Lagoon 4 Preliminary Geotechnical Investigation

# Appendix H

**FOUNDATION ENGINEERING, INC.**
*Professional Geotechnical Services*

# Memorandum

**Date:** October 7, 2008

**To:** Denny Muchmore, P.E.
Westech Engineering, Inc.

**From:** James K. Maitland, P.E., G.E.

**Subject:** Preliminary Geotechnical Investigation

**Project:** Dayton Polishing Pond Leak
FEI Project 2081077


We have completed a preliminary geotechnical investigation of the Polishing Pond at the Dayton Wastewater Treatment Plant in Dayton, Oregon. Our observations and preliminary findings are described below.

## DEFINITION OF PROBLEM

On September 10, 2008, the Oregon Department of Environmental Quality (DEQ) conducted a water quality inspection of the Dayton Wastewater Treatment Plant. During the inspection, DEQ observed standing water on the northeast side of the polishing pond, at the fenceline. It was surmised that the ponded water was caused by a leak in the polishing pond dike. In a letter dated September 10. 2008, Mark E. Hamlin (Water Quality Specialist) sent a letter to Kurt Reimer (Public Works Director for the City of Dayton). In the letter Mr. Hamlin raised the concern that immediate steps might be needed to prevent a catastrophic failure of the dike. He also recommended checking the leak on a regular basis and notifying him of any changes. Westech Engineering, Inc. (Westech) is the City's prime consultant.

Foundation Engineering Inc., (FEI) was asked by Westech to conduct a preliminary investigation of the site and express an opinion concerning the potential risk of catastrophic failure of the dike. The present investigation was limited to the review of available documents, a site visit, and preparation of this report. A detailed geotechnical investigation, field exploration and sampling, soil testing and detailed engineering analysis were beyond the current scope of work.

It is our understanding that the City has been monitoring the leak daily since receiving DEQ's letter and has reported no change in site conditions.

## BACKGROUND AND PROJECT DESCRIPTION

The polishing pond (also known as Pond 4) is located north of the Yamhill River and is accessed via SE Kreder Road. Drawings provided to us[1] suggest that the pond was likely built in 1980. It has overall (outside-to-outside) dimensions of ±550x550 feet and consists of two cells separated by an interior dike.[1]

[1] City of Dayton, Oregon, STP Expansion & Modifications, drawings prepared by Consultants Northwest dated March 1980.

A cross-section of the facility (Section A-A, Sheet 4 attached) indicates that the polishing pond dikes were built over the top of a previous pond dike. The top of the original dike was raised from El. 102 to El. 106.5. Therefore, ±4 feet of fill was placed over the original dike (plus 6 inches of ¾-inch minus crushed rock surfacing). The dike fill was not specified on the drawings. Notes on Section A-A called for 8 inches of the inside face of the existing dike to be removed and replaced with 6% lime-treated fill (to be extended to the top of the new dike).

## SITE VISIT

We visited the site on September 30, 2008. We were accompanied by Mr. Reimer and Denny Muchmore (Westech). During our visit, we discussed the history of this facility, observed the wet area and took photographs. No field exploration or sampling was conducted at this time. We were subsequently provided a copy of the original drawings for the pond.

## FIELD OBSERVATIONS

For orientation purposes, we have referred to the access gate as the north side of the project, which may differ from the references in the previously cited DEQ letter. The top of the dike is ±10 feet wide and was constructed with 3:1 side slopes. Currently, the crest of the dike is rounded and the edges are ill-defined. The water level on the inside of the pond was reportedly ±8 feet deep at the time of our site visit. The exterior slope extends to within ±15 feet of an existing fenceline, and then flattens to approximately level ground. The pond is surrounded on the east and south sides by a hazelnut orchard.

At the time of our site visit, we noted a long, narrow area of ponded water that essentially parallels the fenceline (Photo 1). The ponded water lies ±50 feet (measured horizontally) from the inside surface of the water. The area of standing water extends over a distance of ±125 feet. The point of most concentrated moisture is located ±150 feet from the southeast corner of the pond (Photo 2).

