# Appendix 1. Accident Data

# Petty Creek Road

MT PFH 71-1(1)

## Accident Report Summary

Feb-04

| Location | Date | Accident Type | Accident # | Conditions | Time of Day | Speed Limit | Remarks |
|---|---|---|---|---|---|---|---|
| T23WR14N Sec 13<br>Petty Creek Road at Bible Lane | 8/22/2002 | Single Vehicle Damage | 200011850803 | Cloudy<br>Dry | Daylight | 35 MPH | Too fast for conditions<br>Overturn |
| T23WR14N Sec 12 | 2/21/1998 | Single Vehicle | 9800011210201 | Cloudy<br>Dry | Daylight | 45 MPH | |
| T23wR14N Sec 13 | 12/20/1998 | Two Vehicle Damage | 9800014101211 | Clear<br>Dry | Daylight | 30 MPH | Inattentive and careless driving<br>Rock or Boulder |
| T23WR14N Sec 13 | 11/12/1998 | Single Vehicle Damage | 9800014101104 | Cloudy<br>Dry | Daylight | 35 MPH | Wild animal |
| T23WR14N Sec 36 | 9/15/1999 | Three Vehicle Damage | 9900014570905 | Clear<br>Dry | Daylight | | Inattentive driving<br>Parked MV |
| T22WR14N Sec 30<br>Petty Creek Road MP 3-4 | 11/30/2001 | Single Vehicle Damage/Injury | 100013991117 | Cloudy<br>Dry | Daylight | 35 MPH | Too fast for conditions<br>Overturn |
| T22WR14N Sec 18<br>Petty Creek Road MP 2-3 | 6/1/2001 | Single Vehicle Damage | 100015480601 | Clear<br>Dry | Daylight | 30 MPH | Exceeded Speed Limit, Too fast for conditions, careless driving |
| T22WR14N Sec. 30 | 3/6/1998 | Single Vehicle Damage | 9800011850304 | Cloudy<br>Dry | Daylight | 35 MPH | Inattentive Too fast for conditions<br>Tree |
| T22WR14N Sec. 30 | 9/15/1998 | Single Vehicle Damage | 9800014640904 | Clear<br>Dry | Daylight | 35 MPH | Exceeded Speed Limit, Too fast for conditions, careless driving |
| T22WR14N Sec. 30 | 2/10/1999 | Single Vehicle Damage | 9900014640206 | Clear<br>Dry | Daylight | 35 MPH | Vegetation Obstruction<br>Wild animal |
| T23WR13N Sec. 11<br>Ed Creek Road | 11/16/2000 | Single Vehicle Damage | 11211108 | Clear<br>Dry | Daylight | | Icy, Tires<br>Overturn |
| T23WR13N Sec. 2<br>6 Miles up Petty Creek | 12/4/2004 | Single Vehicle Damage | 11851202 | Clear<br>Dry | Daylight | 35 MPH | Too fast for conditions<br>Embankment overturn |
| T23WT13N Sec. 1<br>Petty Creek Road | 10/4/2000 | Single Vehicle Damage | 15671002 | Clear<br>Dry | Daylight | 35 MPH | Rut, Holes, Bumps<br>Embankment overturn |

| Location | Date | Accident Type | Accident # | Conditions | Time of Day | Speed Limit | Remarks |
|---|---|---|---|---|---|---|---|
| T23WR13N Sec. 2<br>6.5 Miles up Petty Creek Road | 12/25/2001 | Single Vehicle Damage | 100015361211 | Cloudy<br>Dry | Daylight | 35 MPH | Too fast for conditions<br>Fence |
| T23WR13N Sec. 13 | 9/29/1999 | Single Vehicle Damage | 9900015350903 | Clear<br>Dry | Daylight | 45 MPH | Fire/Explosion |
| T23WR13N Sec. 24 | 6/8/1998 | Single Vehicle Damage | 9800013870608 | Cloudy<br>Dry | Daylight | 45 MPH | Careless Driving<br>Utility Pole |
| T23WR13N Sec. 24 | 10/26/1998 | Single Vehicle Damage | 9800011851006 | Clear<br>Dry | Daylight | | Too fast for conditions<br>Fence |
| T22WR13N Sec. 31 | 4/21/2002 | Single Vehicle Damage/Injury | 200014640402 | Clear<br>Dry | Daylight | 35 MPH | Alcohol, Too fast for conditions<br>Overturn |
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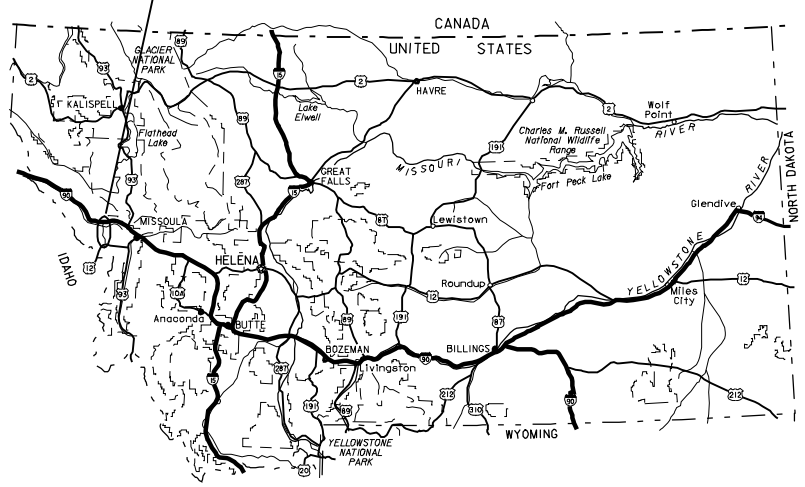
# Appendix 2. Wetland Map

| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-(1) | A.1 |

# U. S. DEPARTMENT OF TRANSPORTATION
# FEDERAL HIGHWAY ADMINISTRATION

Project Location




MONTANA KEY MAP

PLANS FOR PROPOSED PROJECT

ST PFH PFH 71-1(1)

# PETTY CREEK ROAD

LOLO NATIONAL FOREST
MISSOULA COUNTY
MONTANA

LENGTH 18.780 KILOMETERS

## INDEX TO SHEETS


**A. GENERAL INFORMATION**
A.1 TITLE SHEET
A.2 PLAN SYMBOLS AND ABBREVIATIONS
A.3 VICINITY MAP

**C. TYPICAL SECTION(S)**
C.1 TYPICAL SECTION AND QUANTITIES

**D. PLAN-PROFILE**
D.1 QUANTITIES AND CONNECTION DETAILS
D.2-D.30 PLAN AND PROFILES

**E. APPROACH ROADS**
E.1-E.15 EROSION CONTROL PLANS
E.16-E.19 EROSION CONTROL DETAILS

**F. EROSION CONTROL**
F.1-F.5 PIPE CULVERT STANDARDS AND DETAILS

**G. MATERIAL SOURCE**
G.1-G.9 GUARDRAIL DETAILS

**H. DRAINAGE**
H.1-H.3 FENCE DETAILS

**I. SAFETY FEATURES**
I.1-I.3 MSE GABION-FACED WALL DETAILS

**J. FENCES, GATES, AND CATTLE GUARDS**
J.1 PERMANENT TRAFFIC CONTROL AND DETAILS

**K. MISCELLANEOUS**
K.1 PETTY CREEK BRIDGE DETAILS 16+614.572

**L. WETALND MITIGATION**

**M. LANDSCAPING PLANS**

**N. TEMPORARY TRAFFIC CONTROL**

**O. PERMANENT TRAFFIC CONTROL**

**P. BRIDGE CONSTRUCTION PLANS**


**TYPE OF CONSTRUCTION:**

*Grading, drainage, base and paving*

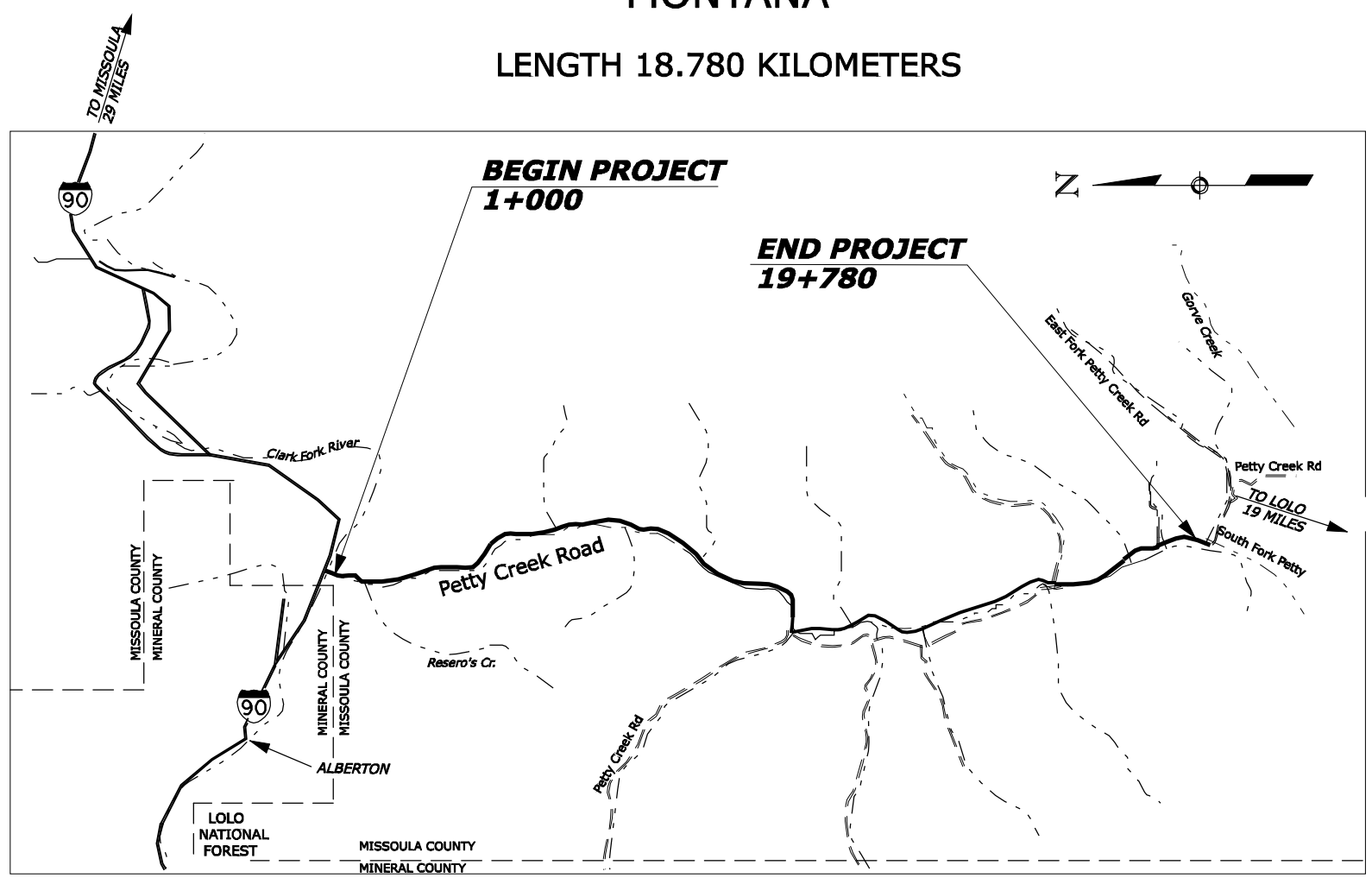
**DESIGN DESIGNATION:**

*ADT (2006) =*
*ADT (2026) =*
*dhv 180*
*V 60 km/h*
*e 0.06 max.*

**SPECIFICATION:**

*Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Metric Units*

FEDERAL LANDS HIGHWAY
Metric
COMMITMENT TO EXCELLENCE




Scale in kilometers
1 .5 0 1 2 3 4 5

PLANS PREPARED BY
**U.S. DEPARTMENT OF TRANSPORTATION**
**FEDERAL HIGHWAY ADMINISTRATION**
WESTERN FEDERAL LANDS HIGHWAY DIVISION
VANCOUVER, WASHINGTON

***RECOMMENDED:***

_____ DATE _____
Project Manager,
Western Federal Lands Highway Division

***APPROVED:***

_____ DATE _____
Director, Project Delivery,
Western Federal Lands Highway Division

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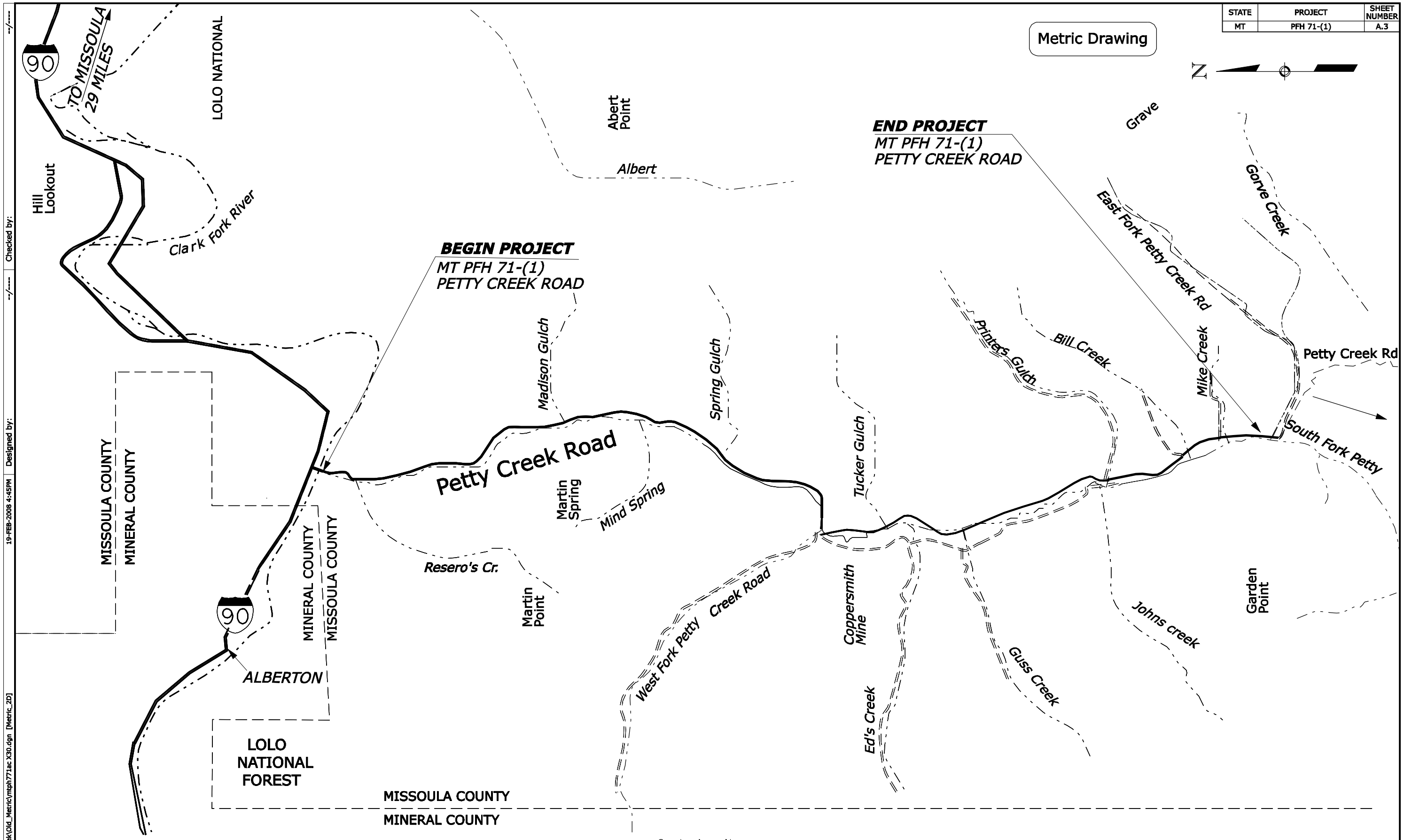
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-(1) | A.3 |

