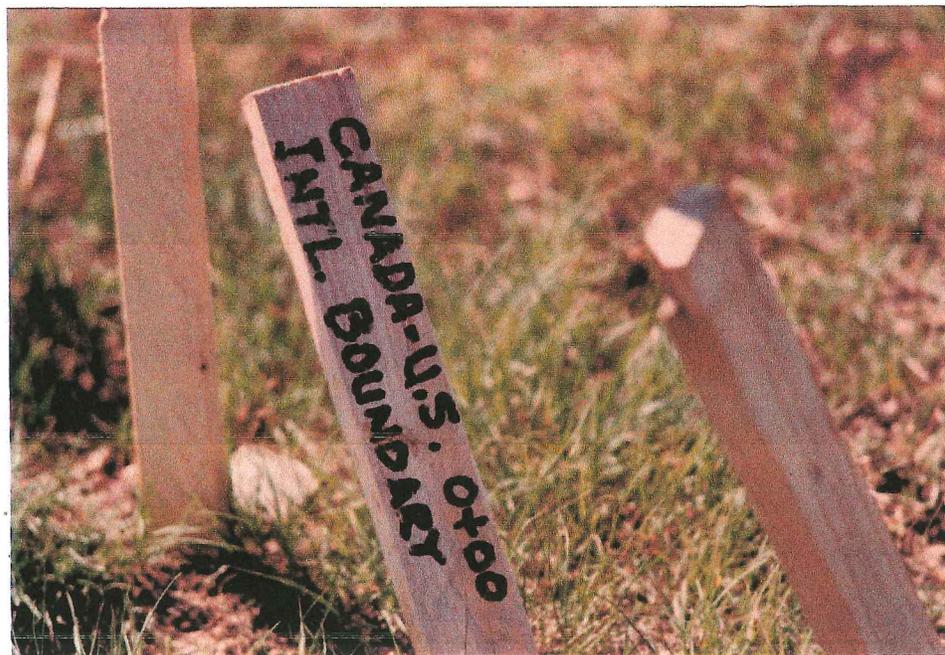




#48 Boring equipment (Idaho).



#49 Survey stakes along the r-o-w. Locations are given in the format "0+00". Table 1 gives survey stations for points where the pipeline enters and leaves state lands.

RIGHT-OF-WAY REQUIREMENTS AND STRIPPING OF TOPSOIL

One of the more important issues that appeared during construction was that of the amount of land needed. NBPC has indicated in its environmental assessment and in its easement application to the Montana Department of State Lands (DSL) that a 100-foot r-o-w would be needed for construction in most cases, because of the generally flat terrain in northeast Montana, with some additional space needs on rougher areas and at road and creek crossings. R-o-w width was an issue in DNRC's impact statements on both the Northern Tier and Northern Border pipelines, and the department recommended in both cases a 90-foot r-o-w. These recommendations were based on engineering work done by contractor to the department. Also, on parcels where easement agreements had not been reached, NBPC instituted condemnation proceedings on a 100-foot strip. This caused problems for the company, when, a short time later, construction began (see photo #28). It rapidly became clear that more than 100 feet were required in many areas and NBPC might have to return to the courts to procure the desired easement. In most cases, this did not occur and NBPC worked out an arrangement with the landowner.

This issue of r-o-w width was important to document for several reasons: 1) the extent of side-hill cutting, and subsequent potential for soil horizon mixing and other environmental problems, was underestimated by the applicant and the DNRC, 2) the potential construction delay, landowner problems and expense it caused the company, and 3) the relationship of r-o-w width to other reclamation issues, such as topsoil storage space requirements when extensive side-hill cutting is needed.

Construction on flat terrain, hillsides, and across drainages.

The photographs that follow show specific construction situations in northeast Montana that support the generalizations about r-o-w requirements that are depicted in figures 1-4. They also depict correct and incorrect topsoil storage techniques. According to Bob Morris, Leonard Pipeline Company's foreman for most of the clearing and clean-up operations, there were three chief constraints and requirements guiding r-o-w preparation operations: 1) a level work pad measuring 50 feet from the ditch centerline on the working side of the ditch, and measuring 35 feet on the ditch spoil side, 2) spoil from side-hill cuts had to be pushed away from its original location perpendicular to the centerline to prevent problems for the re-contouring crew (i.e., if spoil is placed in this manner, dozer operators can push it back without guessing where it came from), and 3) the pipe cannot be placed in fill for various engineering and structural reasons.



