

Impacts of Oil and Gas Drilling on Viewscapes and Soundscapes at the Chaco Outlier of Pierre's, San Juan County, New Mexico

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INTRODUCTION

The National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) stipulate that Federal agencies take into account not only direct but also indirect and cumulative impacts when contemplating energy development. Oil and gas production in the Mancos Shale of northwest New Mexico are creating indirect and cumulative impacts to the archaeological and cultural heritage of the ancient Chacoan landscape. The Chaco Culture National Historical Park and its outlying Chaco Protection Sites are recognized as a UNESCO World Heritage Site. Archaeological investigations indicate that viewscapes and soundscapes were integral to Chacoan life a millennium ago, yet we are only beginning to study these less tangible dimensions of the Chacoan polity. Piecemeal cultural resource management practices do little to help manage or protect less quantifiable dimensions of the landscape, such as viewscapes and soundscapes. In November 2016, I visited the Pierre's Chacoan outlier, which is protected from development as part of the Chaco Protection Sites, to assess the impact of oil and gas production in the surrounding area on the viewshed and soundscapes of the community. In the following paper, I report on the results of this investigation. I then recommend some future actions for the BLM and BIA to avoid repeating and amplifying the problems described herein.

My investigation, reported here, indicates that although the BLM has taken care not to place drill rigs on top of surface archaeological sites, there are major indirect and cumulative impacts to the resources – specifically, to the viewscapes and soundscapes. Sadly, rather than a sacred landscape and part of a UNESCO World Heritage Site, the Pierre's community today resembles an industrial park. I urge the Bureau of Land Management and the Bureau of Indian Affairs to develop specific guidelines and criteria for mitigating the indirect and cumulative impacts of oil and gas production on viewscapes and soundscapes. Future leasing should not proceed without development of a Master Leasing Plan that takes viewscapes and soundscapes into account. Ideally, such a plan would involve Class III survey at a landscape level across the potentially affected areas, and avoidance or better mitigation of indirect and cumulative impacts.

VIEWSCAPES AND SOUNDSCAPES IN ARCHAEOLOGY

The sense of sight is fundamental to human learning, navigation, and being in the world. Phenomenologists, landscape archaeologists, and GIS-based scholars are among those interested in the study of visibility — who can see whom, and what can be seen — on the ancient landscape. GIS databases and software are excellent tools for examining and modeling visible connections over large areas (e.g., Bernardini et al. 2013; Bernardini and Peeples 2015;

Connolly and Lake 2006; Fisher et al. 1997; Johnson 2003; Lake 2007; Llobera 1996, 2003, 2007; Waldron and Abrams 1999; Wheatley 1995; Wheatley and Gillings 2002). GIS-based visibility studies usually focus on determining lines-of-sight (the reciprocal ability of people at two locations to see one another), viewsheds (the surrounding terrain and features that can be seen from a single location), and viewnets (networks of locations connected by lines-of-sight). However, GIS cannot tell us whether visibility was meaningful (Fitzjohn 2007; Frieman and Gillings 2007; Hacıgüzeller 2012; Llobera 2007). Although remote aerial data can be useful, archaeologists are ultimately interested in what ancient peoples could see from a human perspective. Thus, there is no substitute for on-the-ground field-based phenomenological investigations focused on viewsapes, or what can be seen by the human eye from a specific location. Phenomenologically-oriented archaeologists have long focused on the visual dimensions of past places (e.g., Barrett and Ko 2009; Brück 2005; Cummings et al. 2002; Cummings and Whittle 2004; Day 2013; Hamilton and Whitehouse 2006; Scarre 2002; Tilley 1994, 2004, 2008, 2010; Van Dyke 2007).

The study of ancient soundscapes is in its infancy (Scarre and Lawson 2006). Recently archaeologists have begun looking seriously at soundscapes, as evidenced by a recent issue of *World Archaeology* (Schofield 2014). We can define a soundscape as “any sonic environment, with particular emphasis on the way it is perceived and understood by an individual or by a society” (Truax in Elliot and Hughes 2014:306). Working in Upper Paleolithic caves, Till (2014) argues that it is important to consider what he terms the “acoustic ecology” of an archaeological site. However, it is particularly challenging to study archaeo-acoustics in open-air sites (D’Errico and Lawson 2006).

VIEWSCAPES AND SOUNDSCAPES AT CHACO

The Chaco phenomenon of northwestern New Mexico in the American Southwest is centered on, but not limited to, Chaco Culture National Historical Park. Chaco Canyon was materially connected with outlying regions through architecture, artifacts, and roads. Between A.D. 850 and 1150, inhabitants developed Chaco Canyon into a focal point for ritual, political, and economic activities that brought together people from diverse outlying settlements. The human eye can see for great distances on this horizontal, high desert terrain, which is punctuated by landmarks such as mountain peaks and mesas. Contemporary descendant communities are concerned with visibility, and archaeological evidence suggests these concerns are of great antiquity.