The ground surface exposed on the dike was very dry and we noted some isolated desiccation cracks. The ground surface was also riddled with 1 to 2-inch burrows (reportedly due to voles) (Photo 3). No standing moisture was noted in the burrows and they do not appear to be related to the issue at hand.

The surface of the dike adjacent to the observed ponded moisture appears to be uniform with no evidence of lateral creep, tension cracks, or scarps (Photo 4). The exterior slope is covered by short grass. The area of ponded water contained significantly greener, taller grasses and scattered pockets of reed grass. Only one small area, near the toe of the exterior slope contained greener grass. Therefore, there is no evidence of concentrated seepage or internal piping emerging from the exterior slope.

## DISCUSSION

There are no areas of unusual vegetation growth on the exterior face of the dike and we noted no soft or wet areas that would suggest concentrated seepage through the embankment. Rather, the wet area along the fence appears to represent accumulated water due to seepage at about the level of the toe of the exterior slope. Mr. Reimer reported that the wet area dries up as the level in the pond drops, but has been present for several years during periods of high water.

Mr. Reimer indicated that the polishing pond is at its highest level at this time, but the level drops significantly during winter time discharge. The original construction drawings indicate that the water in the pond was to rise from a "normal water" level of El. 98 to a "high water" level of El. 104.5. Therefore, the high water level extends ±2.5 feet above the top of the original dike.

Based on the lack of concentrated seepage on the exterior face of the dike, we have concluded that the observed wet area is not a result of seepage through the upper portion of the dike. Therefore, active internal piping through the dike fill is not likely. Rather, it is likely that the seepage is occurring along the contact between the original dike and the subsequently placed fill. We have seen no records describing the preparation of the surface of the original dike, the lime treatment or the placement of embankment fill. It is possible if the surface of the original dike was dry during construction that a relatively permeable layer formed at the contact between the new and old fill. As the water level rises in Pond 4, it crests over the level of the original dike and, where permeable, water infiltrates, migrating to the east toward the toe of the embankment. Because the wet area is ±125 feet long, seepage may be occurring along a diffuse (albeit buried) surface rather than at a single, isolated point or series of points. At this time, the seepage appears to be centered at a point ±150 feet from the southeast corner of the pond.

Another possibility is that the bottom of the original pond leaked (and continues to do so). The increased water level in the new pond would have increased the seepage from the bottom. This explanation is believed to be less likely since the wet area is limited to one section of the pond, rather than the perimeter of the entire facility.

The face of the exterior dike slope is uniform and we noted no tension cracks, bulges scarps or other evidence that there is any lateral creep or movement of the slope. The scattered cracks noted along the top and sides of the dike appear to be shallow and consistent with the observed desiccation of the fill. The animal burrows are dry and appear to be too shallow to impact dike performance. Therefore, there is no evidence that the leakage has compromised the structural integrity of the exterior dike nor is there any evidence of on-going slope creep, movement or incipient failure. Therefore, it is our opinion that the risk of sudden, catastrophic slope instability is low.

## PRELIMINARY CONCLUSIONS

We have concluded, based on a review of the available information and our recent site visit, the following:

1. The exterior dike is not in imminent danger of catastrophic collapse.

2. The ponded water noted along the fenceline is likely due to seepage along the contact between the original berm and the additional fill that was placed in 1980. Additional geotechnical work will be required to confirm this assumption.

3. The observed wet area does not appear to be a new phenomena and likely has developed seasonally for several years.

4. Repair work on the dike to reduce or eliminate leakage can be delayed until after the Wastewater Facilities Plan is completed.

## REPAIR OPTIONS AND RECOMMENDATONS FOR FUTURE GEOTECHNICAL WORK

Because the leakage problem likely represents a diffused infiltration of ground water beneath the top of the dike, repair at a single point is not expected to be effective. Options to reduce or eliminate the leakage typically include grout curtains, sheet pile walls, or other hydraulic barriers to reduce seepage through the core of embankment fill. Since the seepage appears to occur over a relatively long section of the exterior dike, it is likely that reconstruction of the dike is the most viable option. The reconstruction would likely involve exposure of the original dike surface, removal of unsuitable materials (i.e., soft/wet soil), preparation of the exposed surface, and placement of new embankment material. It is likely that the bulk of the existing embankment fill could be reused.