#50 State land parcel VA057 near the west boundary of the Fort Peck Reservation looking west on April 21 shortly before construction began. (see next photo).



#51 Same view as #50, about 300 yards farther west and from atop the trench spoil bank on July 23. Note that in the distance a trencher was used and in the foreground a backhoe was used. An 85-foot right-of-way was cleared in this area, and it became slightly wider after ditching, especially where the backhoe was used.



#52 An 85-foot cleared right-of-way on cropland in Roosevelt County on June 26. The r-o-w width increased slightly as the pipeline was constructed, but the width was well within 100 feet in most cases on this flat terrain.



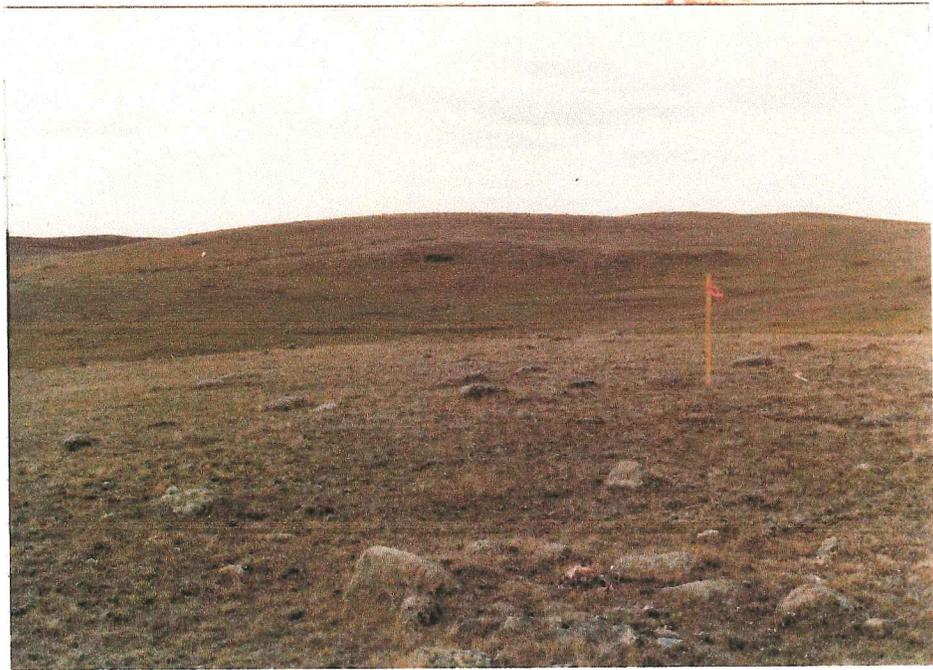
#53 State parcel R0195 southeast of Bainville, looking west on April 21 at an approaching dust storm two weeks before construction began. See next photo.



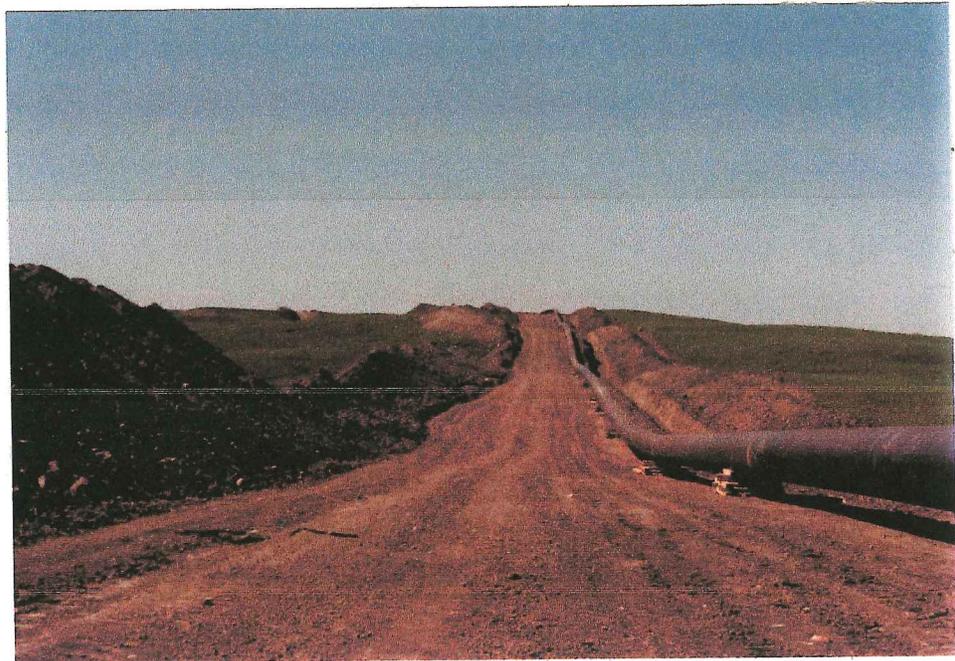
#54 Same view as #53 on July 24. This was the only state parcel that was cropped. The r-o-w was generally about 85 feet wide on this parcel although it was wider in the foreground because the field road was bored under rather than ditched through.