In the American Southwest, many high places are visible and intervisible by virtue of the elevated topography and the open skies. For Navajo and Pueblo peoples past and present, prominent visual landmarks help with wayfaring and contribute to the creation of a sense of community (Bernardini and Peeples 2015). Oddly shaped mountain peaks, buttes, and volcanic plugs figure prominently in oral histories (Duwe 2011; Fowles 2009; Kelley and Francis 1994; Linford 2000; McPherson 1992, 2001; Ortiz 1969, 1972). It is likely that intervisibility helped weave together the fabric of the Chacoan world (Van Dyke et al. 2016).

The Chaco phenomenon is characterized by highly visible, monumental structures called great houses, which are often, but not always, situated on high places. During the Classic and Late Bonito phases, builders often positioned outlier great houses in highly visible locations on

elevated terrain, at mesa edges, or teetering precipitously atop badland spires. For example, builders erected the Guadalupe great house on an isolated sandstone butte high above the Rio Puerco of the East, approximately 90 km southeast of Chaco Canyon (Baker 1983; Baker and Durand 2003; Pippin 1987). Although only one story high, the great house commands a 360° view of the surrounding terrain, including Cabezón Peak, and sits above a community of 30–40 small sites on the valley floor.

Archaeologists also have documented a range of smaller features — shrines, stone circles, herraduras, and cairns — that often were sited deliberately in locations of high visibility. In a recent study, Van Dyke et al. (2016) used GIS-based viewshed and viewnet analyses to argue that great houses on high places create an intervisible network centered on Chaco Canyon, and that shrines and related features play a role in creating this network. However, our study is incomplete, as many areas of the San Juan Basin that are likely to contain shrines on high places have not been systematically investigated.

There are many possible reasons why Chacoans placed architectural features on high places, and these are not necessarily mutually exclusive. People standing on these locations may have intended *to see* (as in surveillance). They also may have intended *to be seen* (as in signaling group membership or political authority) by the surrounding community. And, people may have been working to facilitate visual communication within communities, as well as between communities and Chaco Canyon. In a few cases where fine-grained outlier community data are present, scholars have employed GIS line-of-sight and viewshed analyses in attempts to untangle these issues, but results are mixed and contradictory (see for example Dungan 2009; Ellenberger 2012; Hayes and Windes 1975:154–155; Kantner and Hobgood 2003; Robinson et al. 2007). Surveillance, communication, and a shared sense of identity are three possible reasons for local outlier great house visibility, and each has different implications for the nature of the Chacoan polity. As noted in the White Paper (Van Dyke, Heitman, and Lekson 2016), at present we lack the high-resolution outlier community data that would be necessary to continue to evaluate these hypotheses. Clearly, more work is needed, in more outlier communities, to evaluate how these processes unfolded across time and space. The answers have implications for our understanding of the nature of the Chacoan sociopolitical system.

Few scholars have attempted to study acoustics in Chacoan communities. Stein et al. (2007) conducted experiments in central Chaco Canyon and determined that the north canyon walls are excellent conductors of reverberative sounds such as whistlers and drums. Weiner (2015) suggests that bells, rattles and drums could have been particularly important for ceremonies and processions in Chaco Canyon. Archaeoacoustics in Chacoan communities, however, remain even more woefully understudied than viewsheds, viewscales and visibility.

Clearly, viewsheds, viewscales and soundscapes are potentially important lines of evidence that may have much to contribute to our understanding of the Chacoan past. However, because these kinds of studies are relatively new in archaeology, we lack robust legislation to help landowners and agencies figure out how to evaluate, study, and mitigate potentially damaging effects from oil and gas drilling or other types of destructive development. Nonetheless, NEPA stipulates that Federal agencies take into account the indirect and cumulative effects that such development has on the landscape. I turn now to a case study — the Pierre’s Chacoan community — to illustrate the kinds of impacts and damage that ensues

when drilling has proceeded in the absence of a Master Leasing Plan, and without due attention to indirect and cumulative effects.

PIERRE'S OUTLIER

The Chacoan outlier of Pierre's is situated 19 km north of Chaco Culture National Historical Park, on the southern edge of the break between the Chaco Slope and the mesas and badlands of the Denazin and Ah-shi-sle-pah Washes on the USGS 7.5' Pueblo Bonito NW quadrangle. The outlier is clearly articulated with the Great North Road, which leaves the vicinity of Pueblo Alto and, in a series of stages, heads north to Kutz Canyon, 50.5 km distant (Figure 1 – Map forthcoming). Powers et al. (1983:94-122) and Harper et al. (1988) both conducted intensive survey and recording in the Pierre's community during the 1980s. The community was also investigated by the Chaco Roads Project (Stein 1983:8-7 - 8-9) and the Solstice Project (Marshall and Sofaer 1988). The Pierre's community is spatially distributed over an area of approximately 1.6 sq km. Powers et al. documented 17 Ancient Pueblo sites in the surrounding community, and Harper et al. added an additional nine. All but one small Basketmaker III - Pueblo I artifact scatter date from the Late Pueblo II or Early Pueblo III period.