Metric Drawing




# VICINITY MAP

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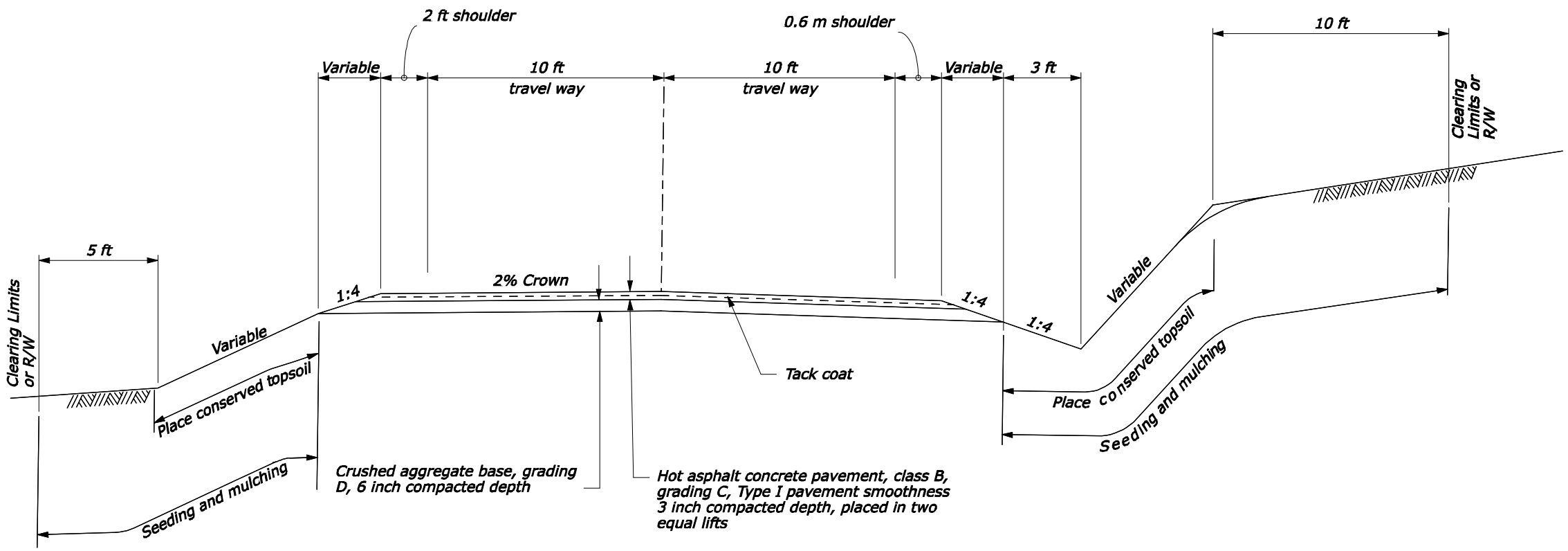
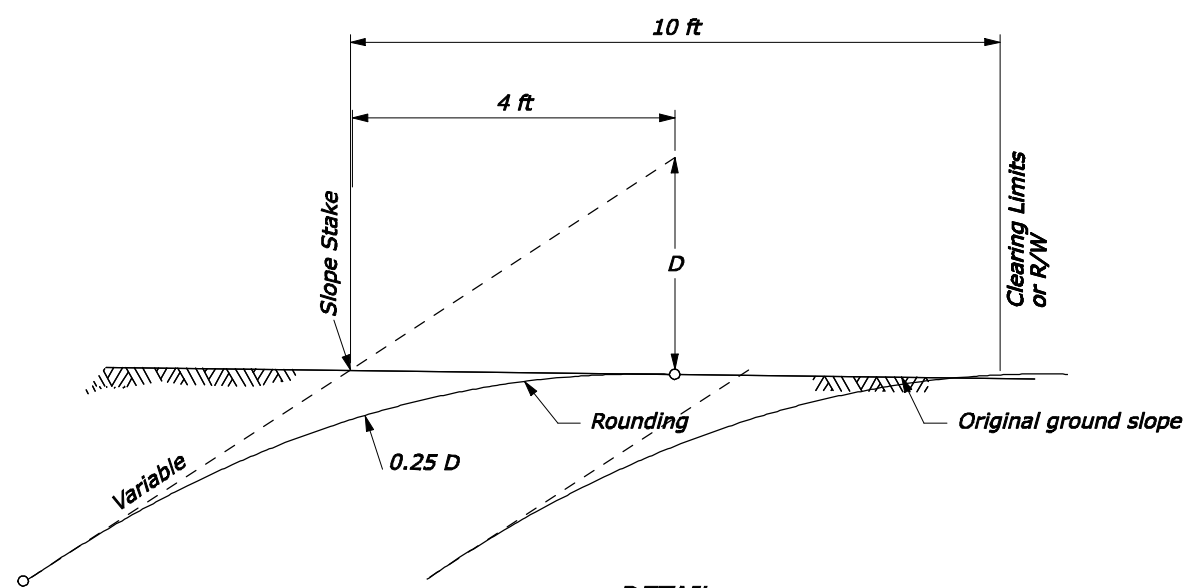
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | C.1 |




**PETTY CREEK ROAD**
**1+000.00 TO 19+780**




DETAIL
**CUT SLOPE ROUNDING**

# TYPICAL SECTION

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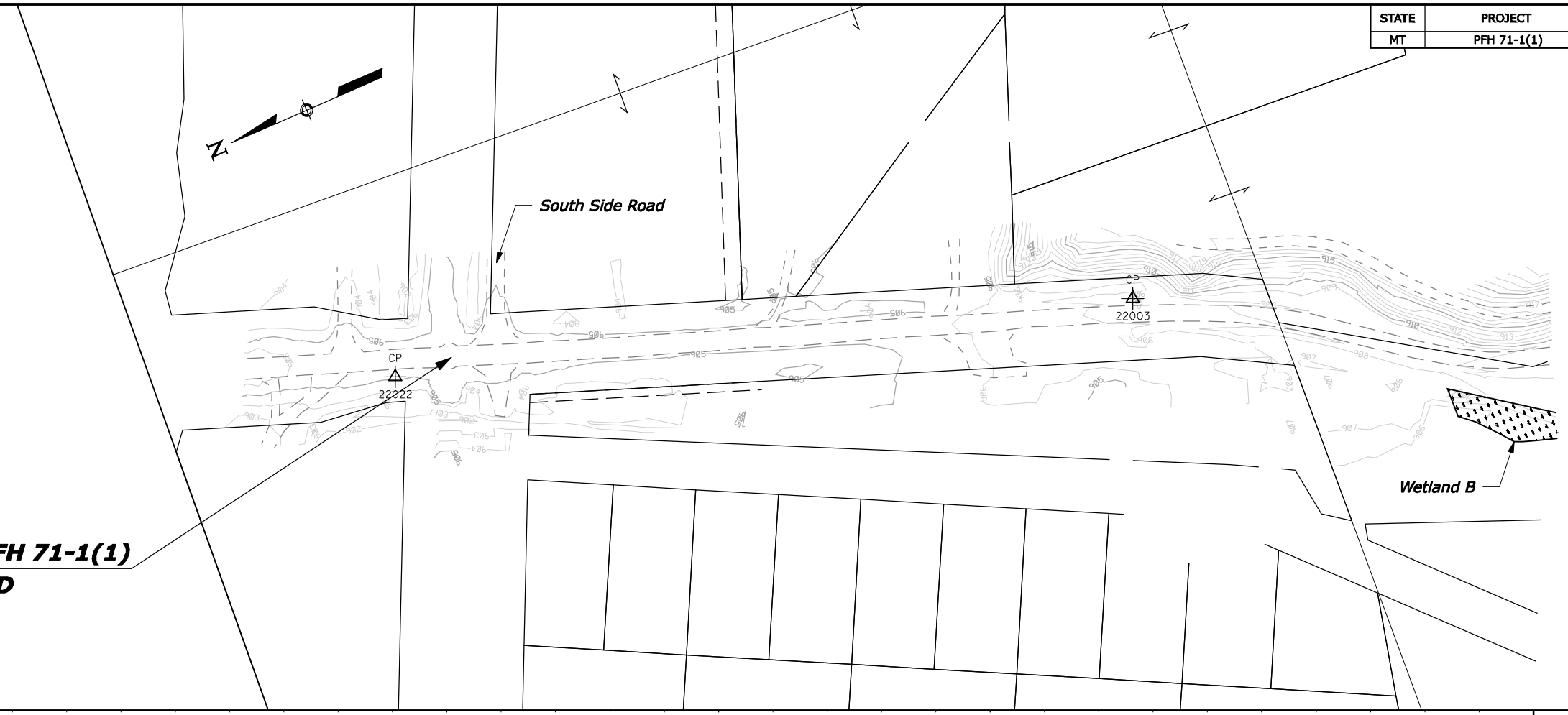
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.2 |

CONTROL POINTS

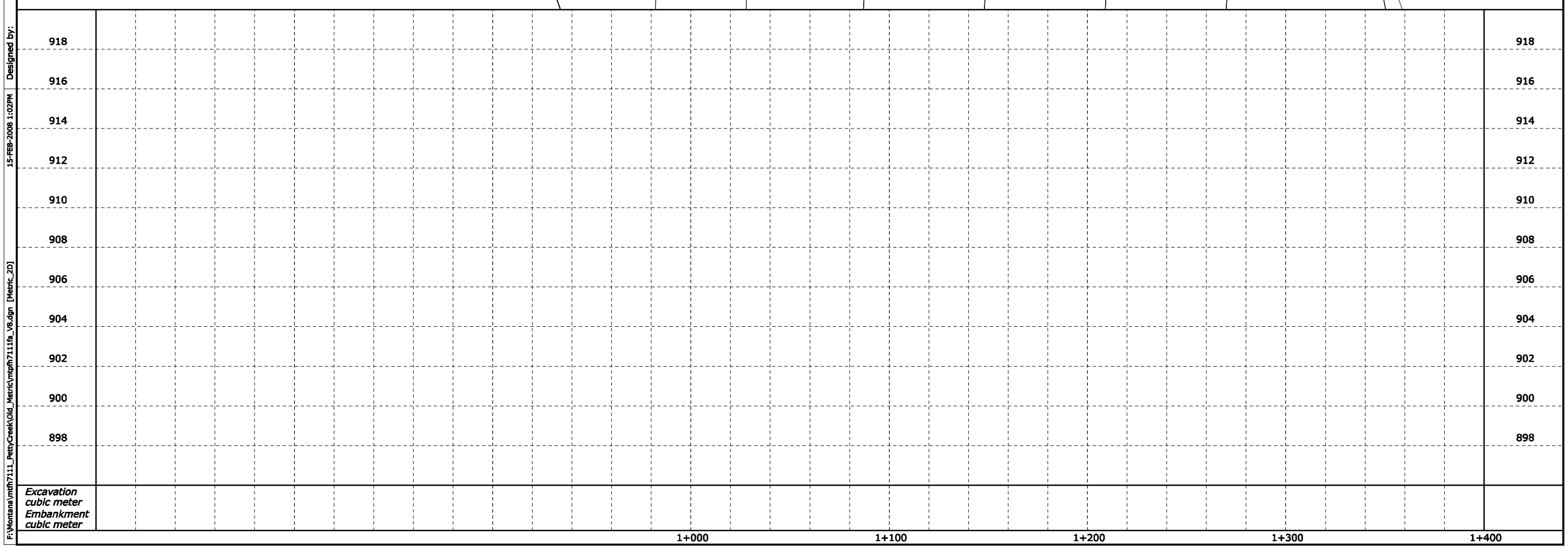
| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22022 | 316462.933 | 224176.240 | 905.021 |
| 22003 | 316202.628 | 224093.946 | 907.411 |




**BEGIN PROJECT PFH 71-1(1)**

**PETTY CREEK ROAD**
**1+000**
N 224174.5509
E 316441.1096

Metric Drawing

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| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.3 |

Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22004 | 316059.407 | 224003.264 | 909.776 |
| 22005 | 315857.802 | 224007.180 | 912.855 |
| 22006 | 315763.327 | 223965.253 | 916.209 |
| 22007 | 315587.355 | 223971.785 | 918.121 |

926
924
922
920
918
916
914
912
910
908
906

Excavation cubic meter
Embankment cubic meter

1+400 1+500 1+600 1+700 1+800 1+900 2+000 2+100

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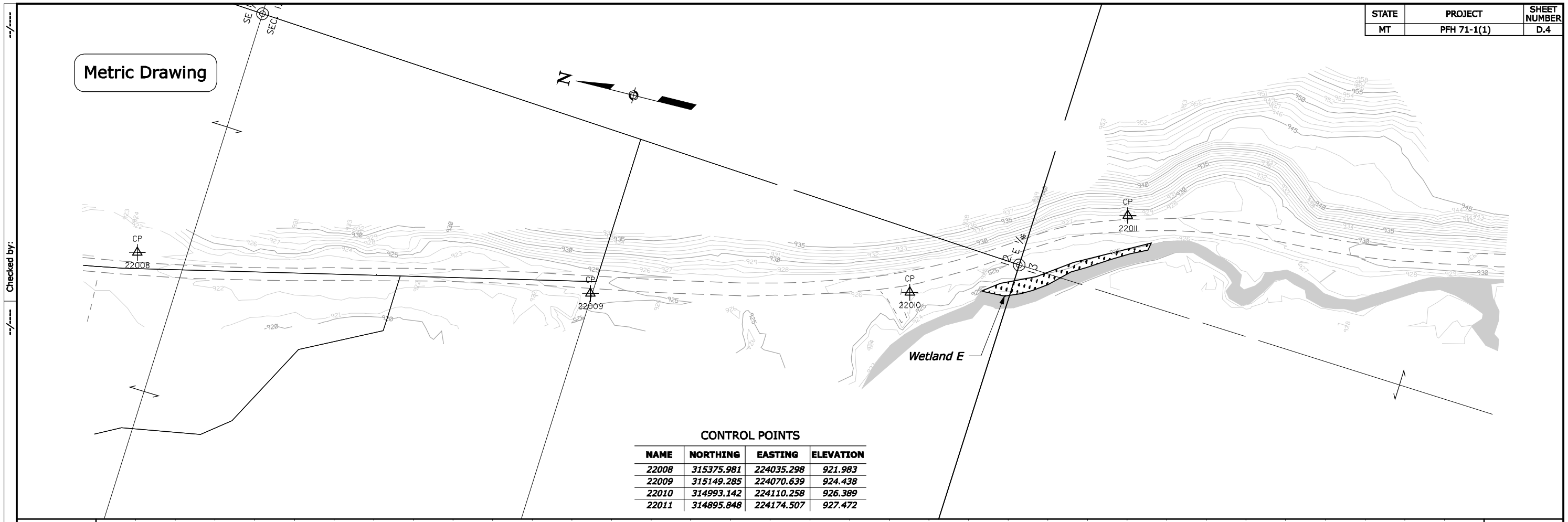


CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22008 | 315375.981 | 224035.298 | 921.983 |
| 22009 | 315149.285 | 224070.639 | 924.438 |
| 22010 | 314993.142 | 224110.258 | 926.389 |
| 22011 | 314895.848 | 224174.507 | 927.472 |