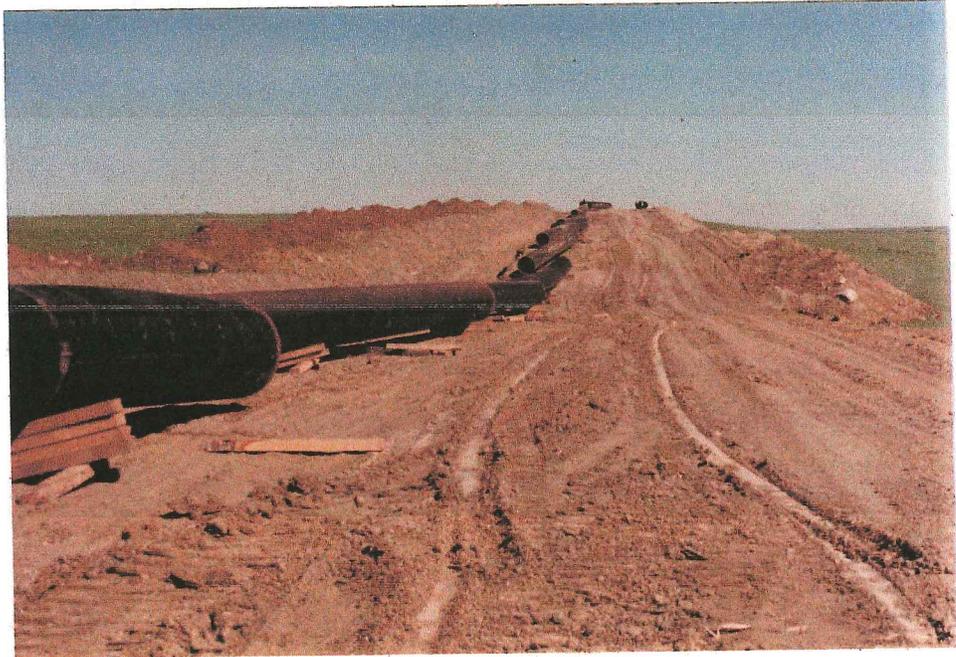
#55 Compare this view with that at cross-section "B" in Figures 1-3 (this view is to the east, however). Note the cut on the left providing fill for the work space on the right. This is taken about 1.5 miles west of state parcel PH018 near Turkey Track Road. Photo taken June 25.