Additional geotechnical will be required to pinpoint the source of leakage and confirm the mechanism of the seepage. We anticipate future geotechnical work would consist of exploratory drilling and sampling of the berm fill to characterize the embankment material and locate zones, if any, of soft/saturated material. Supplemental exploratory trenching may also be required to establish the location of the seepage and confirm the existing conditions. We understand that a Wastewater Facilities Plan for the existing facility will be completed within the next year. We recommend that the additional geotechnical work be delayed until the long-term use of Pond 4 is better known. During the interim, we recommend that the condition of the wet area and the adjacent slope be monitored monthly by the City. We should be notified if any changes in site conditions are observed. We recommend a follow-up site visit by FEI next year when the water level is high.

FEI is available to assist with preparation of a detailed program for investigation at the appropriate time. It was our pleasure assisting you with this matter. Please do not hesitate to call if you have any questions.

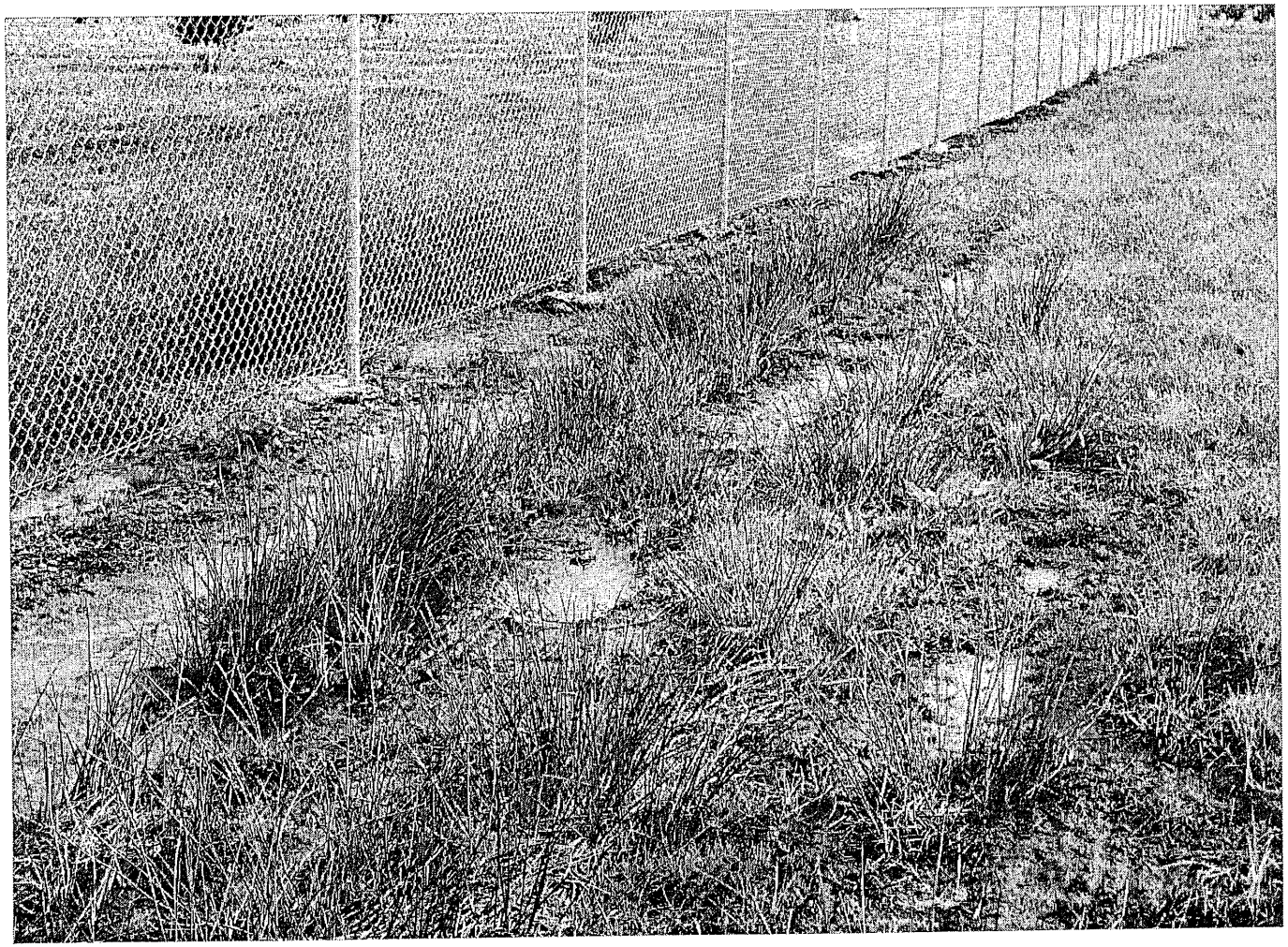


Photo 1. Moist area along the toe of the embankment.

Photo 2. Ponded water at fenceline.

Photo 3. Typical animal burrows and desiccation cracks.

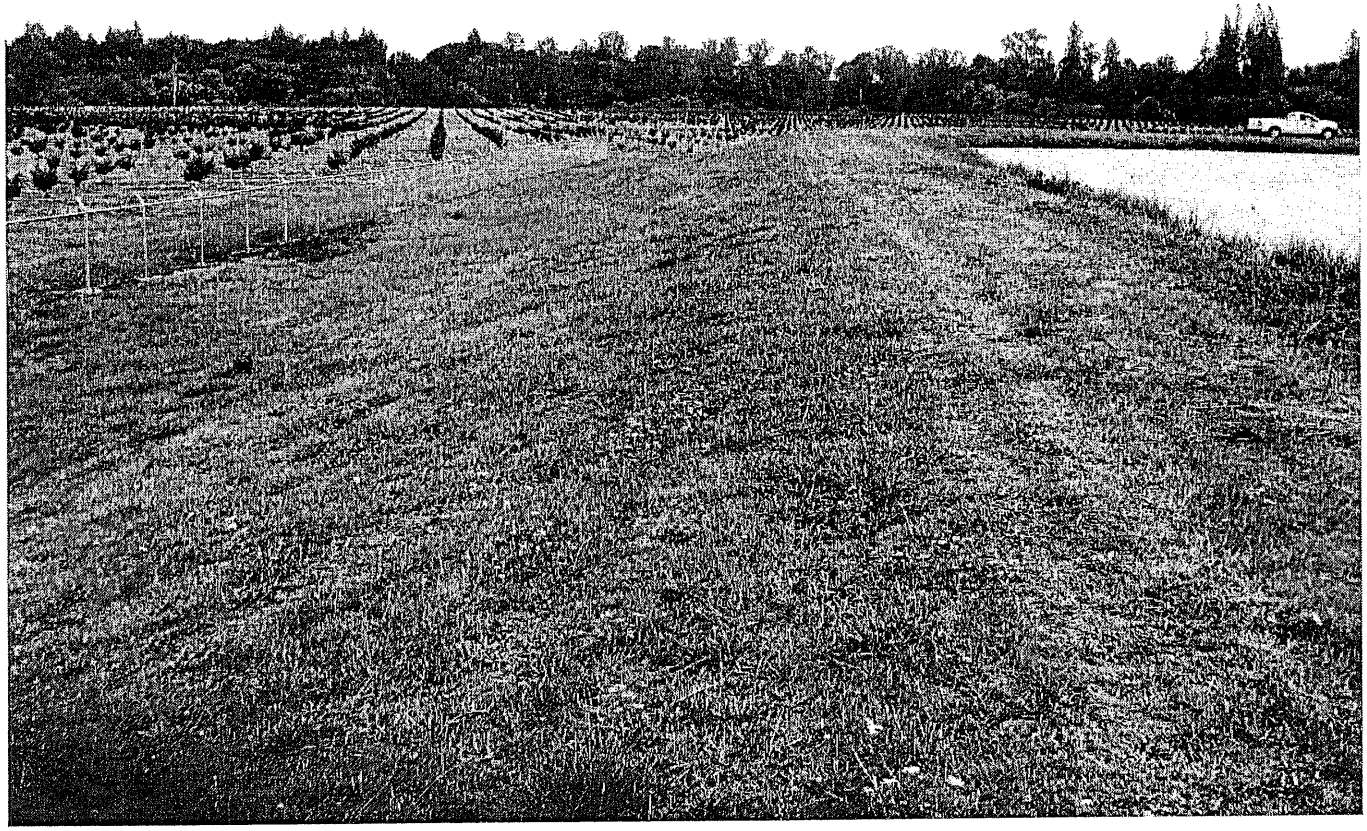
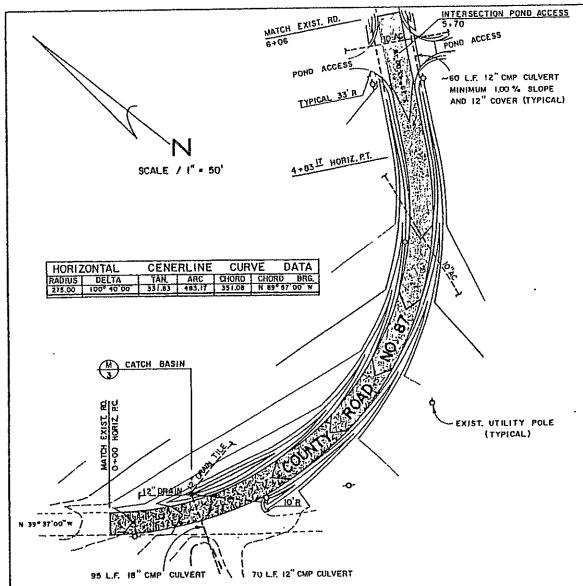