There are several Bonito style structures in the community. The "Acropolis" cluster consists of two core-and-veneer structures (LA 16509, House A and LA 16508, House B) atop a large butte near the center of the community. House A contains an estimated 15 ground floor rooms and 3 enclosed kivas over an area of 255 sq m. House B is located 30 m to the north/northeast of LA 16509. House B contains an estimated 13 ground floor rooms and a single enclosed kiva and covers 315 sq m. An additional structure, House C (LA 35423), is an isolated room located approximately 5 m northwest of LA 16509; although the room was given a separate site number by the Chaco Roads Project, Harper et al. (1988:119) contend that House C should be considered part of LA 16508.

"El Faro," or "The Lighthouse," consists of a pinnacle on the valley floor that is topped by a small, 3- room structure including an exposed hearth (LA 16514, Powers et al.'s P-5). At the base of this pinnacle, there is another massive core-and-veneer building covering 505 sq m, estimated to contain 18 rooms and one enclosed kiva (LA 16515, Powers et al.'s P-6). A neighboring pinnacle 80 m ESE of El Faro hosts at least two small roomblocks, LA 16518 (P-9) and LA 16519 (P-10). LA 16519 is situated directly on top of this second pinnacle and might be considered to represent an "atalaya" or watchtower, following Marshall and Sofaer (1988).

There is little doubt among Chacoan researchers that the Pierre's complex is a ritual landscape, situated here because of its visibility and position vis à vis the Great North Road. Stein (1983) traced the North Road to within 300 m of El Faro, and all previous researchers consider enclosures on the south side of El Faro as potentially road related. It is logical for Chacoans to have positioned a major site complex in this location, because this is the first major topographic break in the landscape moving north from Chaco Canyon. The pinnacles and butte of Pierre's are visible from Pueblo Alto, and vice versa. Chacoans likely engineered road segments using backsights, and they could have oriented buildings and roads to the sun with a simple gnomon device (Lekson 1999). However, road construction would have required a clear line of sight, as is possible between Pierre's and Pueblo Alto. Gwinn Vivian and Doug Palmer have conducted experiments with mirrors flashed in the sunlight to establish line-of-sight connections between Pierre's and the canyon great houses of Pueblo Alto and Tsin Kletsin. I participated in one of these experiments in September 2015. The hearths atop the two pinnacles (El Faro, LA 16514, and the atalaya, LA 16519) suggest that the Chacoans were, indeed, interested in signaling between

these locations. Looking north along the Great North Road past Pierre's the next topographic break is Carson Divide (Marshall and Sofaer 1988) which is also topped by a potential signaling feature. Where great house communities are situated along engineered Chacoan road segments, it is likely that localized ritual processions may have taken place. Marshall (1997), for example, suggests that Chacoans processed north along the Great North Road to deposit vessels (and perhaps, symbolically, the dead) in Kutz Canyon. Such possibilities are understudied and could benefit from experimental reconstruction.

The importance of the Pierre's landscape for the Chaco phenomenon has been recognized for 35 years. When Chaco Culture National Historical Park was created on December 19, 1980 (PL 96-550 Title V), the legislation also included "Thirty-three outlying sites ... hereby designated 'Chaco Culture Archaeological Protection Sites'" (Sec 502b), recognizing "...the potential for conflicts between resource preservation and energy development" (JMP 1983:1). The Protection Sites are jointly administered under a Joint Management Plan (hereafter, JMP) by Federal and State agencies and the Navajo Nation (JMP 1983, amended 1990). On December 8, 1987 Chaco was accepted and inscribed on UNESCO's World Heritage List. The World Heritage listing acknowledged the geographic scale of ancient Chaco by including some Protection Sites, including Pierre's. Both the JMP and the World Heritage listing noted the potential for future conflicts between energy development and site protection. Sadly, such conflicts are much in evidence on the Pierre's landscape, as I will demonstrate in what follows. A pumpjack, Dugan Production Corp Hoss Com #95, is located just outside the Pierre's community only 650 m southwest of the butte, and the noise of this machinery is audible within the outlier community.

METHODS

Any assessment of the visual and aural nature of an archaeological site must incorporate an element of direct human observation. I visited the Pierre's community on November 25, 2016 – a cold, clear, sunny, late autumn day. Because the Pierre's sites – particularly LA 16509 (House A), LA 16508 (House B), LA 16514 (El Faro), and LA 16519 (the atalaya) – are very likely to be significant in terms of visibility along the Chacoan road, I chose these 4 locations for 360 degree viewscape investigation. I also included LA 16515, the large Bonito style structure at the base of El Faro on the basin floor. Each of my 5 viewscape locations is found on this map (Figure 2).