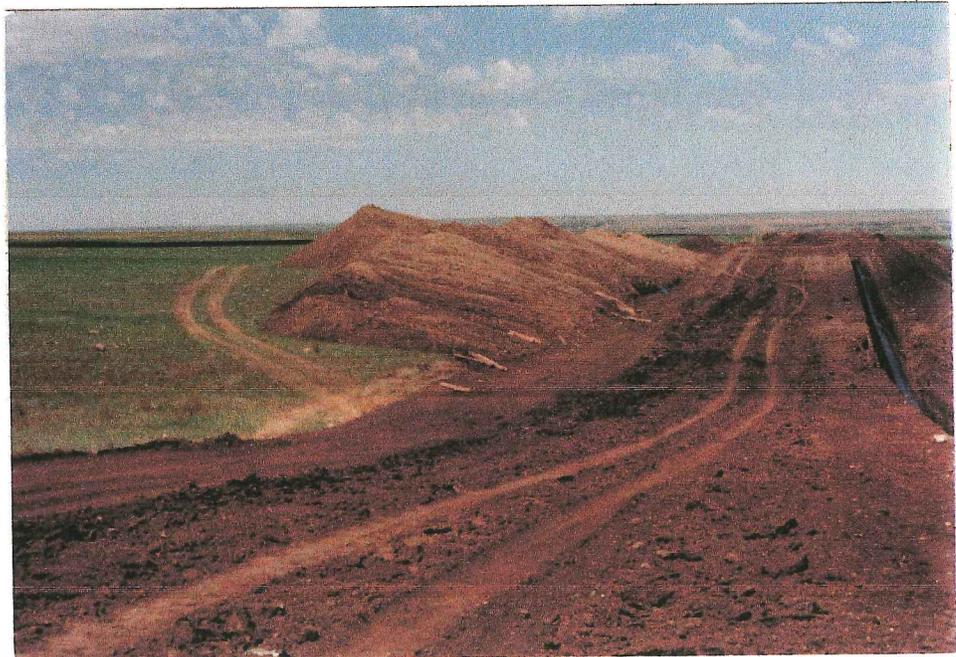
#56 Looking northwest on state parcel PH021 on April 21 before construction began. See next photo.



#57 Same view as #56 on June 25 about 150 yards farther to the southeast. Note similarities to cross section "B" on Figures 1-3.



#58 Looking east on June 25 at a long stretch of south-facing slope on state parcel PH026. Note that on this parcel topsoil has been stored uphill to the left.



#59 Compare this view to views of cross section "A" on Figures 1-3. This photo, taken July 15, looks west on state parcel VA006. Note that there is poor topsoil separation in this area, although a small pile can be seen behind the large pile of subsoil.



#60 Compare this view to cross section "A" (on Figures 1-3) and to #59. This view looks west on private land several miles west of the parcel shown in #59. Note the pile of topsoil on the outside of the pile of material from the cut.



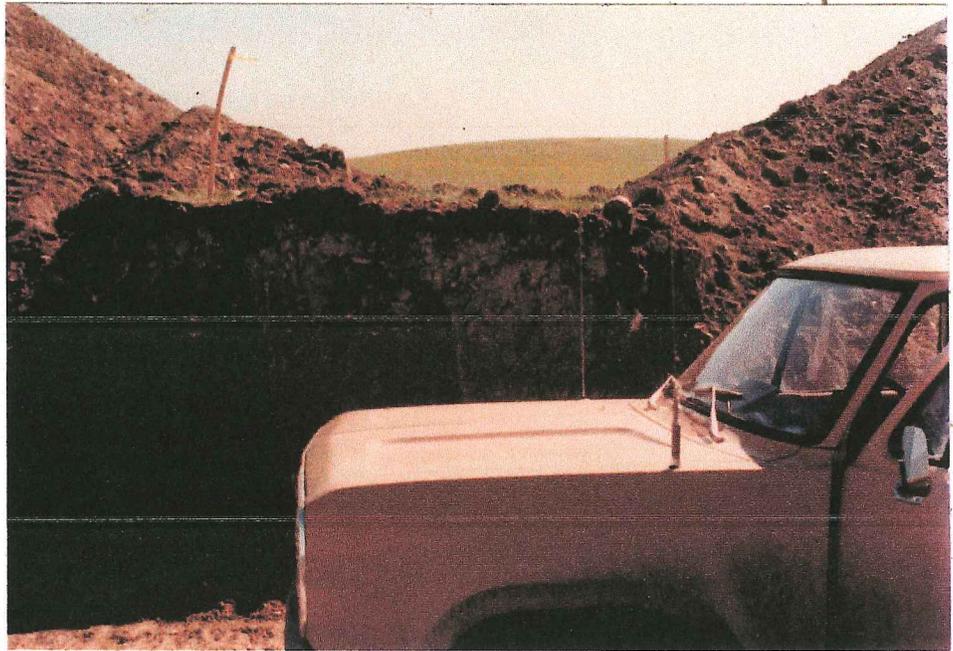
#61 Compare this view with that of #62. Both look west on state parcel PH012 from about the same spot. This photo was taken a few feet downhill from #62 on April 21, shortly before construction began.