936
934
932
930
928
926
924
922
920
918
916

Excavation cubic meter
Embankment cubic meter

2+100 2+200 2+300 2+400 2+500 2+600 2+700 2+800

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| STATE | PROJECT | SHEET NUMBER |
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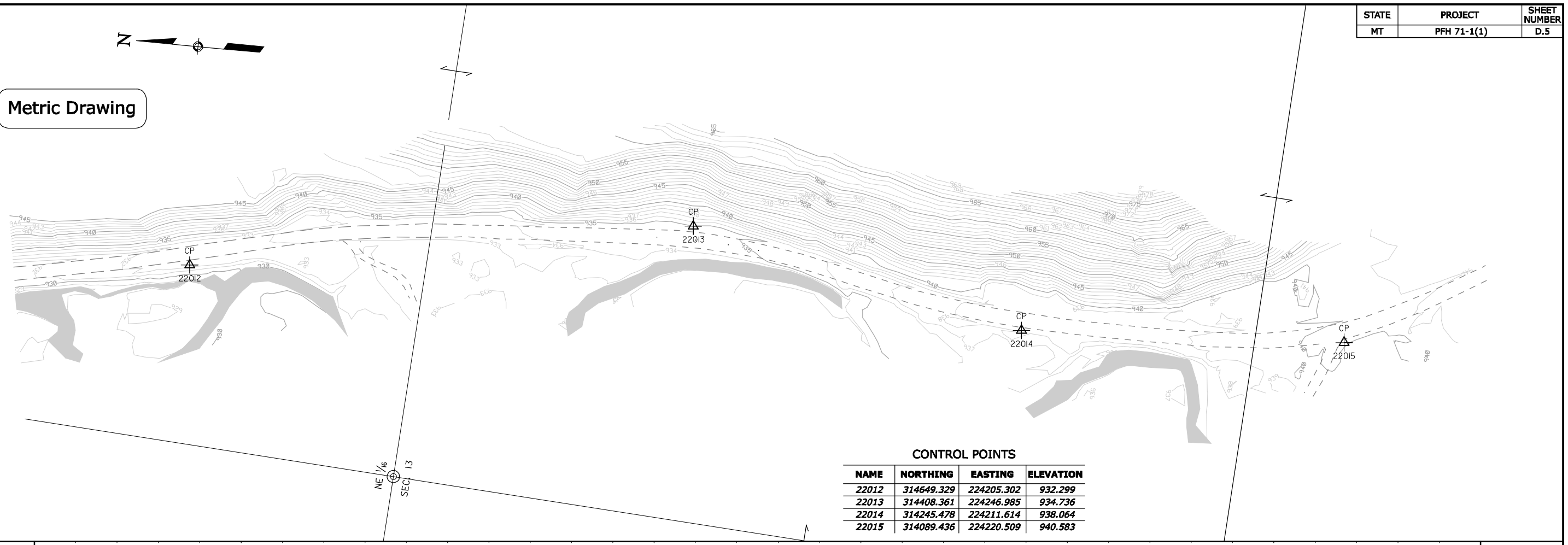
Metric Drawing




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22012 | 314649.329 | 224205.302 | 932.299 |
| 22013 | 314408.361 | 224246.985 | 934.736 |
| 22014 | 314245.478 | 224211.614 | 938.064 |
| 22015 | 314089.436 | 224220.509 | 940.583 |

946
944
942
940
938
936
934
932
930
928
926

*Excavation cubic meter*
*Embankment cubic meter*

2+800 2+900 3+000 3+100 3+200 3+300 3+400 3+500

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| STATE | PROJECT | SHEET NUMBER |
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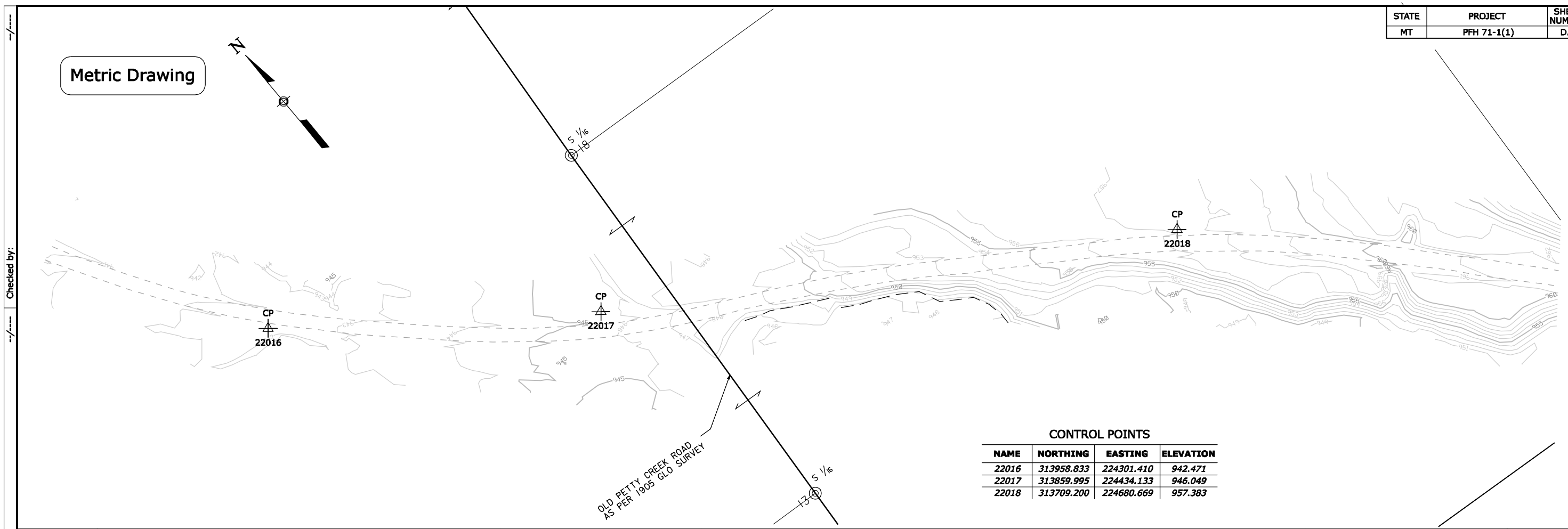
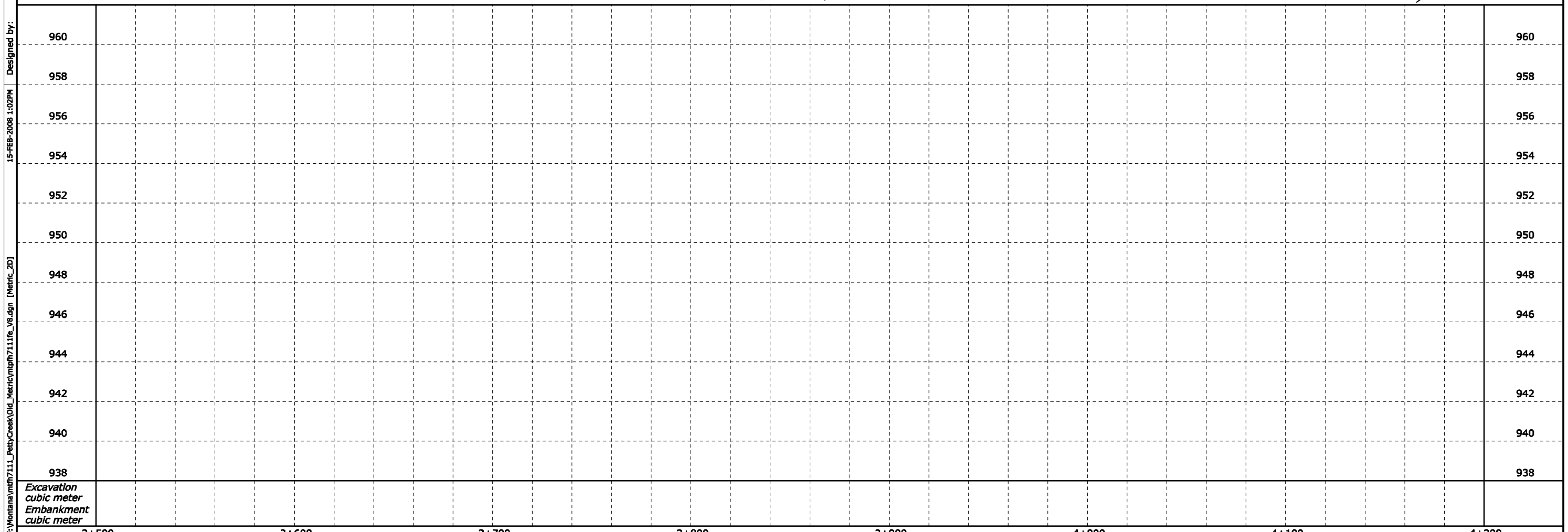



CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22016 | 313958.833 | 224301.410 | 942.471 |
| 22017 | 313859.995 | 224434.133 | 946.049 |
| 22018 | 313709.200 | 224680.669 | 957.383 |

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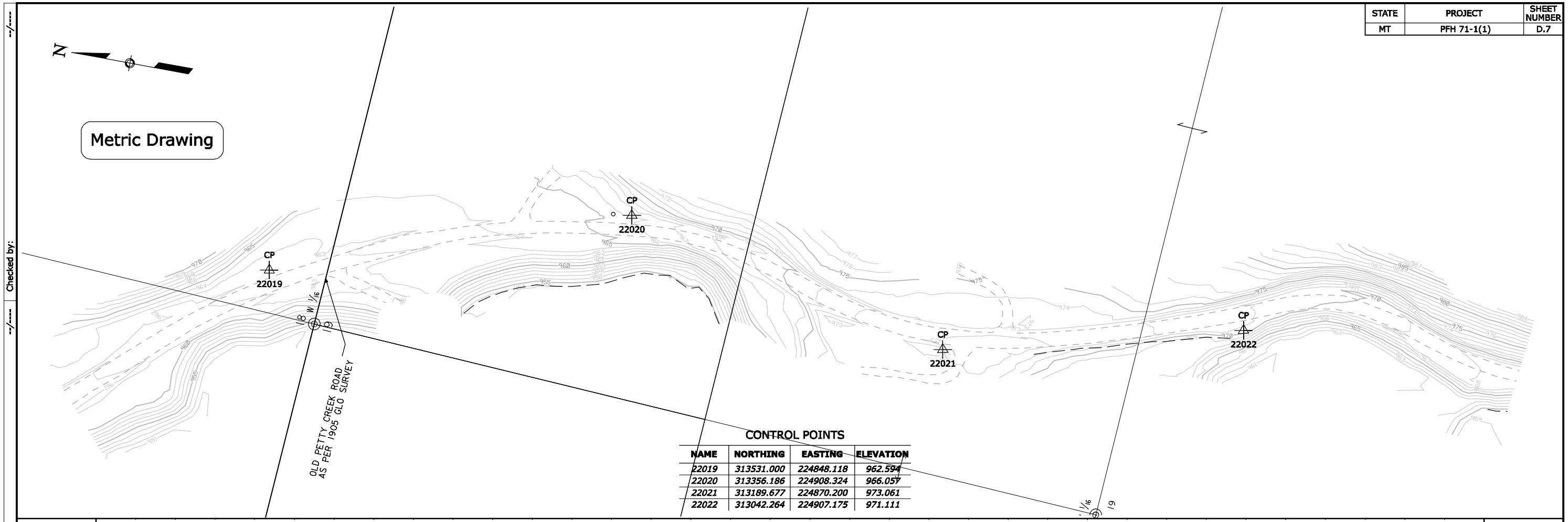


CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22019 | 313531.000 | 224848.118 | 962.594 |
| 22020 | 313356.186 | 224908.324 | 966.057 |
| 22021 | 313189.677 | 224870.200 | 973.061 |
| 22022 | 313042.264 | 224907.175 | 971.111 |

980
978
976
974
972
970
968
966
964
962
960
958

*Excavation cubic meter*
*Embankment cubic meter*

4+200 4+300 4+400 4+500 4+600 4+700 4+800 4+900

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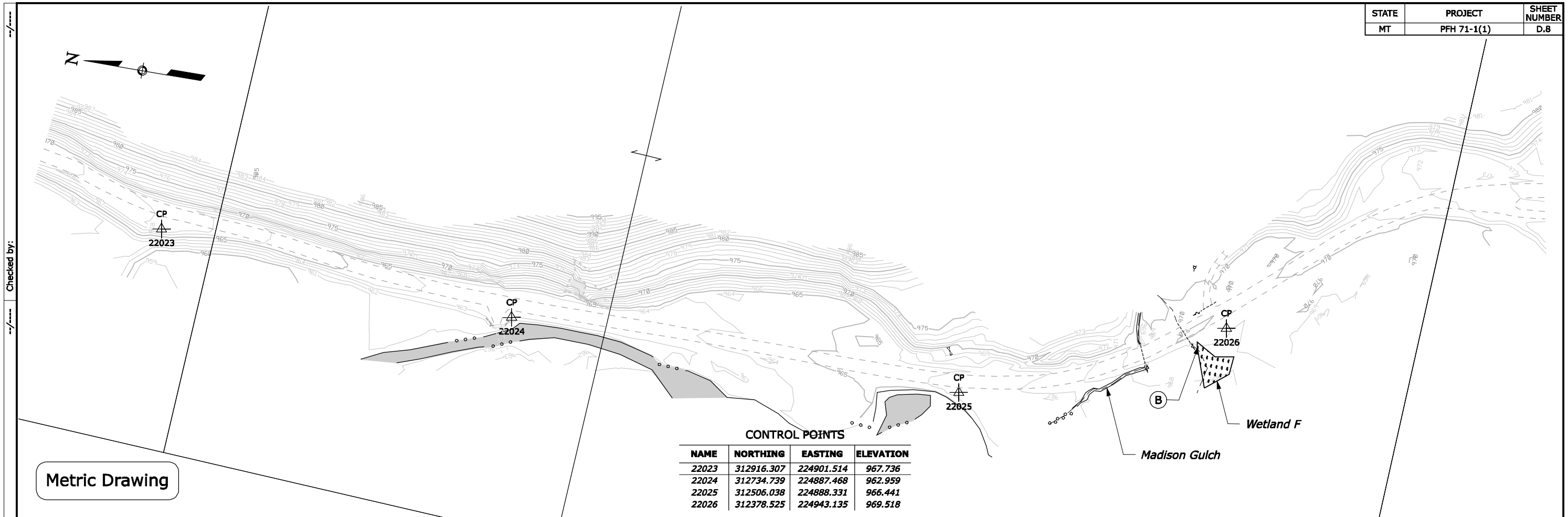
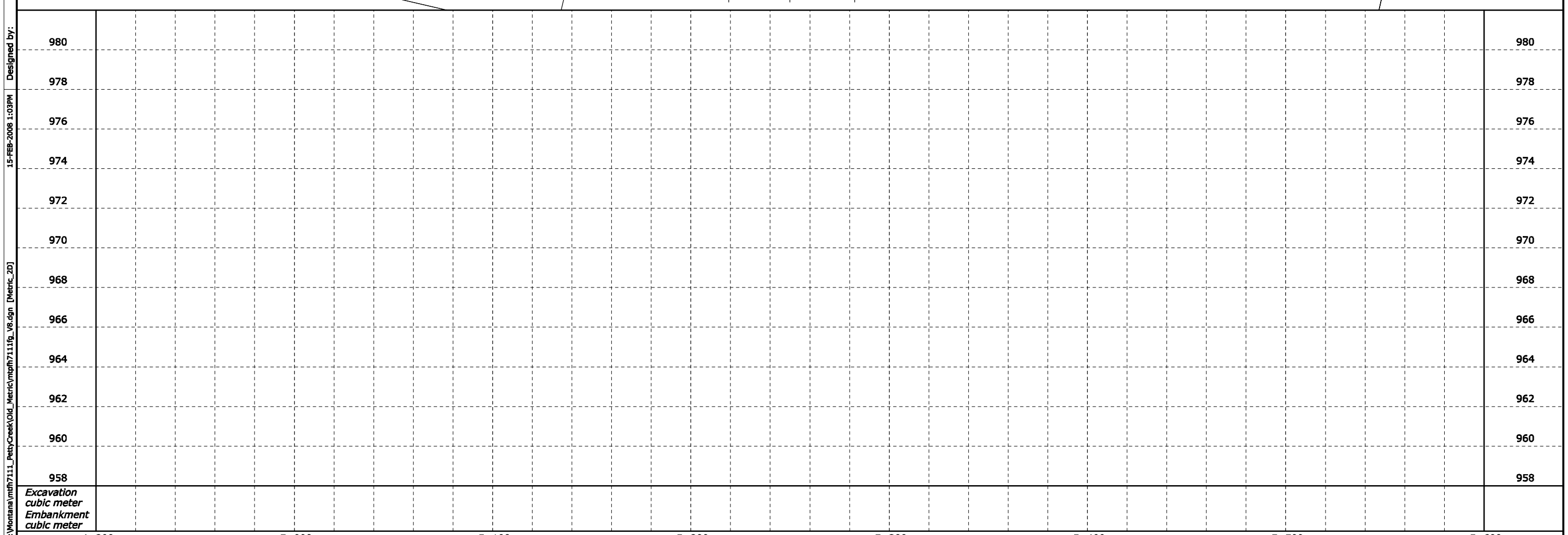



CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22023 | 312916.307 | 224901.514 | 967.736 |
| 22024 | 312734.739 | 224887.468 | 962.959 |
| 22025 | 312506.038 | 224888.331 | 966.441 |
| 22026 | 312378.525 | 224943.135 | 969.518 |

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| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
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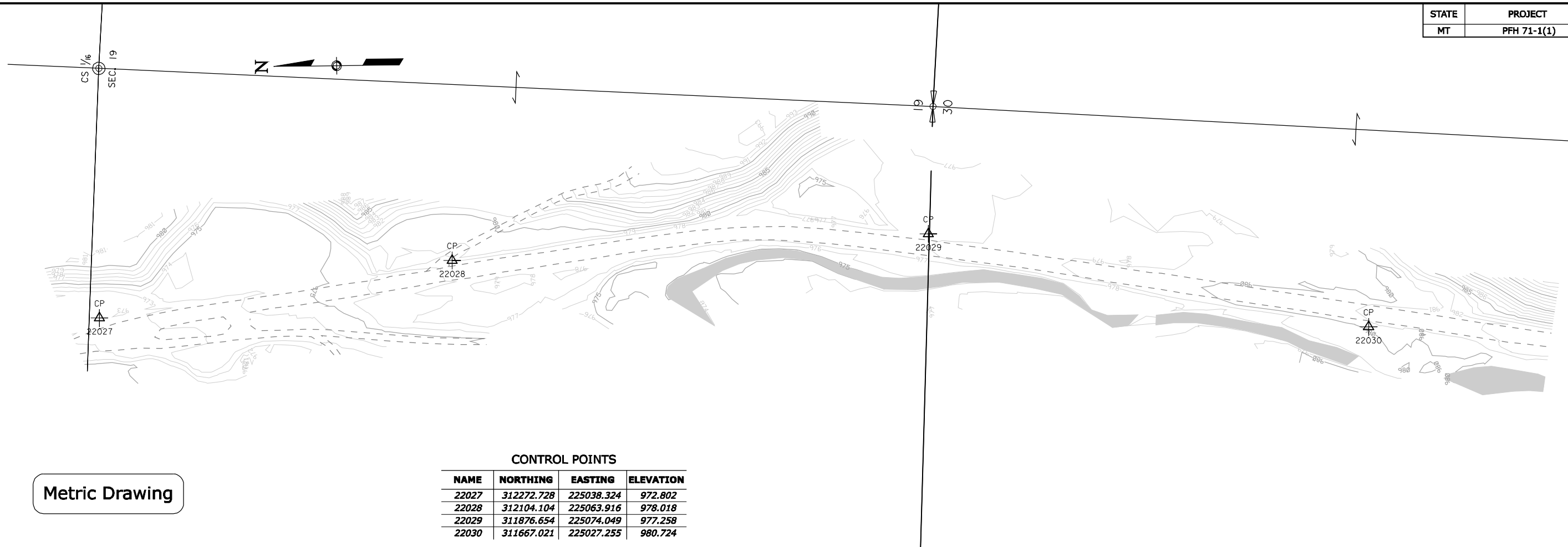


Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22027 | 312272.728 | 225038.324 | 972.802 |
| 22028 | 312104.104 | 225063.916 | 978.018 |
| 22029 | 311876.654 | 225074.049 | 977.258 |
| 22030 | 311667.021 | 225027.255 | 980.724 |

988
986
984
982
980
978
976
974
972
970
968

*Excavation cubic meter*
*Embankment cubic meter*

5+600 5+700 5+800 5+900 6+000 6+100 6+200 6+300

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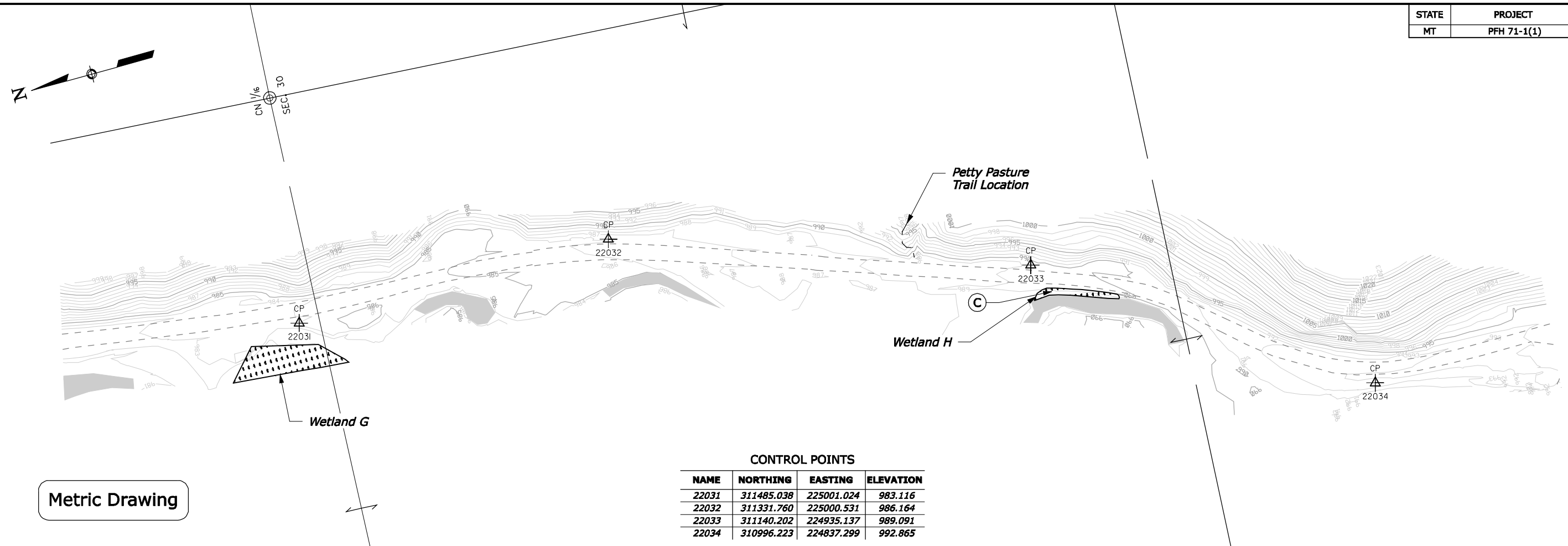
| MT | PFH 71-1(1) | D.10 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22031 | 311485.038 | 225001.024 | 983.116 |
| 22032 | 311331.760 | 225000.531 | 986.164 |
| 22033 | 311140.202 | 224935.137 | 989.091 |
| 22034 | 310996.223 | 224837.299 | 992.865 |

998
996
994
992
990
988
986
984
982
980
978

Excavation cubic meter
Embankment cubic meter

6+300 6+400 6+500 6+600 6+700 6+800 6+900 7+000

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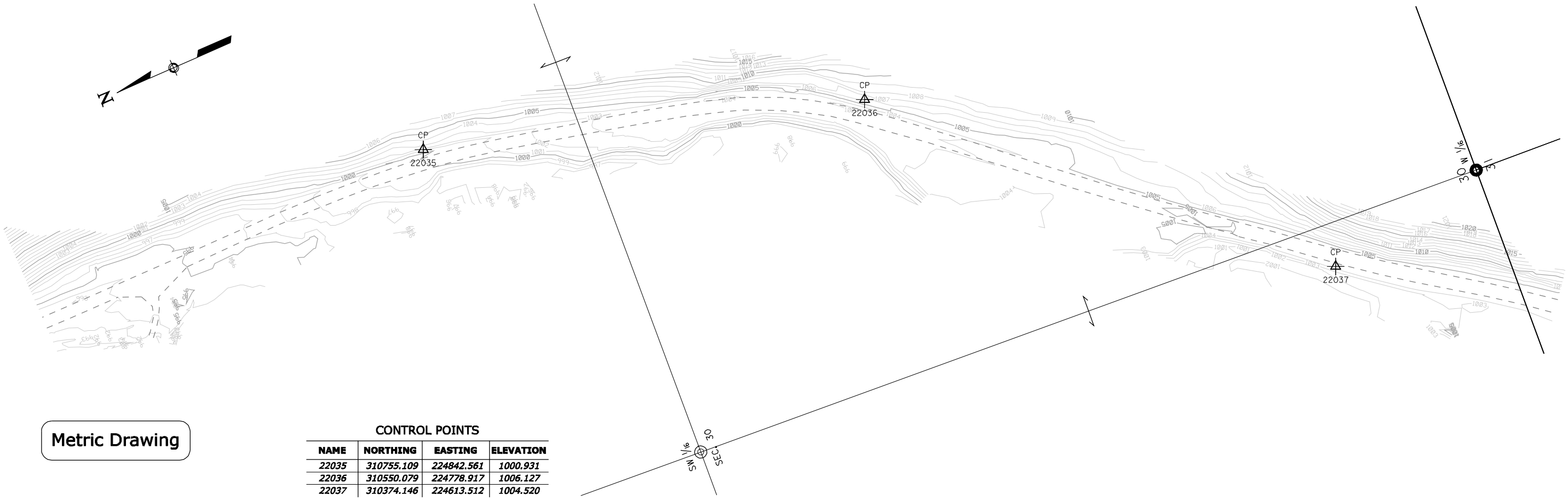
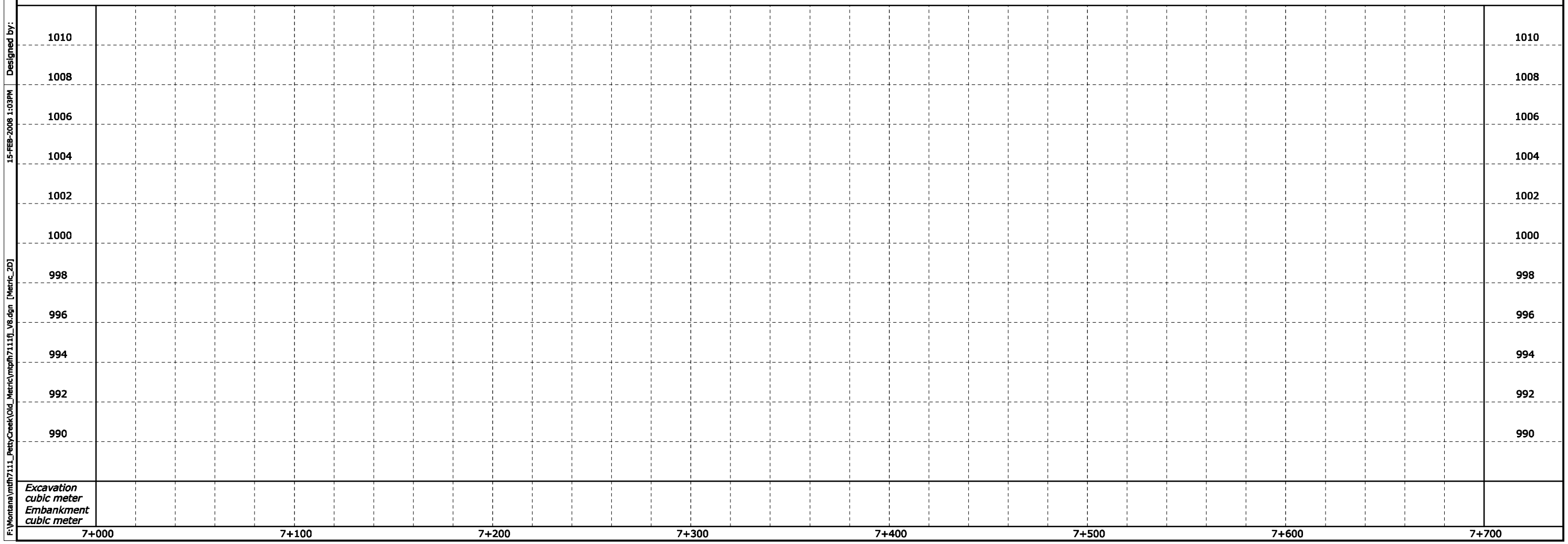
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.11 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22035 | 310755.109 | 224842.561 | 1000.931 |
| 22036 | 310550.079 | 224778.917 | 1006.127 |
| 22037 | 310374.146 | 224613.512 | 1004.520 |