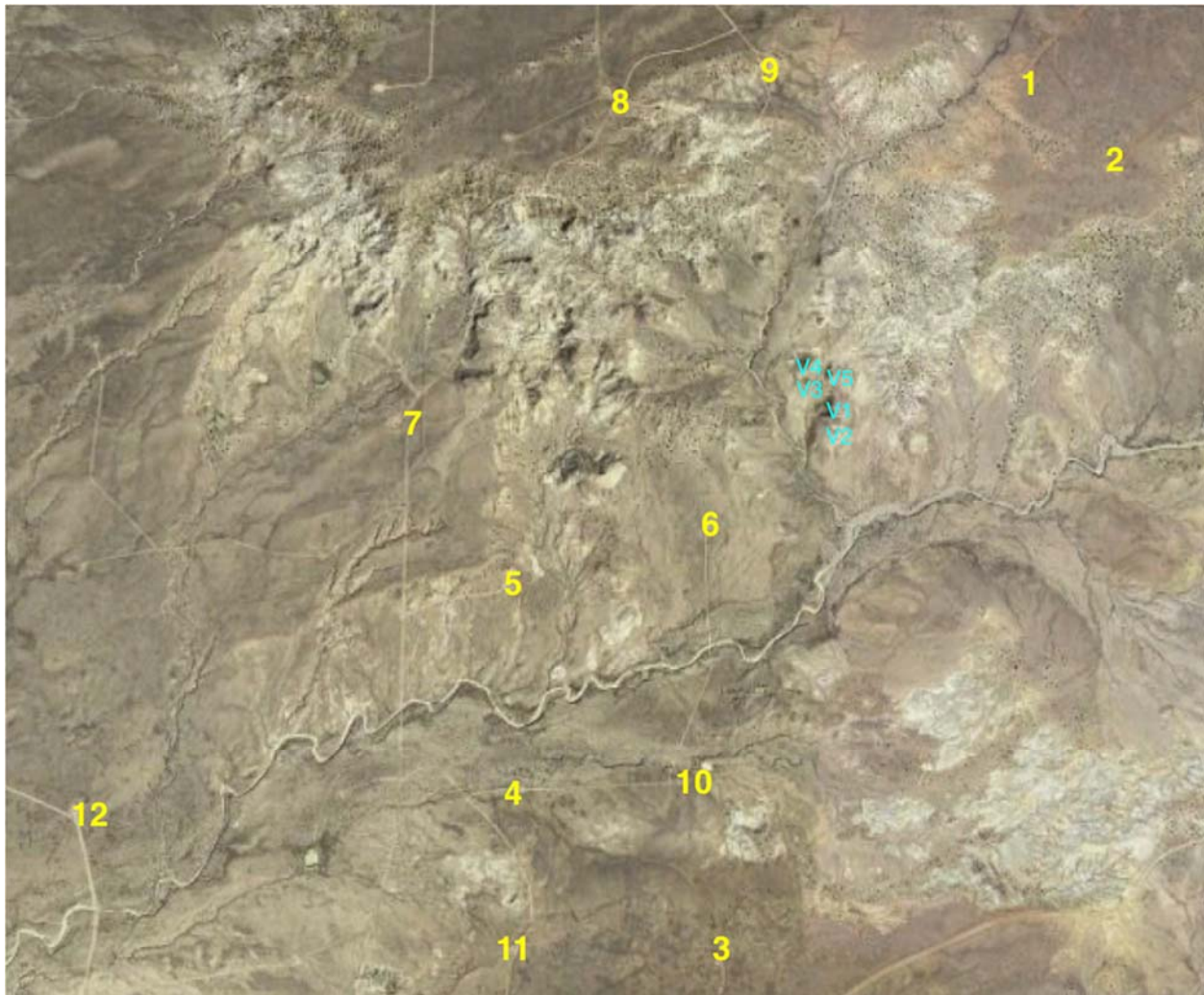


Figure 2: The Pierre's Community: Locations of Viewscapes 1-5 and Pumpjacks 1-12.

At each of these 5 locations, I determined cardinal directions using a Silva Ranger compass oriented to magnetic north. I then recorded the 360° viewscales at each of these locations using three techniques: still photography; video photography; and drawings. I used an iPhone 6 with a 29-mm lens and 8 mega-pixel resolution to capture a series of still photographs in 360° circumference from each of the 5 locations. I used the same iPhone 6 to shoot high definition (1080 pixel) video in 360° at 60 frames/second. I used a graphic method of field recording developed by Hamilton and Whitehouse (2006) to create 360° circular drawings of the viewscales from each location (Appendix A). These drawings include 3 sight horizons (near distance, middle distance, and final horizon). Within each horizon, and using the compass for accuracy, I noted major topographic features, architectural features, and oil and gas drilling features. I numbered the pumpjacks within the viewscales from #1 to #12. Back from the field, I used my collected data to create 5 short videos in iMovie 10.1.4. These videos, labeled Viewscapes 1, 2, 3, 4, and 5, are available as mp4 video files at <https://www.dropbox.com/sh/b3xbu93tnxn35xc/AABiARKk96SsT9H065wjKgsfa?dl=0>.

At each of the 5 locations, I also attempted to record the decibel intensity of nearby drill rig noise (audible in the community) using a Roland Edirol R-09HR portable sound recorder with internal microphone. This was not particularly effective in the morning, due in part to 5-10 mph winds, and due to the low and fluctuating frequencies of the drill rig noise. In the afternoon, the wind died down, and I successfully used the recorder to capture the low hum and occasional backfire of the nearby drill rig, Hoss Com #95. For quantifiable results, future endeavors should utilize an industrial grade sound sensor or decibel meter.