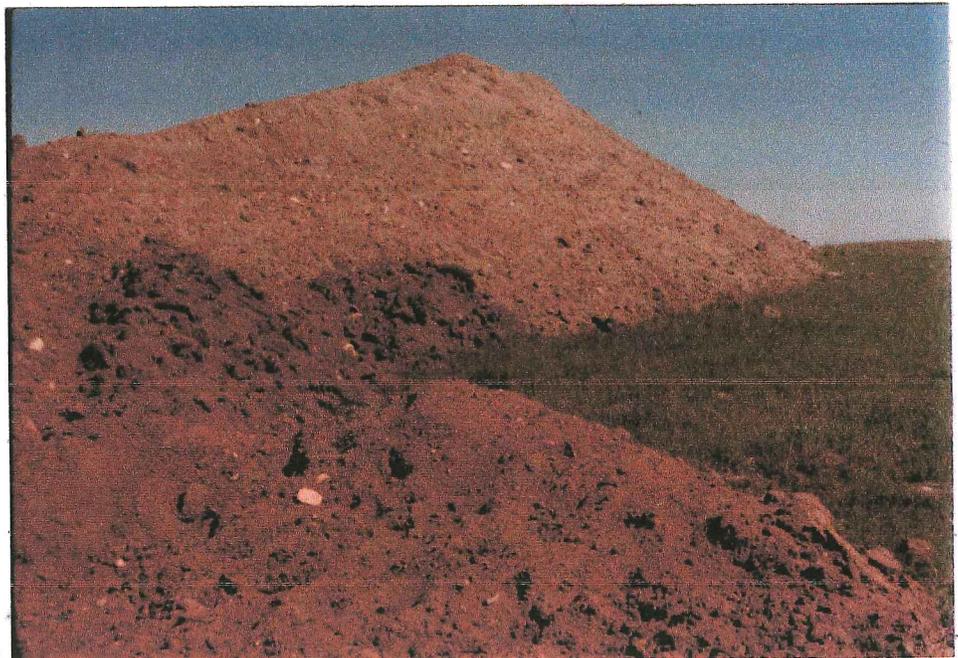
#62 Same view as #61 on June 26, and see view "A" on Figures 1-3. Note the lack of topsoil storage piles. This section was cleared in the first few days after construction began, and little topsoil was saved even though saving 12 inches of "topsoil" was stipulated on the Department of Lands lease. (See conclusions section.)



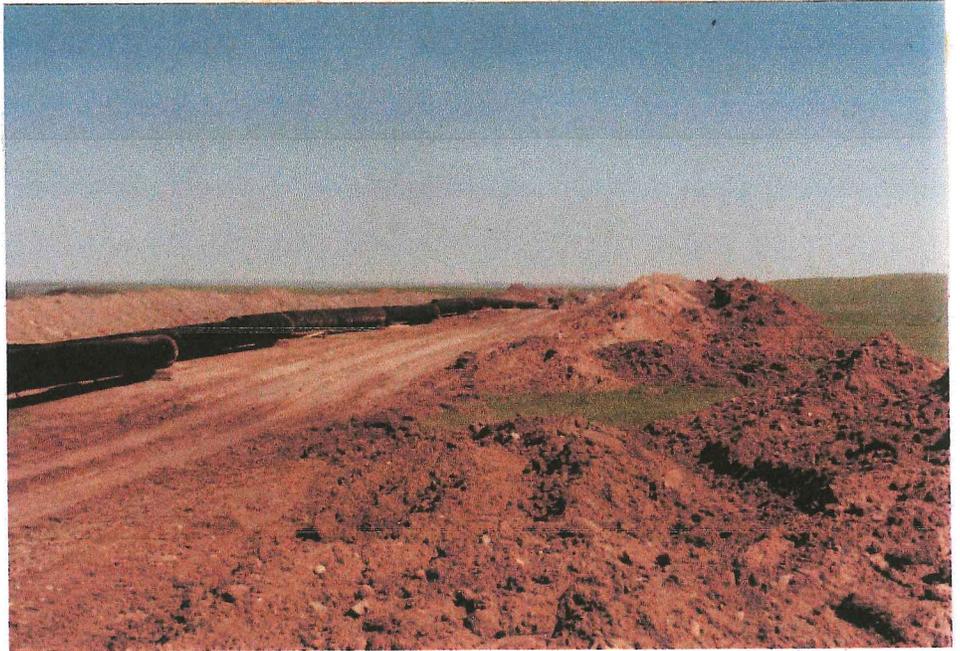
#63 State parcel PH026 on April 21, looking southeast past the reservoir in the middle of the section. See #64, #65, and #66.