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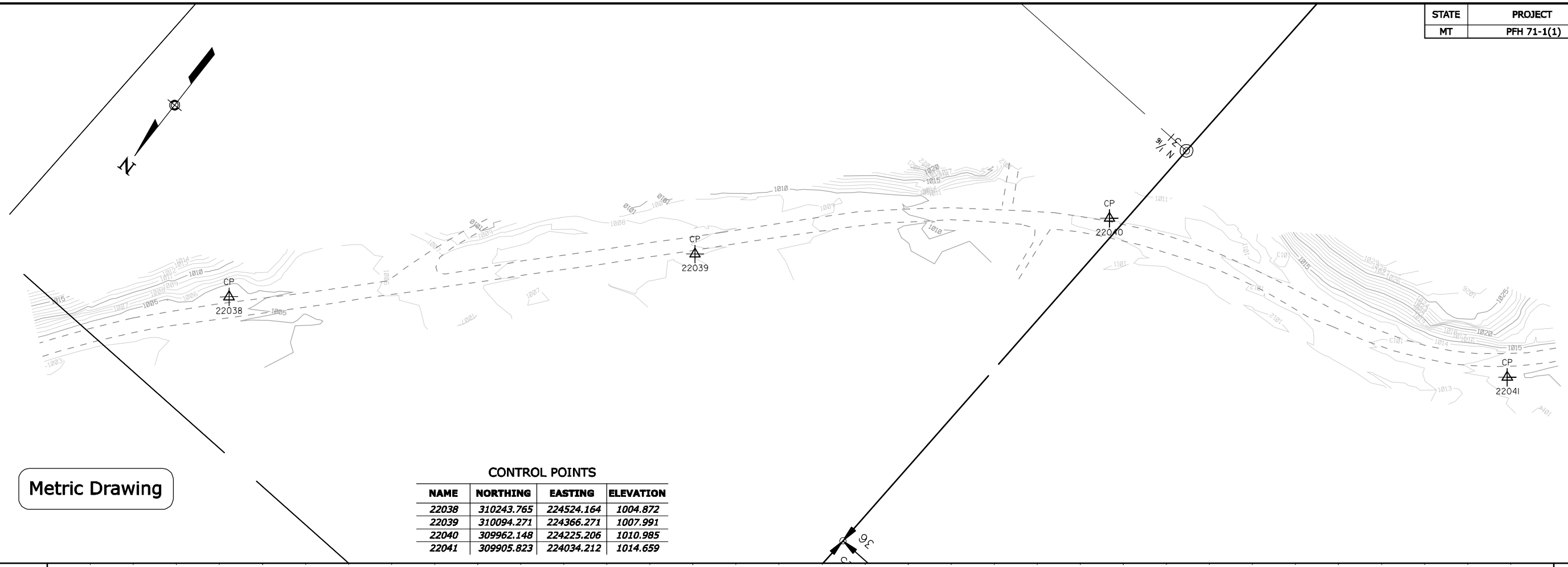
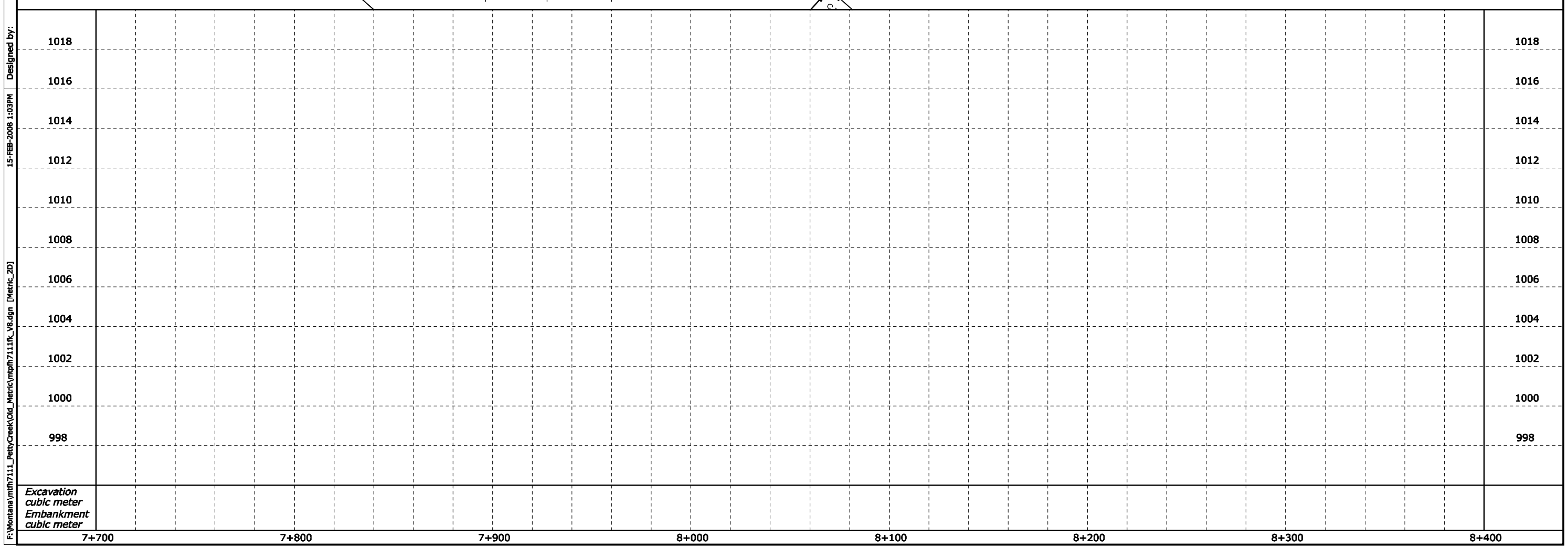



Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22038 | 310243.765 | 224524.164 | 1004.872 |
| 22039 | 310094.271 | 224366.271 | 1007.991 |
| 22040 | 309962.148 | 224225.206 | 1010.985 |
| 22041 | 309905.823 | 224034.212 | 1014.659 |

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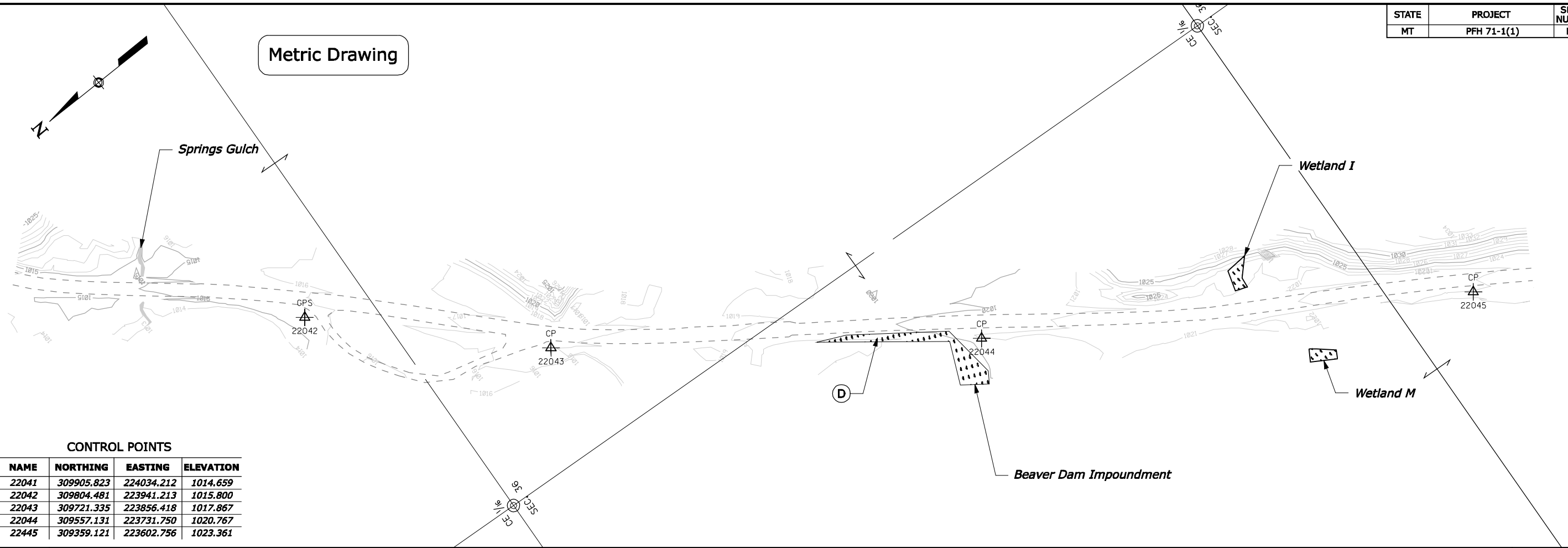
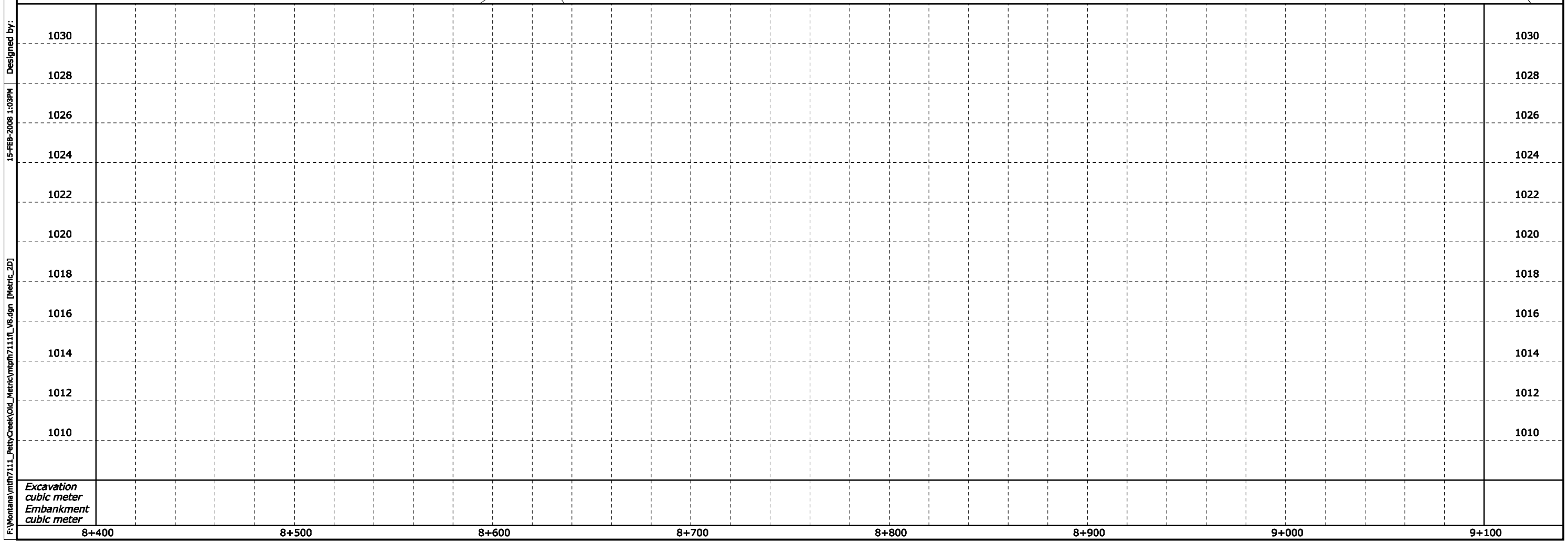



CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22041 | 309905.823 | 224034.212 | 1014.659 |
| 22042 | 309804.481 | 223941.213 | 1015.800 |
| 22043 | 309721.335 | 223856.418 | 1017.867 |
| 22044 | 309557.131 | 223731.750 | 1020.767 |
| 22445 | 309359.121 | 223602.756 | 1023.361 |

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| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
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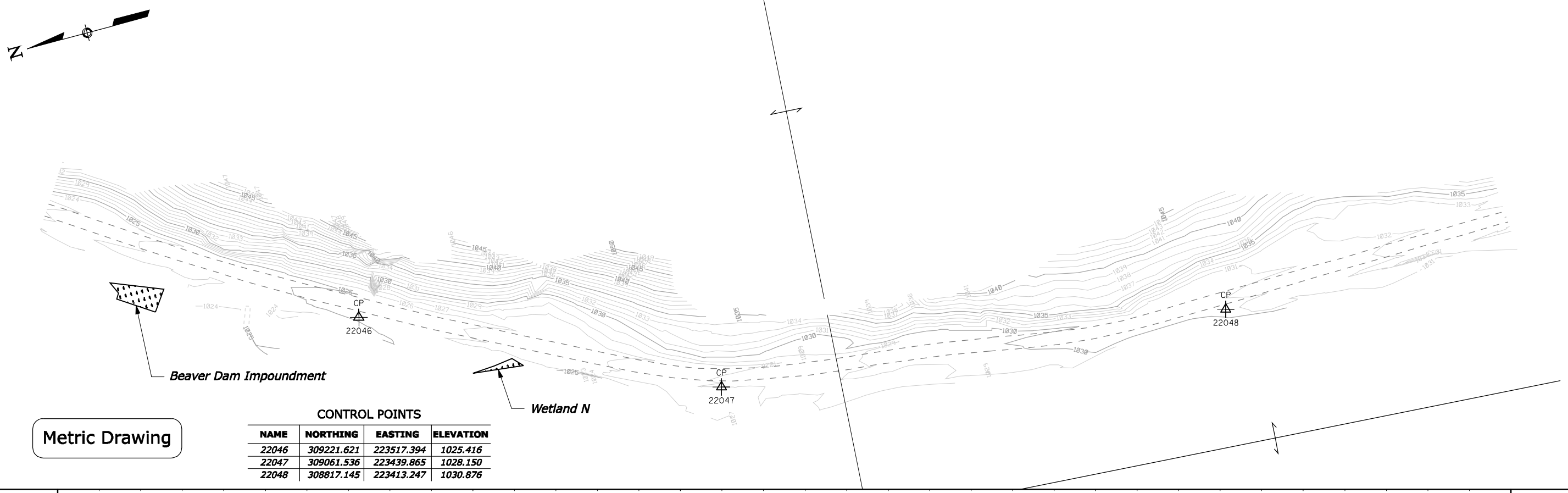
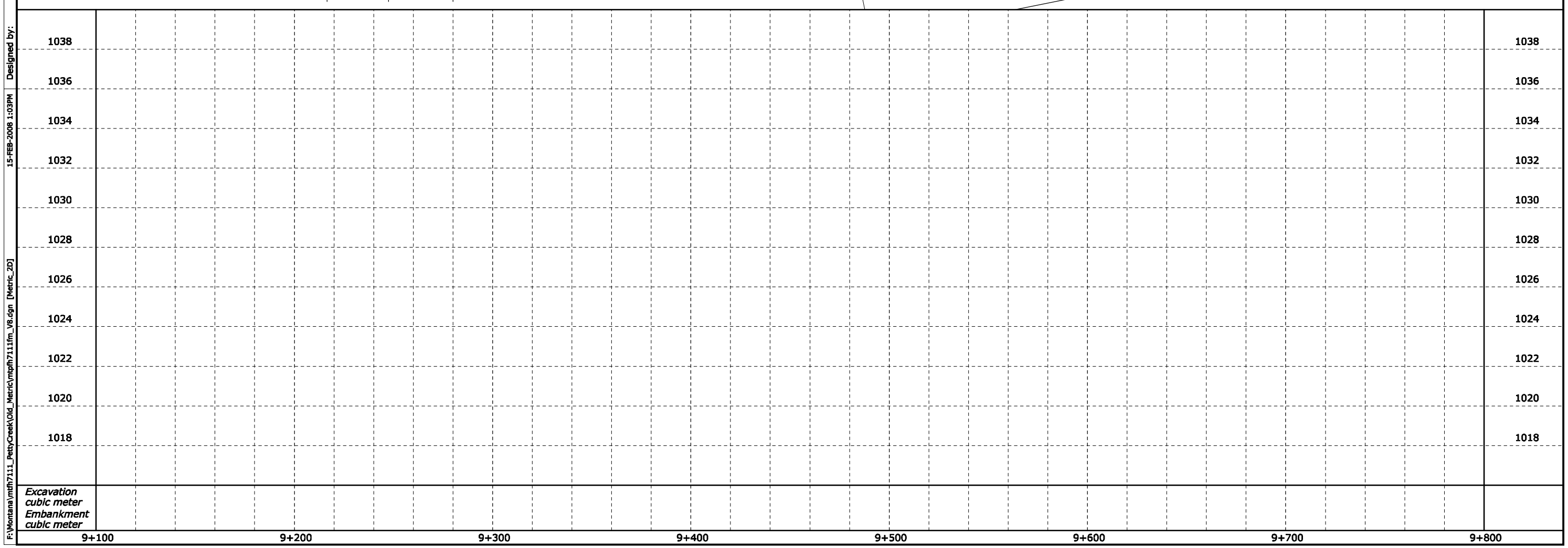



Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22046 | 309221.621 | 223517.394 | 1025.416 |
| 22047 | 309061.536 | 223439.865 | 1028.150 |
| 22048 | 308817.145 | 223413.247 | 1030.876 |