RESULTS

Viewscape 1 records the 360 degree view from the highest point on LA 16508, Pierre's Great House B, and Viewscape 2 records the 360 degree view from the highest point on LA 16509, Pierre's Great House A. The two viewscales are similar. There are a total of 12 pumpjacks visible. To the north, there are two pumpjacks on the horizon (#1 and #2); the closest of these is approximately 900 m away. There are also three drilling tanks. To the northwest, pumpjack #9, which is painted camouflage colors, is visible on the horizon, together with a drill tank; pumpjack #7, which is dark red, stands out against yellow caprock and is visibly moving – it is also accompanied by a tank on the horizon. To the west, pumpjack #7 moves up and down on the horizon. To the southwest, I can see the knob on the other side of the Pierre's community with the Chuska Mountains on the far horizon, and White Rock visible in the foreground. White Rock is an important relay point for line-of-sight connections from Chaco to the outliers in the Chuska Valley. There are two pumpjacks labeled #10 and #12 visible on the valley floor just south of the knob. On the valley floor 650 m to the southwest is pumpjack #6, or Hoss Com #95. Looking across the landscape towards Chaco Canyon, there is a whole string of pumpjacks in view positioned along at least two rig roads: # 5, 12, 11, 4, and 3. Behind them, the major topographic landmarks of Chaco Canyon all visible to the south: West Mesa, Hosta Butte, South Gap, South Mesa, Fajada Butte, and Chacra Mesa. It is possible to flash mirrors between this location and Pueblo Alto as well as Tsin Kletsin. To the east on the far horizon there are a few tanks as well as a Navajo settlement. It was very windy in the morning when I shot Viewscales 1 and 2, and I was unable to record any sound from this location over and above the wind.

Viewscape 3 records the 360 degree view from LA 16515, the large masonry house on the valley floor, at the base of the El Faro pinnacle. The closest pumpjack to the community, Hoss Com #95, is not visible from this point but it is audible, particularly when the engine backfires, which happens every couple of minutes. We thought at first someone was shooting, but it turned out to be the backfire. Because LA 16515 is on the valley floor, there are only 3 pumpjacks visible from this spot (#3, 4, & 8), but all 3 can be seen bobbing up and down on the horizon. The view to the north is truncated by the pinnacle. To the east is the neighboring pinnacle with LA 16519 (Viewscape 5). Beyond this pinnacle, the view to the east is effectively truncated by badlands topography. The large butte crowned by Great Houses B and A, or LA 16508 and LA 16509 is to the ESE. Looking towards Chaco Canyon to the SSE, I can see South Mesa, South Gap, West Mesa, and Hosta Butte. Pumpjack #3 is bobbing up and down on the horizon in front of South Mesa. Looking to the south, pumpjack #6 (Hoss Com #95) is blocked from view by a swale. However, as the wind has died down, I can clearly hear the engine

puttering as well as the occasional backfire. Looking to the SSW towards Little Hosta Butte and Dalton Pass, pumpjack #4 is bobbing up and down on the horizon immediately in front of Dalton Pass. To the west, the local topography blocks most of the view, with the Chuska Mountains partially visible on the far horizon. However, to the NNW, pumpjack #8 is clearly visible on the horizon, again, bobbing up and down on the horizon.

Viewscapes 4 and 5 record the 360 degree views from the sites at the tops of two pinnacles – El Faro (LA 16514) and the atalaya (LA 16519), respectively. When I recorded these viewscapes, it was early afternoon, and the sun angle was low and to the south. There are 9 visible pumpjacks from these locations. To the north, I can see pumpjacks #1 and #2; #1 is on the horizon 850 m away, and #2 is in the middle distance just under the horizon (Figure 3).



Figure 3: Pumpjacks 1 and 2 looking north from the atalaya.

To the east, the badlands topography blocks the long-distance horizon, although in the far distance, buildings and vehicle on the horizon represent a Navajo settlement. To the ESE is the large butte crowned by the two great houses A and B, or LA 16508 and LA 16509. To the south is the landscape of Chaco Canyon, with Mount Taylor, South Mesa, South Gap, Hosta Butte, West Mesa, and Little Hosta Butte (Figure 4).