Photo 4. View of exterior pond slope.

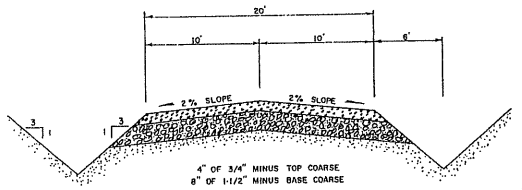



HORIZONTAL CENERLINE CURVE DATA

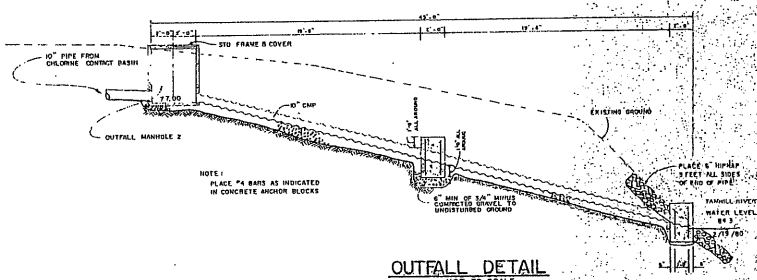
| RADIUS | DELTA | TAN | ARC | CHORD | CHORD BRG. |
|---|---|---|---|---|---|
| 275.00 | 100° 40' 00" | 331.83 | 483.17 | 351.08 | N 89° 57' 00" W |