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Checked by:
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| STATE | PROJECT | SHEET NUMBER |
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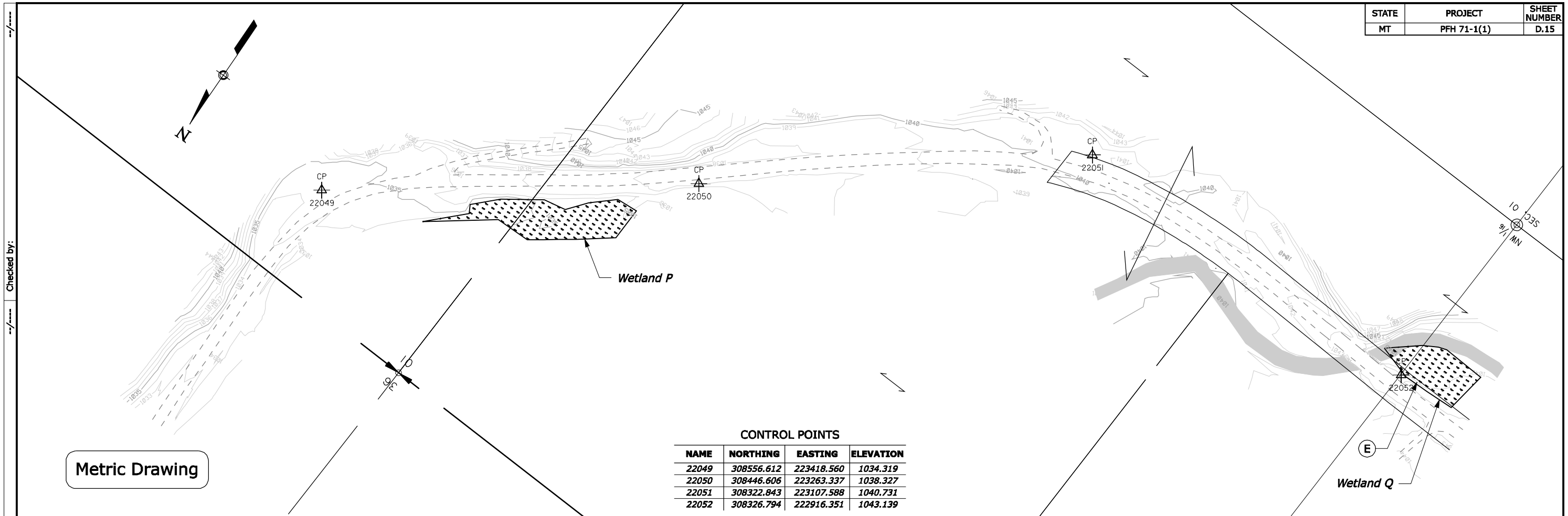



CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22049 | 308556.612 | 223418.560 | 1034.319 |
| 22050 | 308446.606 | 223263.337 | 1038.327 |
| 22051 | 308322.843 | 223107.588 | 1040.731 |
| 22052 | 308326.794 | 222916.351 | 1043.139 |

1048
1046
1044
1042
1040
1038
1036
1034
1032
1030
1028

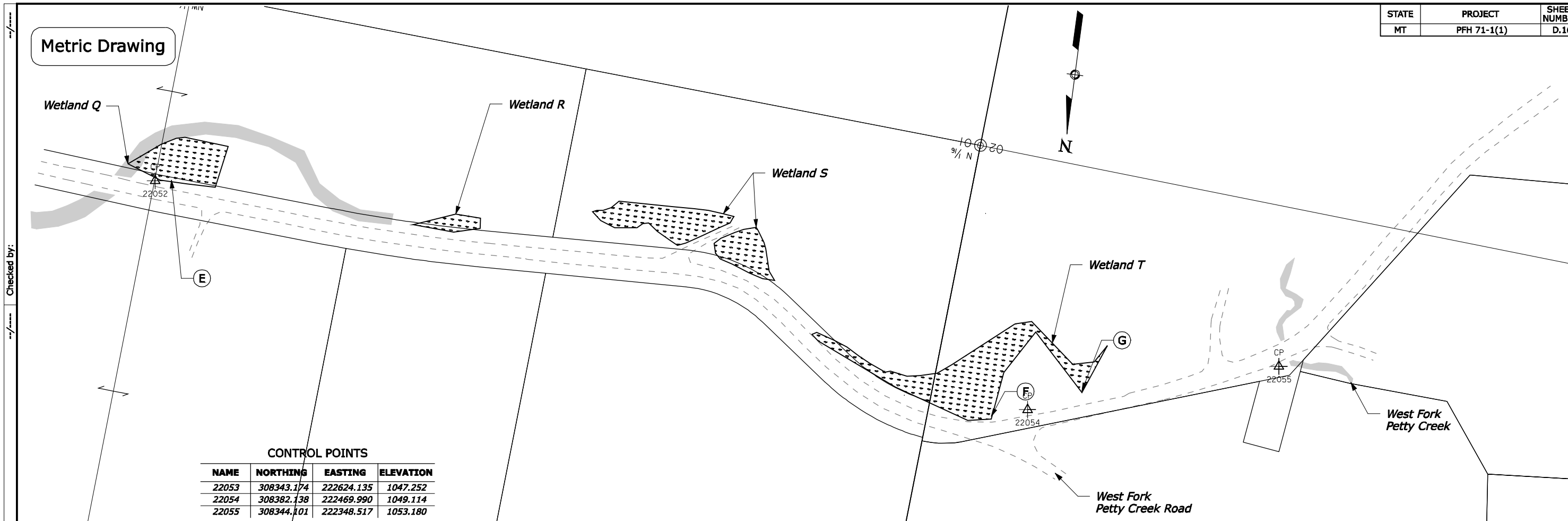
*Excavation cubic meter*
*Embankment cubic meter*

9+800 9+900 10+000 10+100 10+200 10+300 10+400 10+500

Designed by: Checked by: 15-FEB-2008 1:04PM F:\Montana\mdfh7111_PettyCreek\Old_Metric\mtpfh7111fn_V8.dgn [Metric_2D]

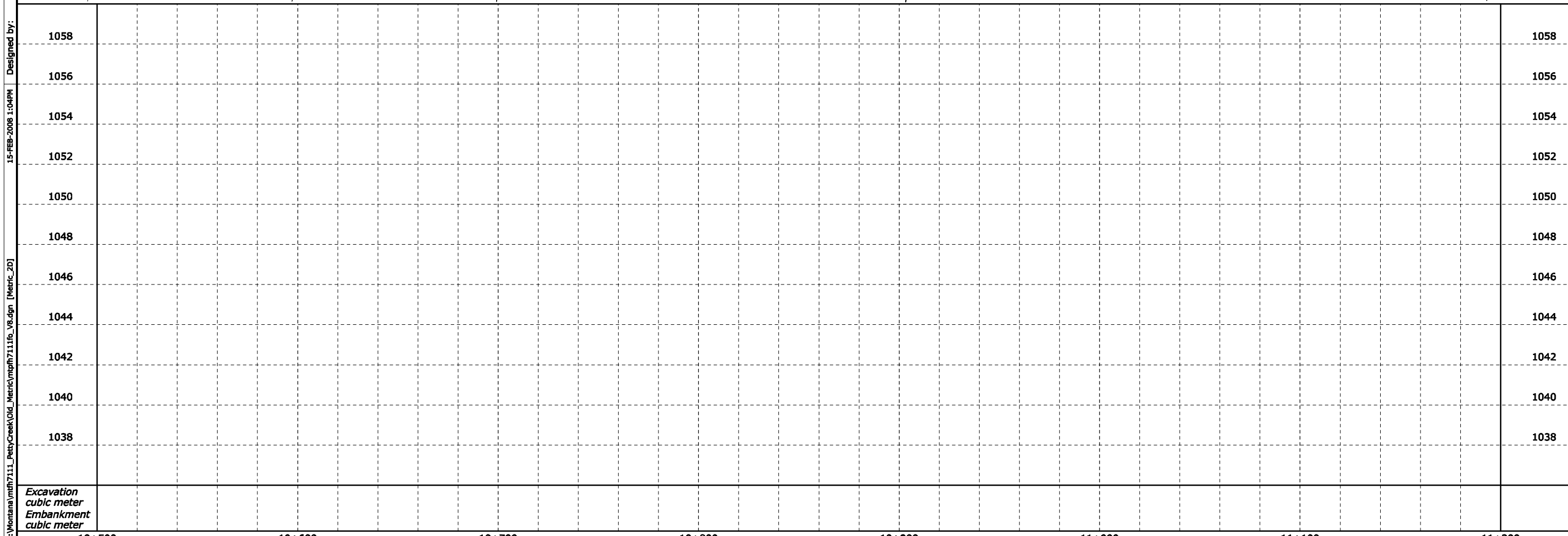
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.16 |

Metric Drawing




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22053 | 308343.174 | 222624.135 | 1047.252 |
| 22054 | 308382.138 | 222469.990 | 1049.114 |
| 22055 | 308344.101 | 222348.517 | 1053.180 |

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| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
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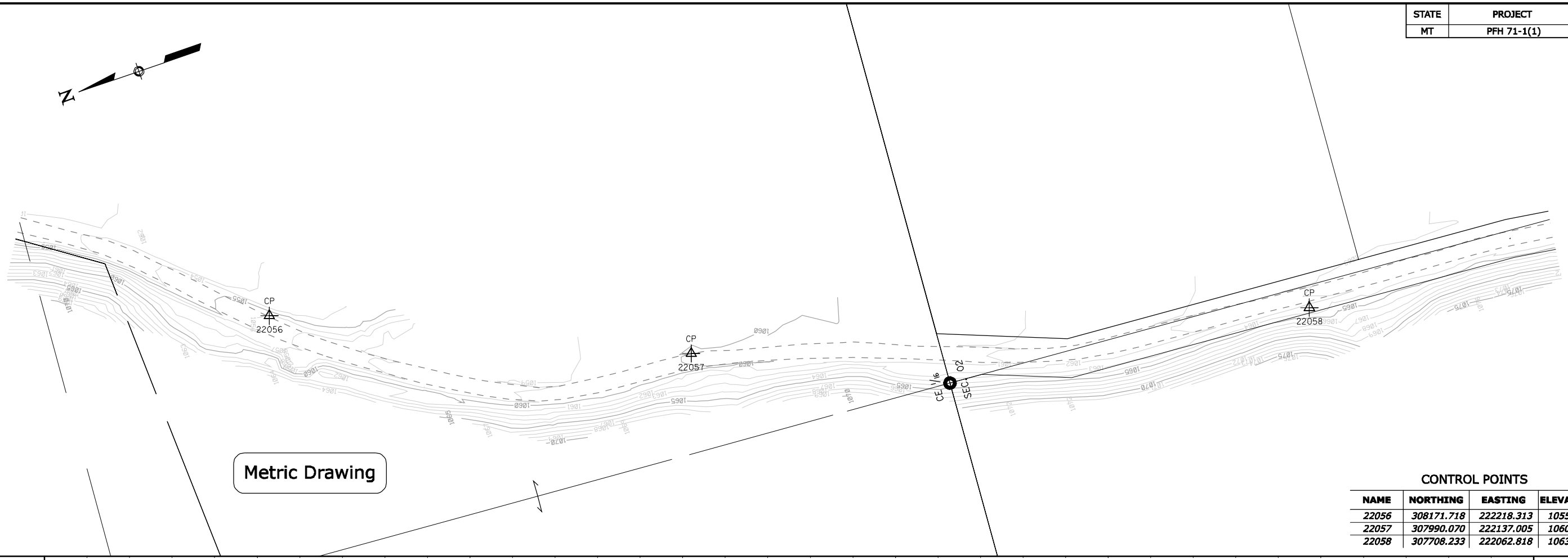
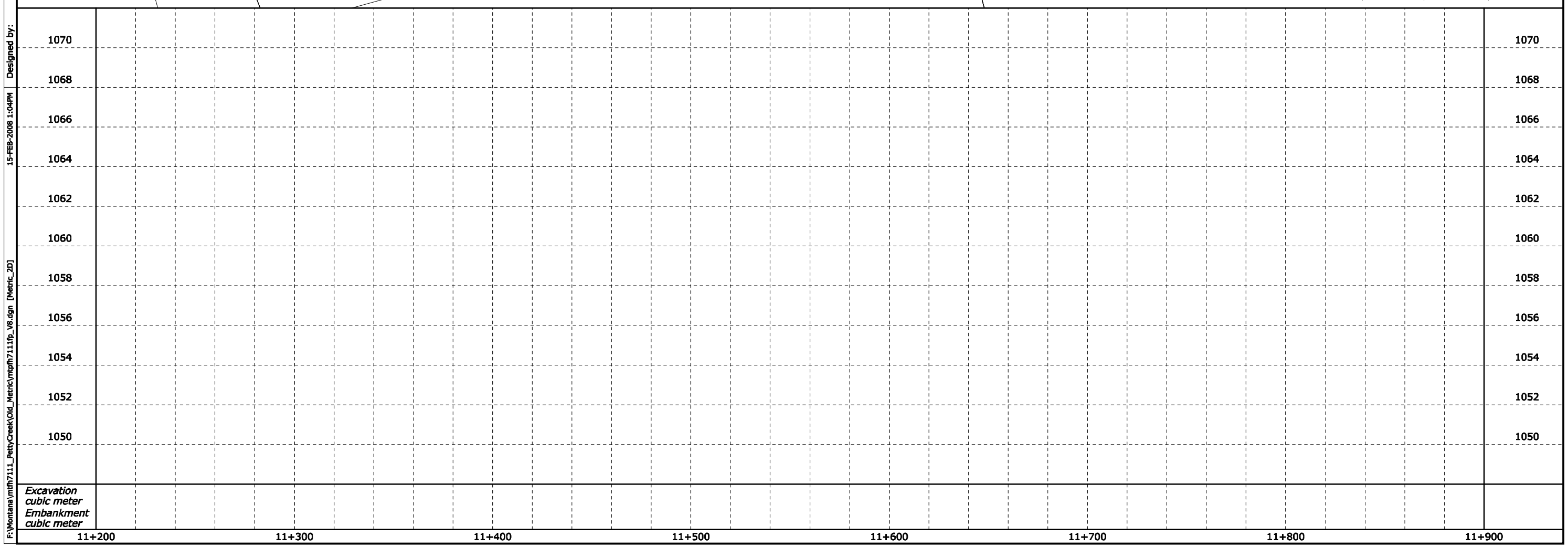



CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22056 | 308171.718 | 222218.313 | 1055.939 |
| 22057 | 307990.070 | 222137.005 | 1060.055 |
| 22058 | 307708.233 | 222062.818 | 1063.529 |