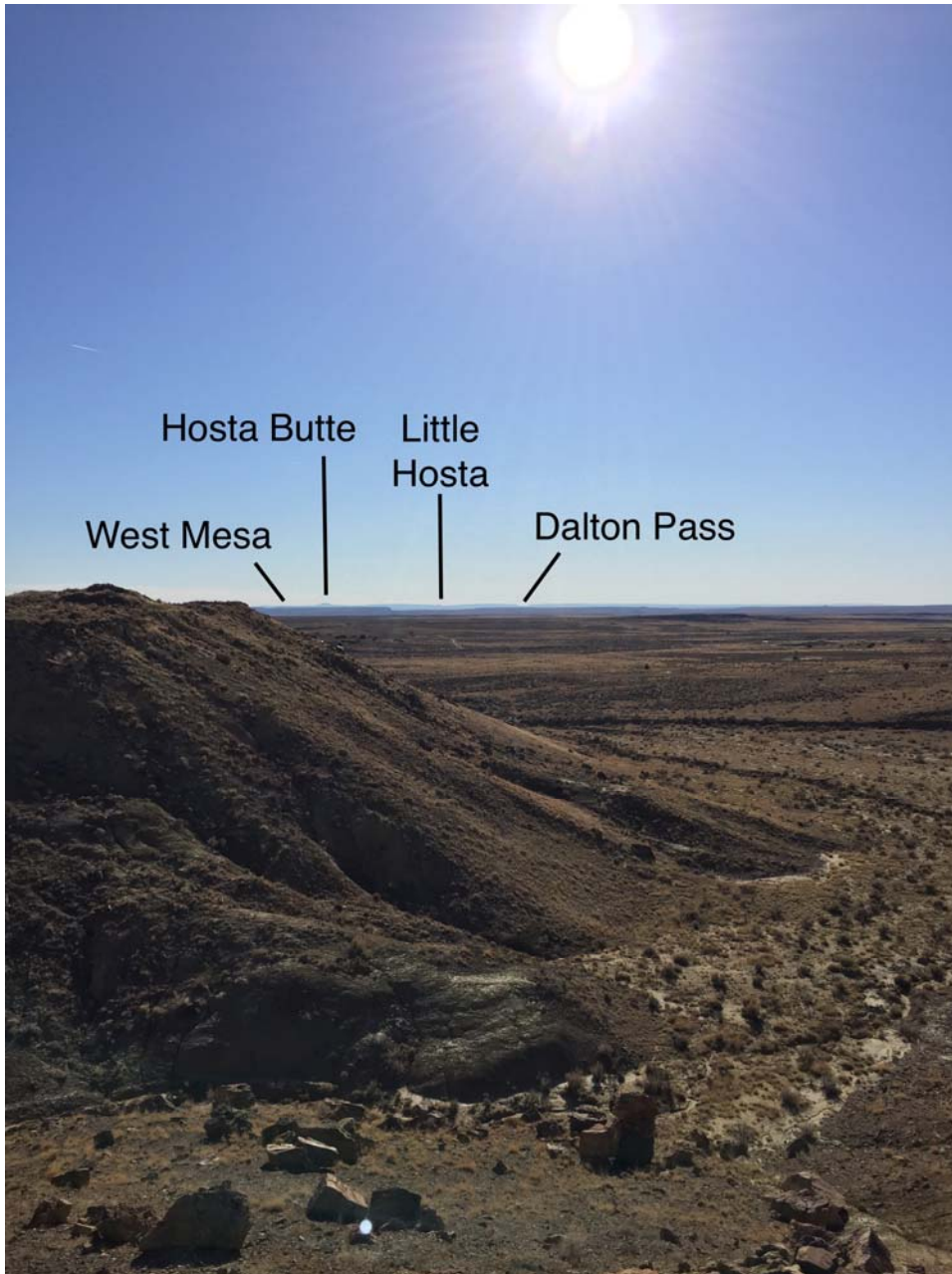


Figure 4: The Chacoan landscape looking south from the atalaya.

But looking southwest down the valley towards the Chaco River I see three pumpjacks (#3, 4, & 5) flashing in the sun as their arms pump up and down (Figure 5).



Figure 5: Pumpjacks 3, 4, 5, and 6 (Hoss Com #95) on the valley floor below El Faro.

Pumpjack #6 on my viewscape map is Hoss Com #95, which is located 750 m to the southwest. It was reportedly placed perpendicular to Houses A & B so that it would be less visible from the Pierre's community, but I note that this method doesn't work from either of the two pinnacle sites. Furthermore, Hoss Com #95 is clearly audible from this location – I can hear the clanking of the engine punctuated by an occasional backfire (Figure 6).



Figure 6: Hoss Com #95 (pumpjack #6), 650 m southwest of the Pierre's community, with LA 16514 (left pinnacle), LA 16519 (labeled), LA 16509 and LA 16508 (top of butte on right) in background.

To the SSW, there is another pinnacle in the middle distance, and the Chuska Mountains and Narbona Pass on the horizon. This is an important direction for visibility; White Rock, in this direction, is an important relay point with communities in the Chuska Valley. To the west, the rim of the valley blocks the far horizon, but pumpjack #7 is clearly bobbing up and down against the horizon on the rim of the valley (Figure 7).



Figure 7: Pumpjack #7 is clearly pumping up and down on the rim of the valley to the west.

To the NNW, the dark red pumpjack #8 is below the yellow sandstone caprock. Pumpjack #9 is on the horizon but less visible since it is painted in camouflage colors (Figure 8). Both are accompanied by tanks.



Figure 8: Pumpjack #8 and #9 (red arrows), looking northwest from the atalaya (LA 16519), with their accompanying tanks (yellow arrows). Although #9 is on the horizon, it is less visible than #8 because it is painted in camouflage colors.