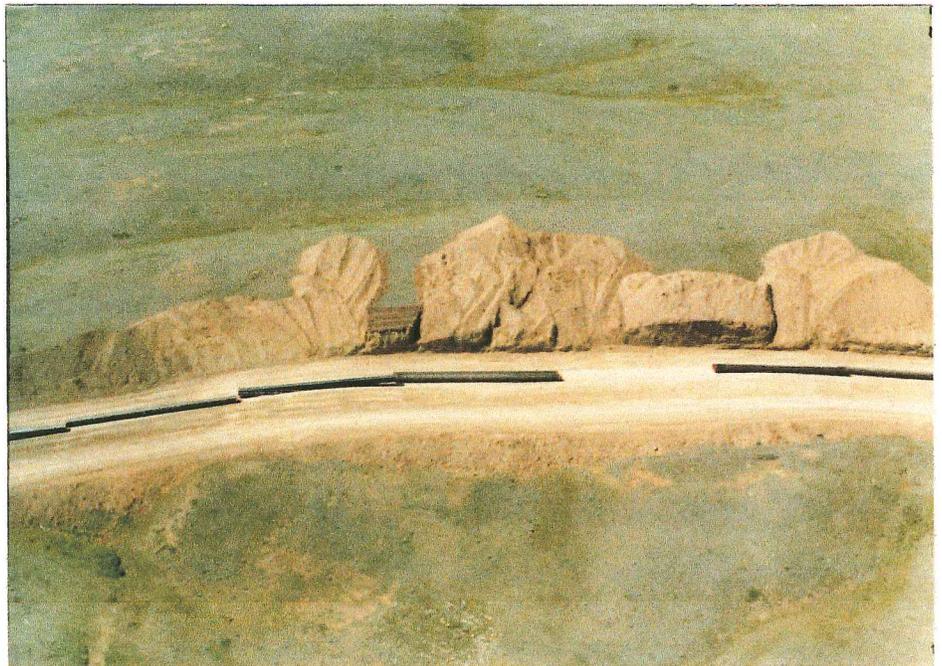
#64 Side-hill cut on work pad (as in cross section "A" on Figure 2) on state parcel PH026. This was the cut made in the hill on the other side of the drainage way shown in #63. Note the shallow depth of the A horizon (compare to #74 below.) Slope is about 7 degrees on this hill. Photo taken June 25.



#65 Topsoil storage pile covered by spoil from cut close to spot where #64 was taken. Photo taken June 25.



#66 Topsoil storage on PH026. View is to the southeast on June 25.



#67 Side-hill cutting similar to cross-section "B" on Figures 1-3. The ditch will be dug next to the cut and the work space is on the near side. This side hill is along a drainage. Photo taken June 26.



#68 View of state parcel VA27.5 looking southeast toward the Willow Creek valley before pipe-stringing began. Note: 1) soil/spoil storage is on alternate sides of the r-o-w, depending on the direction of slope, 2) the cleared r-o-w is about 85 feet wide on the flat areas shown in the photo, and 3) r-o-w requirements rapidly expand when soil/spoil storage areas are needed. VA27.5 begins on the other side of the fence beyond the sharp bend. This bend is the beginning of the "Bitter Creek Re-route" which follows an old road through the Bitter Wilderness Study area. Photo taken on June 26.