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15-FEB-2008 1:04PM
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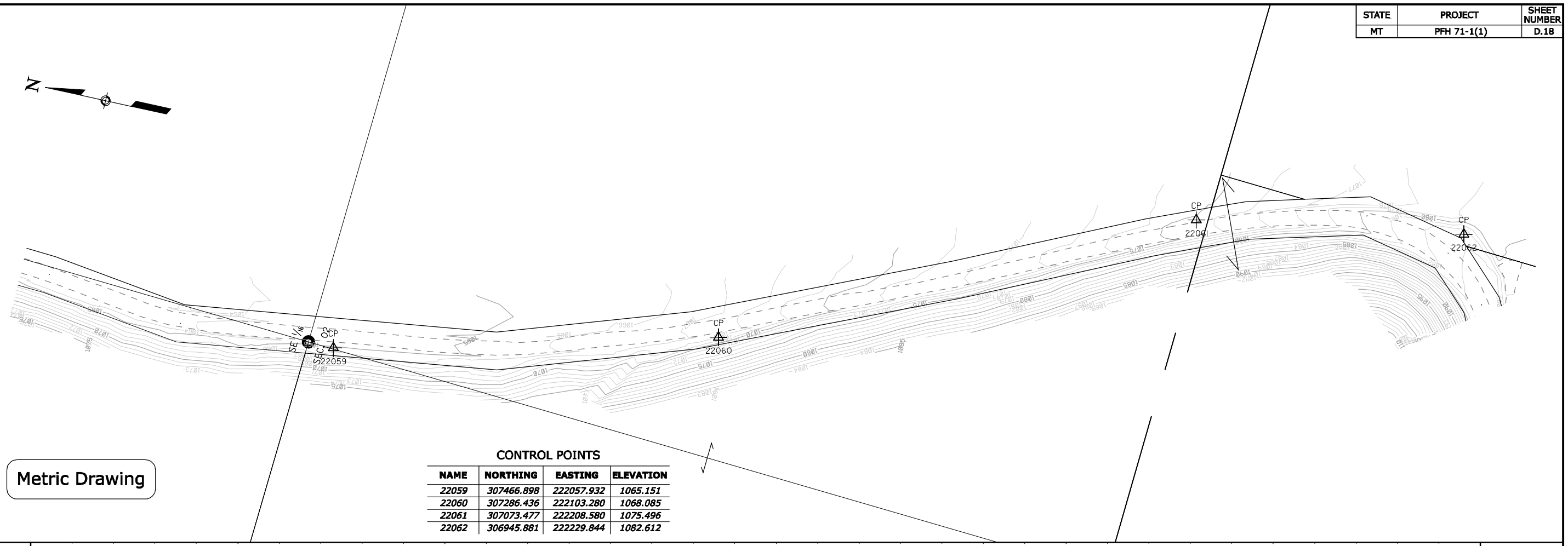
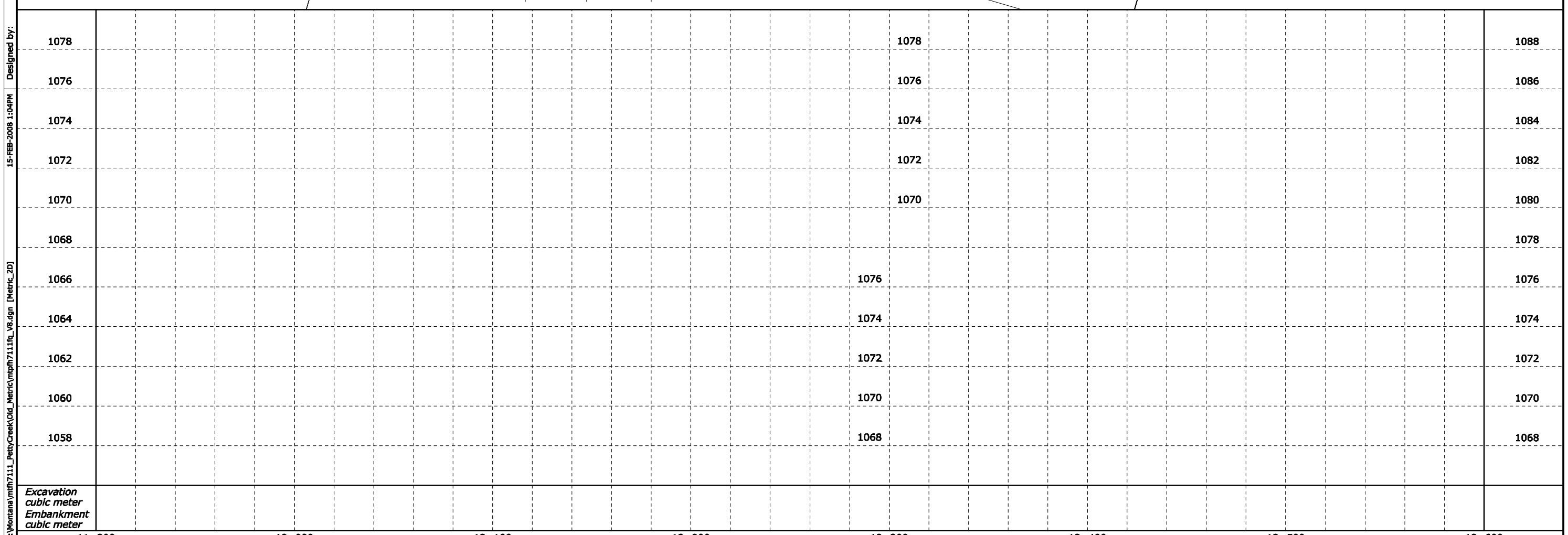
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.18 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22059 | 307466.898 | 222057.932 | 1065.151 |
| 22060 | 307286.436 | 222103.280 | 1068.085 |
| 22061 | 307073.477 | 222208.580 | 1075.496 |
| 22062 | 306945.881 | 222229.844 | 1082.612 |

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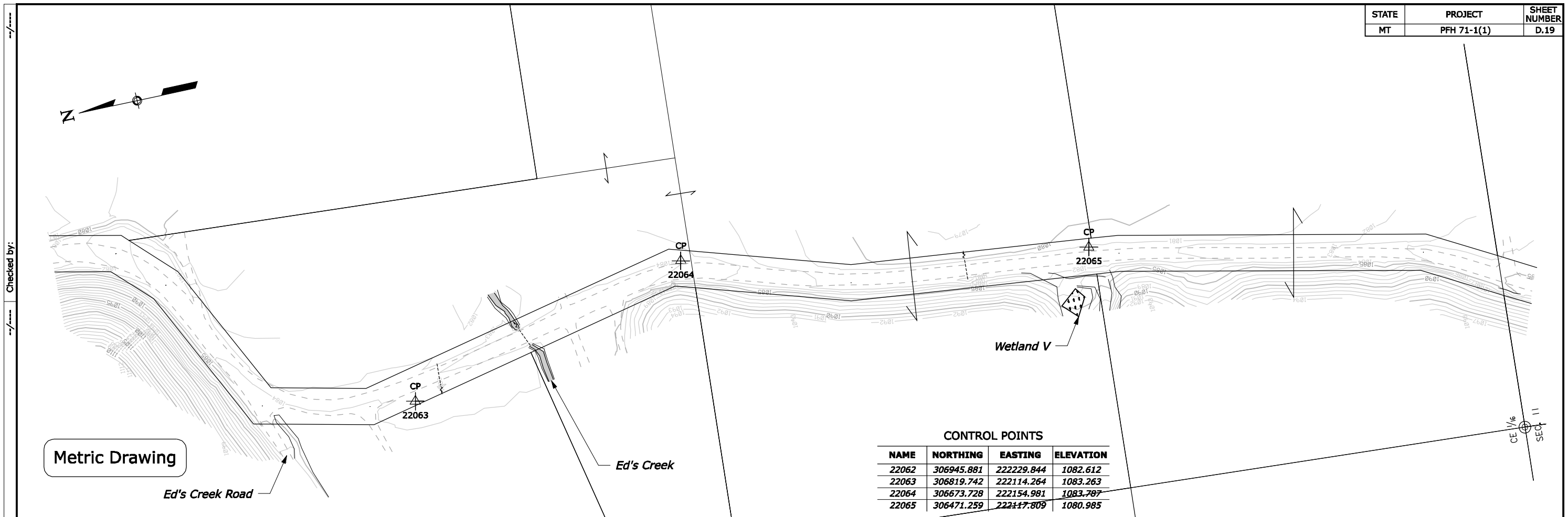
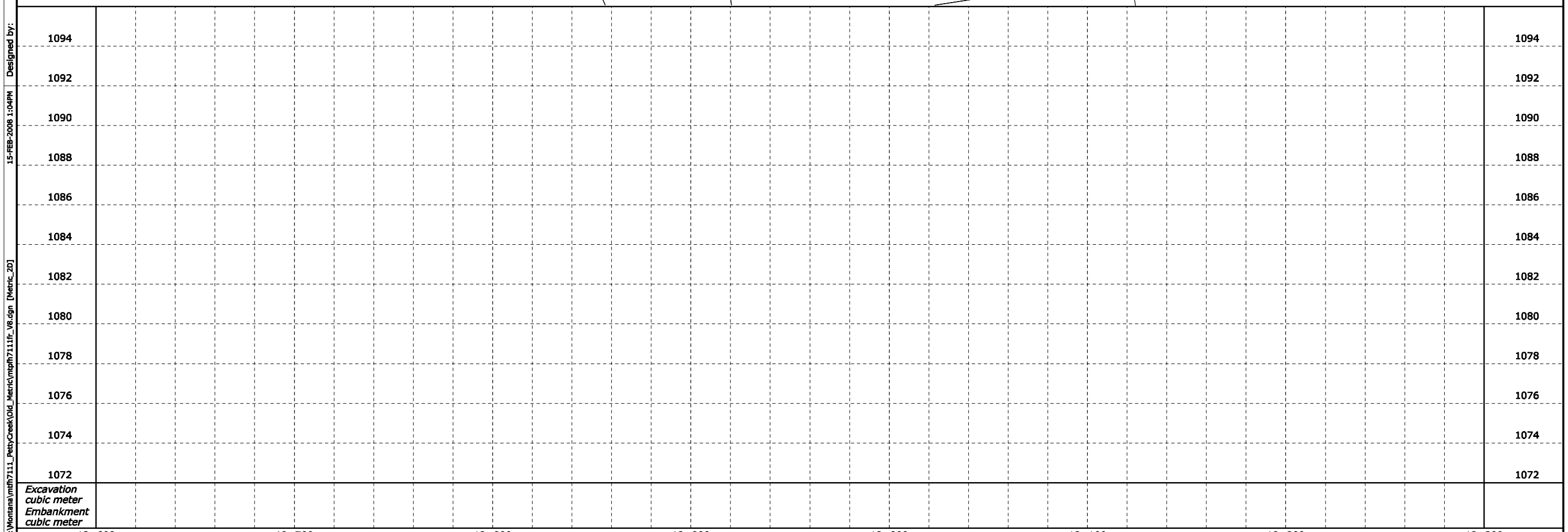
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.19 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22062 | 306945.881 | 222229.844 | 1082.612 |
| 22063 | 306819.742 | 222114.264 | 1083.263 |
| 22064 | 306673.728 | 222154.981 | 1083.787 |
| 22065 | 306471.259 | 222117.809 | 1080.985 |




Checked by:

Designed by:

15-FEB-2008 1:04PM

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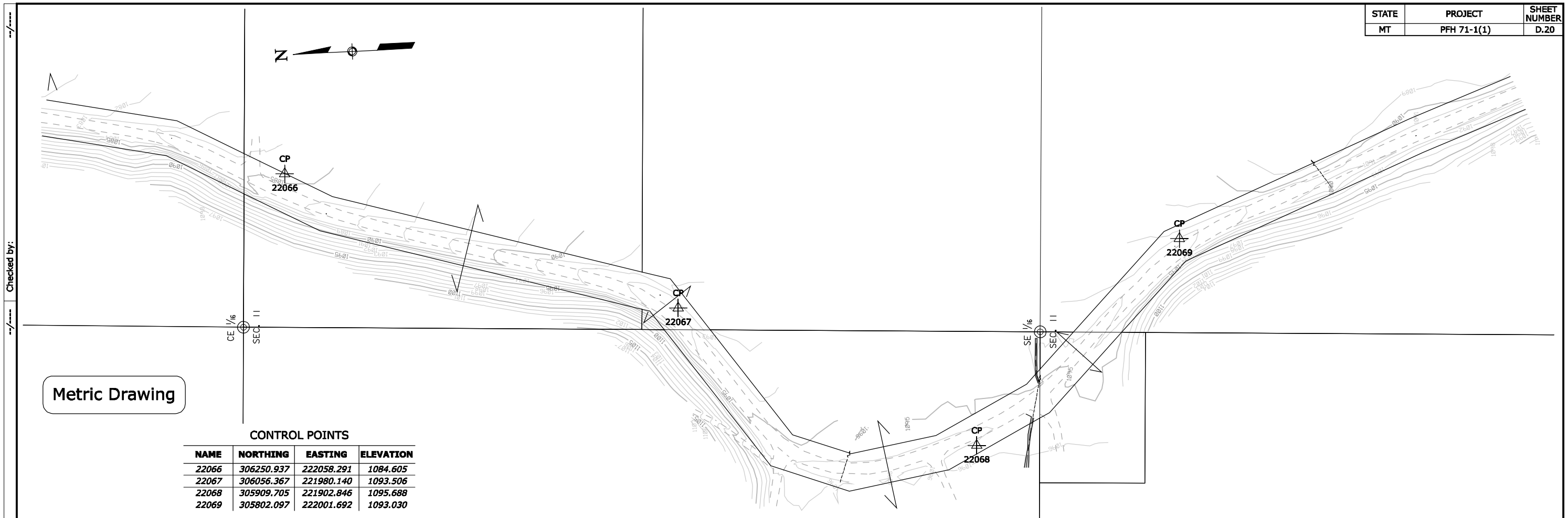
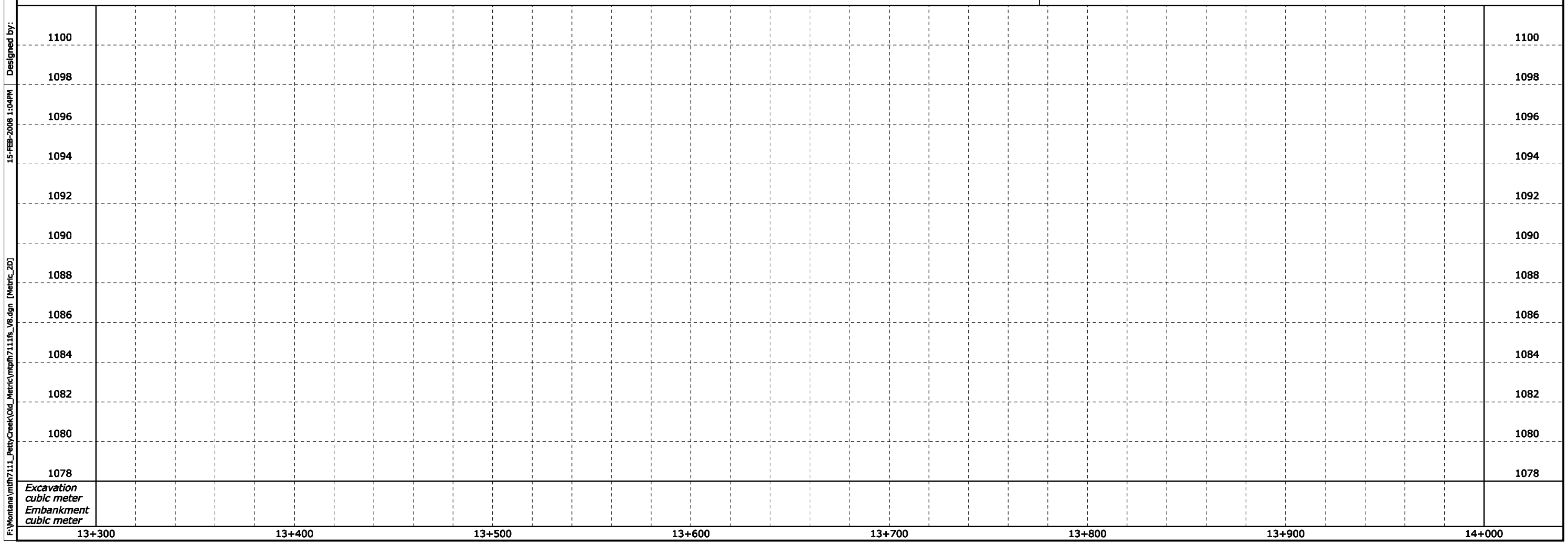
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.20 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22066 | 306250.937 | 222058.291 | 1084.605 |
| 22067 | 306056.367 | 221980.140 | 1093.506 |
| 22068 | 305909.705 | 221902.846 | 1095.688 |
| 22069 | 305802.097 | 222001.692 | 1093.030 |