SUMMARY AND CONCLUSIONS

Despite the efforts of the Bureau of Land Management and the National Park Service to jointly minimize the ground footprint impacts of oil and gas drilling on the Pierre's community, there have been significant impacts to the viewscape and the soundscape. No less than 12 pumpjacks and at least 5 drilling containers are visible from the high places in the community. Pumpjacks labeled #1, #2, #7 and #9 are prominently visible on the skyline from Houses A and B as well as the pinnacle sites. Noise from the nearest pumpjack (#6), Dugan Production Corp Hoss Com #95, located approximately 600 m southwest of Pierre's butte, is audible from throughout the community. Although this pumpjack was positioned to be perpendicular in the line of sight from Houses A and B (Viewscape 1 and 2), it is NOT perpendicular to the line of sight from El Faro (Viewscape 4) and the atalaya (Viewscape 5). Looking south towards Chaco

Canyon, numerous pumpjacks (#3, 4, 5, 10, 11 & 12) dot the valley floor. Rather than a sacred landscape and part of a UNESCO World Heritage Site, the Pierre's community today has the feeling of an industrial park. Clearly, the BLM did not take indirect and cumulative effects of the oil and gas drilling into account (as required by NEPA) when these drills were authorized.

Viewscales and soundscapes should be considered important aspects of the ancient Chacoan landscape. Chacoan viewscales and soundscapes should not be impacted without assessment and attempts at mitigation. It is my recommendation that the Bureau of Land Management should implement landscape-level Class III survey prior to any oil and gas leasing agreements in the San Juan Basin, and these surveys should include assessment of the viewscales and soundscapes of Chacoan outlier communities, as I have conducted here. Ideally, no drilling would take place within the topographic area visible from (and audible from) any Chaco outlier great house. The areas covered by such a moratorium would vary based on local topography at each great house – a blanket protection of 1-2 km, for example, is not sufficient, because every great house's topographic situation is different. This is a further reason for the need for Class III survey prior to leasing. If drilling must take place within the viewscale and soundscape of a Chacoan community, the drilling company should be required to camouflage equipment by painting it the same color as the surrounding terrain. They should furthermore be required to use quiet pumpjacks or sound-dampening equipment to mitigate the noise. A Master Leasing Plan is needed to ensure that these indirect and cumulative effects are mitigated in the future.

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Appendix A: Viewscape Circle Maps

Viewshed Circle Map #1

Site No: LA 16508 (Pine's House R)

Recorder: R. Van Dyke Height: 4' (500 cm)