HYDRAULIC PROFILE

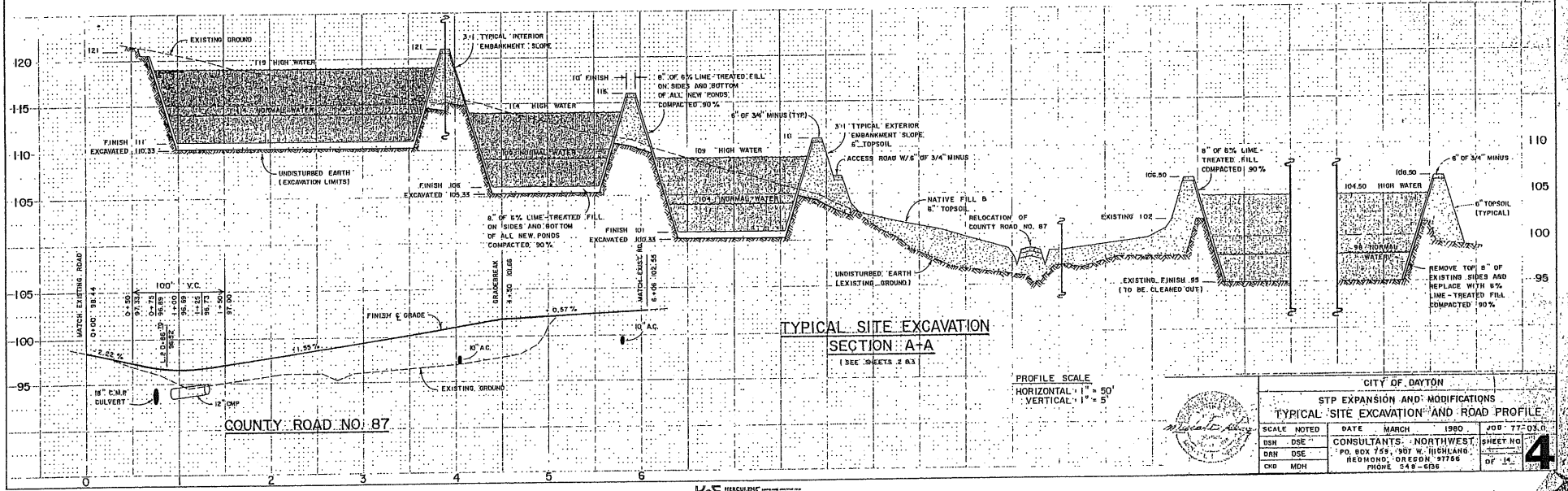
| | |
|---|---|
| DESIGN POPULATION | 2295 |
| RAW SEWAGE CHARACTERISTICS | |
| FLOW | |
| DESIGN AVERAGE | .206 MGD |
| DESIGN PEAK | .906 MGD |
| BIOCHEMICAL OXYGEN DEMAND | 390 PPD |
| SUSPENDED SOLIDS | 459 PPD |
| POND SURFACE AREA | |
| NORMAL OPERATION | |
| POND #1 | 2.42 ACRES |
| POND #2 | 2.06 ACRES |
| POND #3 | 1.59 ACRES |
| POND #4 | 5.64 ACRES |
| HIGH WATER OPERATION | |
| POND #1 | 3.05 ACRES |
| POND #2 | 2.92 ACRES |
| POND #3 | 2.14 ACRES |
| POND #4 | 6.53 ACRES |
| CHLORINE CONTACT BASIN | |
| AVERAGE FLOW | 475 MGD |
| CAPACITY | 19964 GAL |
| DETENTION TIME | |
| AVERAGE | 61 MINUTES |
| PEAK | 38 MINUTES |
| CHLORINATORS | |
| NUMBER | 1 |
| CAPACITY | 50 PPD |




TYPICAL ROAD CROSS-SECTION
NOT TO SCALE




OUTFALL DETAIL
NOT TO SCALE




TYPICAL SITE EXCAVATION
SECTION A+A
(SEE SHEETS 2 & 3)

PROFILE SCALE
HORIZONTAL 1" = 50'
VERTICAL 1" = 5'

CITY OF DAYTON
STP EXPANSION AND MODIFICATIONS
TYPICAL SITE EXCAVATION AND ROAD PROFILE

| | | | |
|---|---|---|---|
| SCALE NOTED | DATE MARCH 1980 | JOB 77-03.0 |
| DSN DSE | CONSULTANTS: NORTHWEST | SHEET NO 4 |
| DRN DSE | PO. BOX 759, 907 W. HIGHLAND | OF 14 |
| CKD MDH | REDMOND, OREGON 97756 PHONE 548-6136 | |

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