-brown unconsolidated sand containing a mix of uncarbonized plant material (probably roots), root casts, small gravel, and artifacts. That layer was capped by a thin layer of gray-brown clay, which was in turn covered by a thick layer of reworked aeolian yellow-brown fine sand. The aeolian layer is capped by a thin gray clay layer that becomes a thick wedge on the south side in which a masonry feature was constructed (Supplemental Fig. 24). The entire fill of the feature is a massive, unstructured deposit consisting of brownish-gray fine sand containing large amounts of charcoal and numerous sherds. It appears that the feature was excavated and left open briefly, allowing some organic debris to accumulate along the bottom, then the retaining wall was built and the base of the feature intentionally lined with dense, hard-packed clay. If this feature was intended to be a canal, it was not used as such and it became a trash dump, or the edges of the growing mound simply spread into it.
West	7	A series of water lain sands and sandy clay deposits that covered the top of SU 6b and interfaces with SU 6c. Small, superimposed rivulets occurred along the north side of this unit, adjacent to the midden that constituted the West Mound (Supplemental Fig. 25). The midden edge (SU 3) is nearly vertical and must have been cut back intentionally by residents to accommodate flows in the rivulets. We think SU 7 was produced by valley floods, similar to those that created SU 4 in the Middle Trench. The apparent relationship to SU 6c indicates that the small unused canal was built during a period of valley flooding but filled during some interval between water spreading events. However, key parts of the stratigraphic sequence are obscured and this interpretation may be incorrect.
West	8	A series of relatively undifferentiated aeolian fine sand layers (SU 8) covered the entire length of the reopened trench. These probably represent slope creep as well as windblown sediments and we assume that they have been extensively reworked, even though the present surface elevations are almost the same as those mapped in 1925. This area was heavily impacted historically (it was under the original NPS Visitor Center maintenance yard until the 1950s) and we were unable to identify any clearly undisturbed sediments near the top of the trench between 470N and 474.5N (Fig. 10).

REFERENCES CITED

Bryan, Kirk

1954 *The Geology of Chaco Canyon, New Mexico, in Relation to the Life and Remains of the Prehistoric Peoples of Pueblo Bonito*. Smithsonian Miscellaneous Collections, Vol. 122, No. 7. Washington, D.C.

Judd, Neil M.

1964 *The Architecture of Pueblo Bonito*. Smithsonian Miscellaneous Collections Vol. 147, No. 1. Smithsonian Institution, Washington, D.C.

Love, David W.

1977 Dynamics of Sedimentation and Geomorphic History of Chaco Canyon National Monument, New Mexico. In *New Mexico Geological Society 28th Field Conference Guidebook*, edited by J.E. Fassett and H. L. James, pp. 291-308. New Mexico Geological Society, Socorro, New Mexico.

1983 Quaternary Facies in Chaco Canyon and Their Implications for Geomorphic-Sedimentologic Models. In *Chaco Canyon Country: American Geomorphological Field Group Field Trip Guidebook*, edited by Steven Wells, David E. Love and T. W. Gardner, pp. 195-206. New Mexico Geological Society, Albuquerque, New Mexico.

Stein, John, Richard Friedman, Taft Blackhorse, and Richard Loose

2007 Revisiting Downtown Chaco. In *The Architecture of Chaco Canyon*, edited by Stephen H. Lekson, pp. 199-224. University of Utah Press, Salt Lake City.

Huckleberry, Gary, Frances Hayashida, and Jack Johnson

2012 New Insights into the Evolution of an Intervalley Prehistoric Irrigation Canal System, North Coastal Peru. *Geoarchaeology: An International Journal* 27:492-520.