Date: 11/25/16

Time: 10:00 AM

Coords: Z 13 E 225209 N 4014879

Position of sun: 150° N Low angle

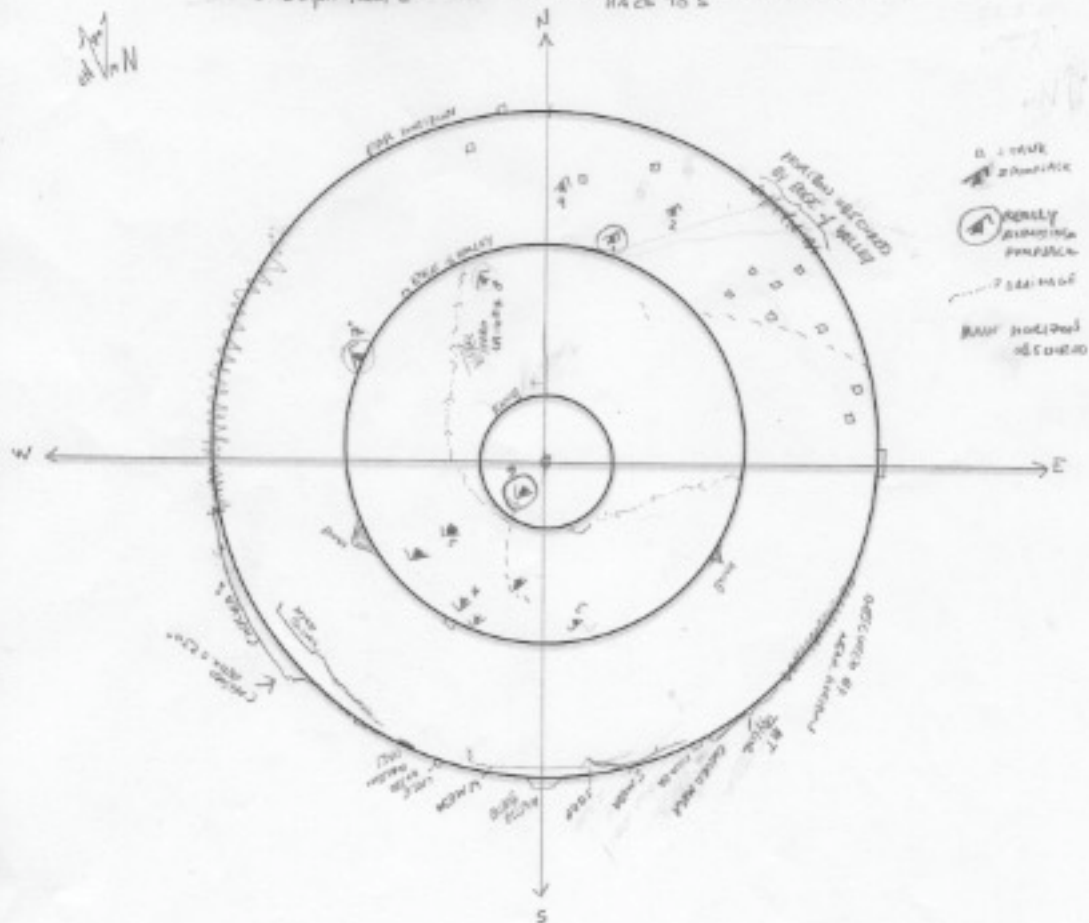
Weather conditions: Cloudy

Light conditions: DRIMT SUN, LOW ANGLE

Temp: 52°

S-15 mph from E

HAZE TO S



Viewshed Circle Map # 2

Site No: LA 16309 (Pine to Maple A)
SOUTHERN BAY & N

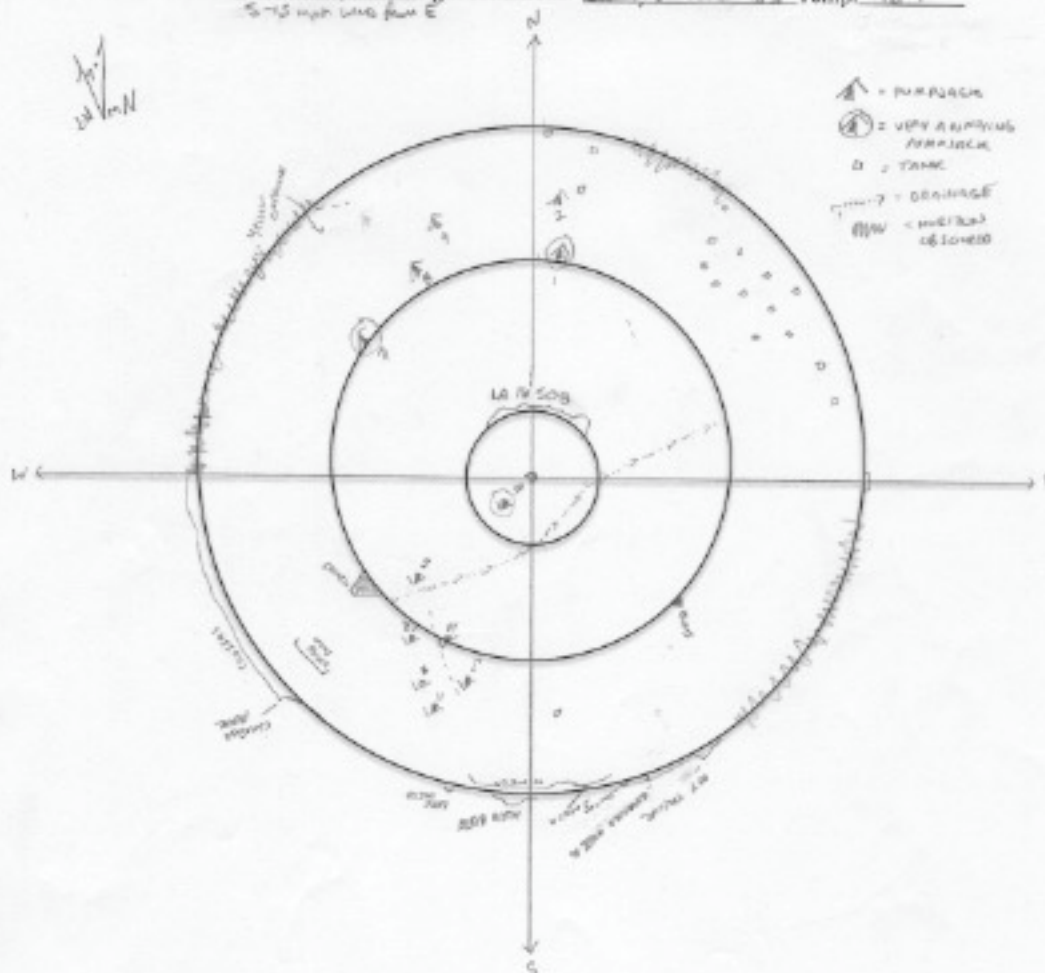
Recorder: R. V. Dyer Height: 4' (crown)

Date: 6/23/16Time: 11:40 AM

Coords: 212 E 235196 N 4014523

Position of sun: low in sky, 160° α and N

Weather conditions: Cloudy, Sunny, Windy Light conditions: Cloudy, but more to S Temp: 42°F

 ≈ 1.5 m/s. Wind from E

Viewshed Circle Map #5

Site No: LA 16519 Recorder: P. Van Dyke Height: 5'2"
 Date: 1/21/04 Time: 2 pm
 Coords: 212 E 285173 N 4015916 Position of sun: SSW
 Weather conditions: light breeze, clear, high Light conditions: clear, high alt, sunny Temp: 58°