Extra-deep pipe burial on rough terrain

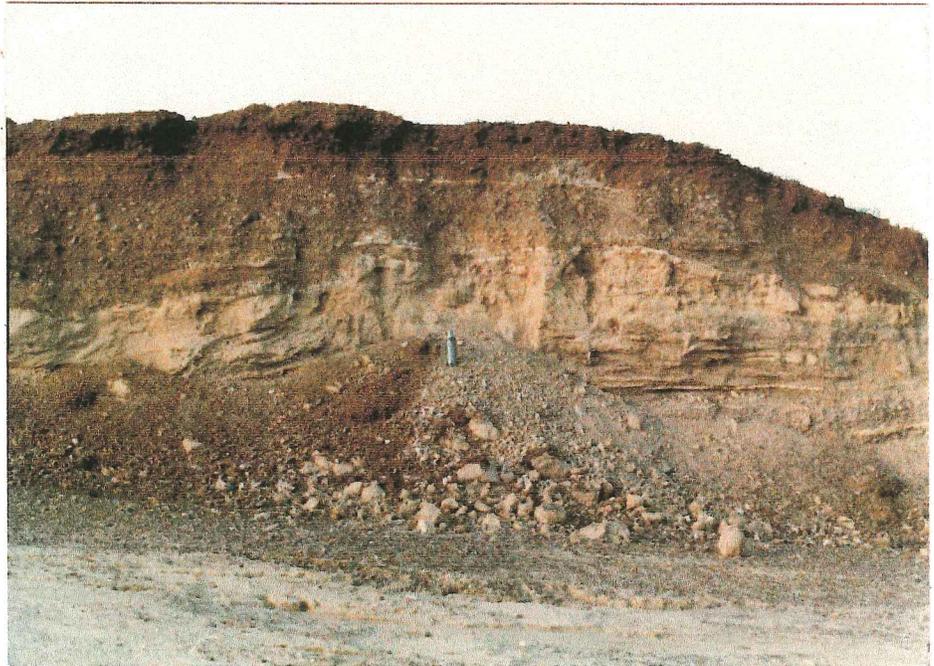
On steeply rolling terrain, or on bluffs above river valleys, pipe bends do not exactly follow the terrain. For example, on the Rock Creek bluffs seen in #38, the drop-off bend into the valley began before it reached the extreme edge of the bluff. This is done to avoid sharp bends as much as possible, and to reduce the overall amount of bending. This can be seen also in the terrain shown in #13. This requirement causes substantial increases in the right-of-way width at the bluff edge, primarily for soil/spoil storage. Photographs #69 through #73 depict some areas where this occurred.



#69 State section VA051 looking west down staked centerline on April 21, 2 weeks before construction began. Compare with #70 and #71. This area is about four miles west of the west boundary of the Fort Peck Reservation.



#70 Same view as #69, same spot, taken June 26, before ditching and pipe stringing began. Note that each ridge is cut extensively, resulting in more gradual bends on top of the hills. This result cannot be obtained at the bottom of drainageways, however, because the pipe cannot be placed in unconsolidated fill.



#71 Close-up view of the first cut on the right side of #70. Note the 1 quart thermos for scale. This area was very gravelly and sandy. The bottom of the pipe will be 7 feet below the level surface at the bottom of the photo. This means pipe burial of about 13 feet deep from the top of this ridge. The cut shown is about 10 feet deep.



#72 State parcel PH012 looking southeast on April 21 down the staked centerline before construction began. NBPC personnel estimated a r-o-w width of 100 feet here on this date. Compare with #73.



#73 Looking southeast at approximately the same spot as #72 on June 25. The r-o-w was about 230 feet wide here as a result of this side-hill cutting, which occurred within a few days of construction start-up (May 4).

Estimates of general r-o-w width requirements.

Figures 1-4 depict the r-o-w requirements for the Northern Border pipeline in Montana, as constructed by the Leonard Pipeline Company. Leonard Company built Spread #1, the first 148 miles, and Leonard/Rohart Inc., a joint venture of Leonard and a minority contractor, built Spread #2, the 28.5 miles from Big Muddy Creek to the North Dakota border. The figures are based on discussions with personnel from Northern Border and Leonard Pipeline Company and are generalized from measurements taken at numerous sites, mostly those shown in photos #50 through #73.

It should be kept in mind that figures 1-3 are most applicable to rangeland, which tends to be more rolling terrain, and are thus applicable to not more than half the Montana route. The other half is flat cropland and figure 4 shows the r-o-w requirements that are more typical of this terrain.

Explanation of Figures 1 through 3

Figure 1

Perspective view of a west-to-east pipeline r-o-w across rolling terrain. The situation depicted is similar to situations encountered on the Northern Border route (also generally west-to-east) across rangeland in northeast Montana. In this figure, looking west, the route first crosses a north-facing slope of about 7 degrees, then a relatively level area, and then a south facing slope, also about 7 degrees. Based on field