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15-FEB-2008 1:04PM
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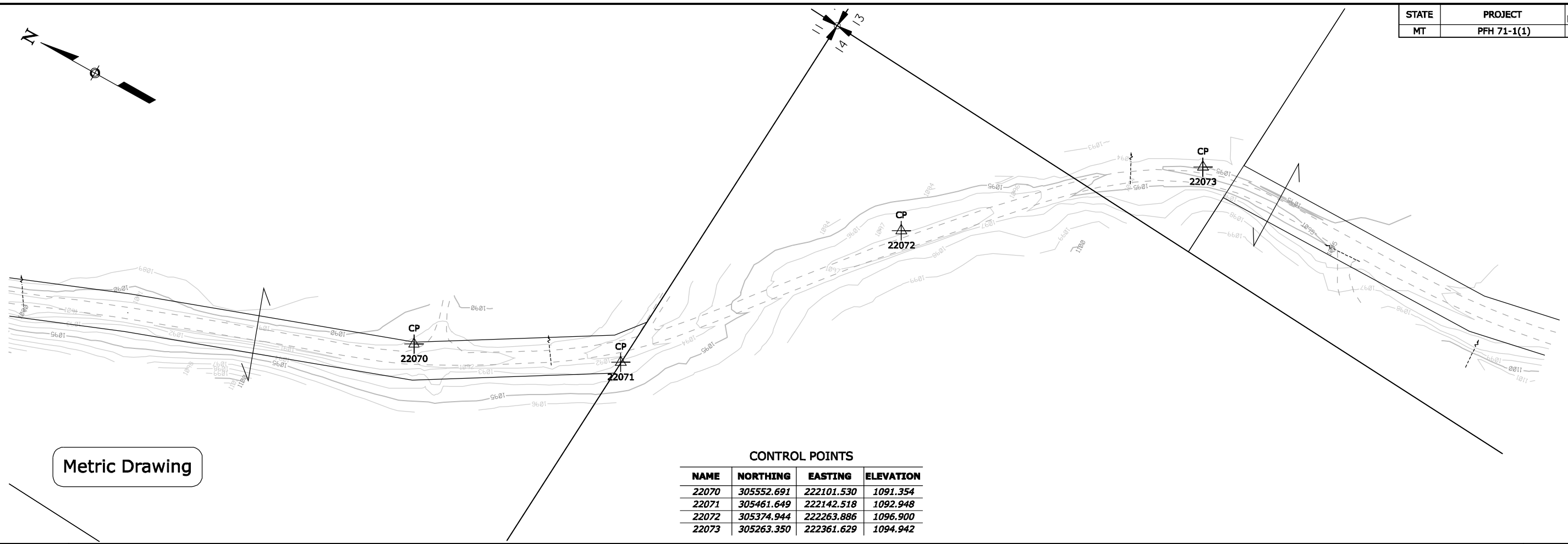
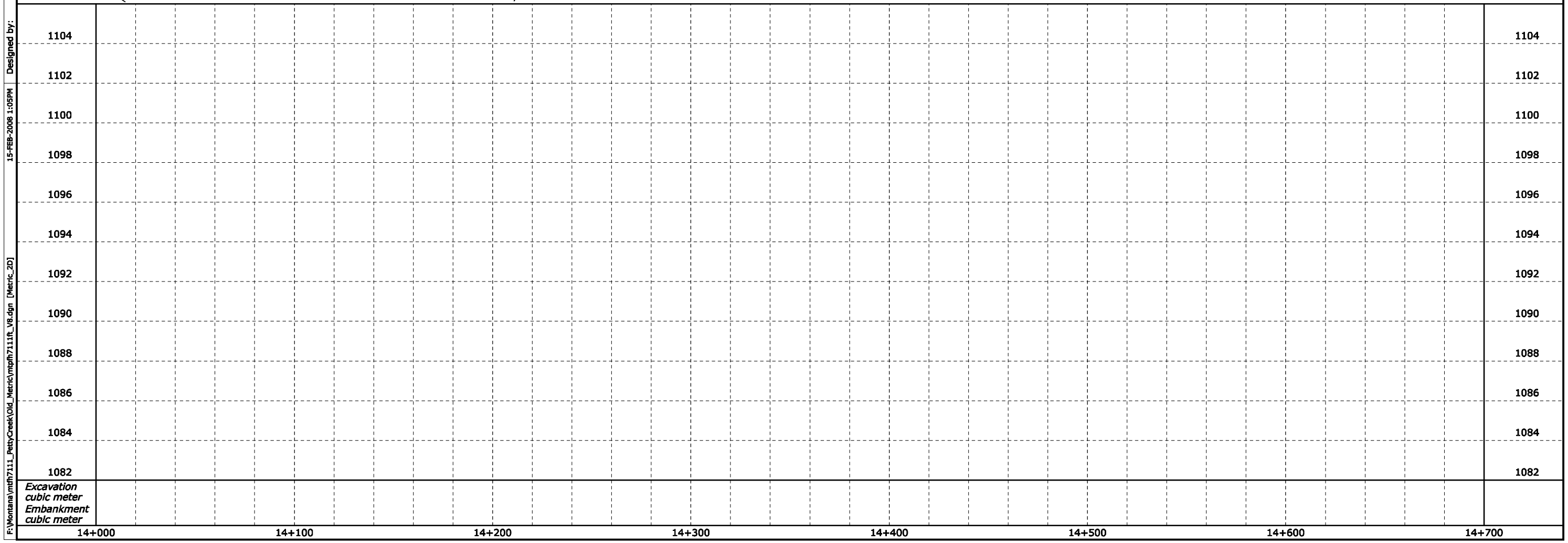
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.21 |




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22070 | 305552.691 | 222101.530 | 1091.354 |
| 22071 | 305461.649 | 222142.518 | 1092.948 |
| 22072 | 305374.944 | 222263.886 | 1096.900 |
| 22073 | 305263.350 | 222361.629 | 1094.942 |

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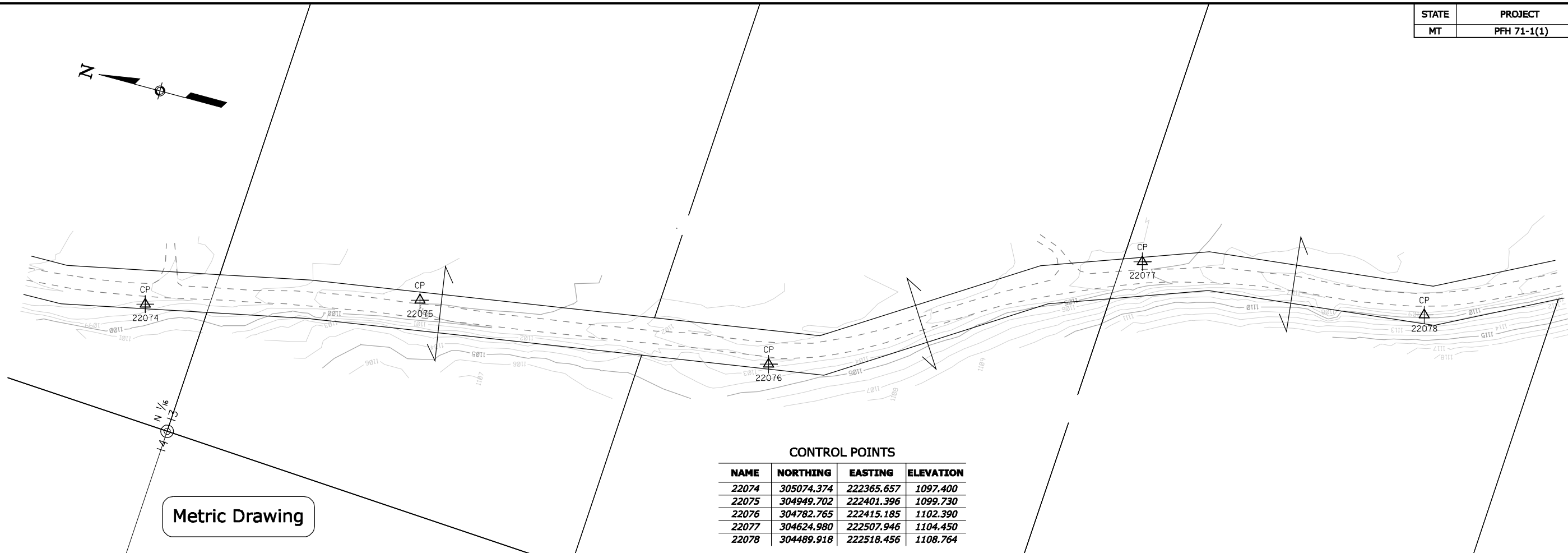
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.22 |




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22074 | 305074.374 | 222365.657 | 1097.400 |
| 22075 | 304949.702 | 222401.396 | 1099.730 |
| 22076 | 304782.765 | 222415.185 | 1102.390 |
| 22077 | 304624.980 | 222507.946 | 1104.450 |
| 22078 | 304489.918 | 222518.456 | 1108.764 |

1112
1110
1108
1106
1104
1102
1100
1098
1096
1094
1092

*Excavation cubic meter*
*Embankment cubic meter*

14+700 14+800 14+900 15+000 15+100 15+200 15+300 15+400

Designed by:
Checked by:
15-FEB-2008 1:05PM
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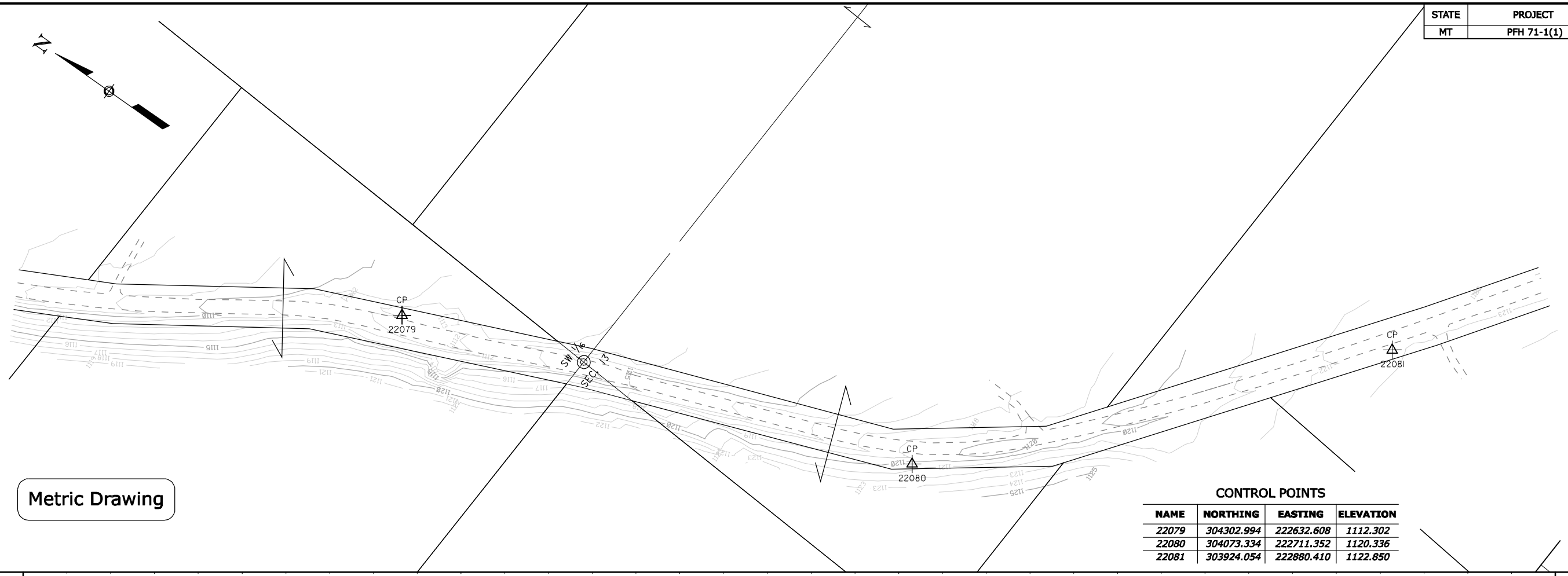
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.23 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22079 | 304302.994 | 222632.608 | 1112.302 |
| 22080 | 304073.334 | 222711.352 | 1120.336 |
| 22081 | 303924.054 | 222880.410 | 1122.850 |

1126
1124
1122
1120
1118
1116
1114
1112
1110
1108
1106

*Excavation cubic meter*
*Embankment cubic meter*

15+400 15+500 15+600 15+700 15+800 15+900 16+000 16+100

Designed by: --/---- Checked by: --/----

15-FEB-2008 1:05PM

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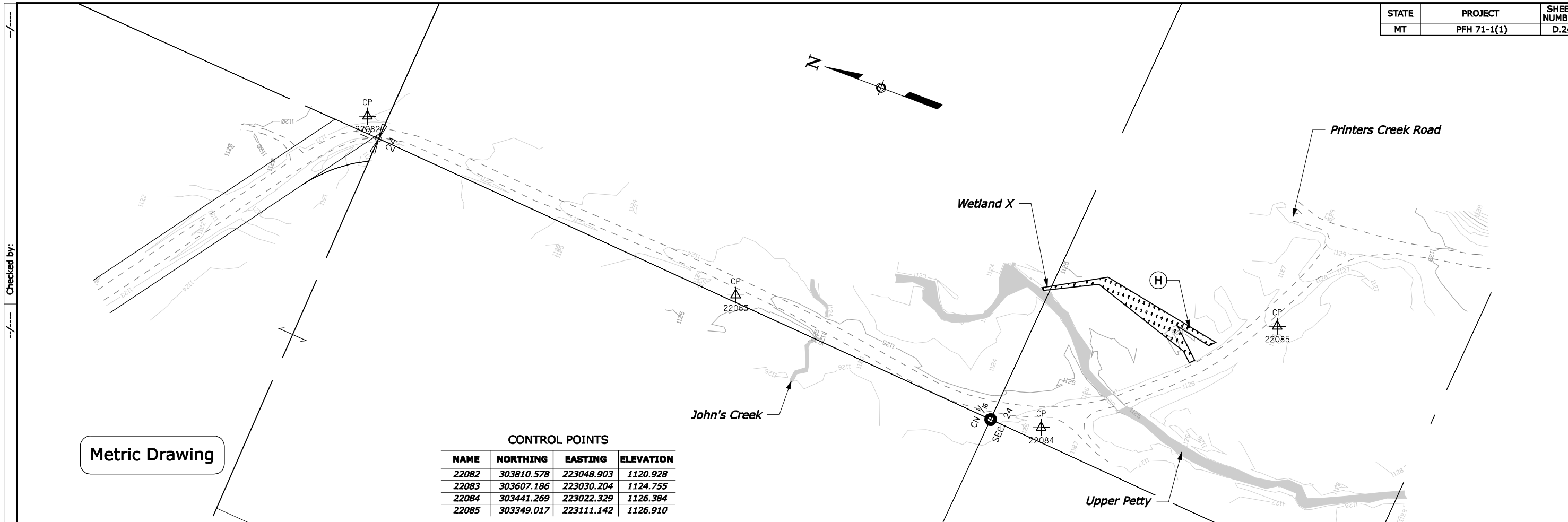
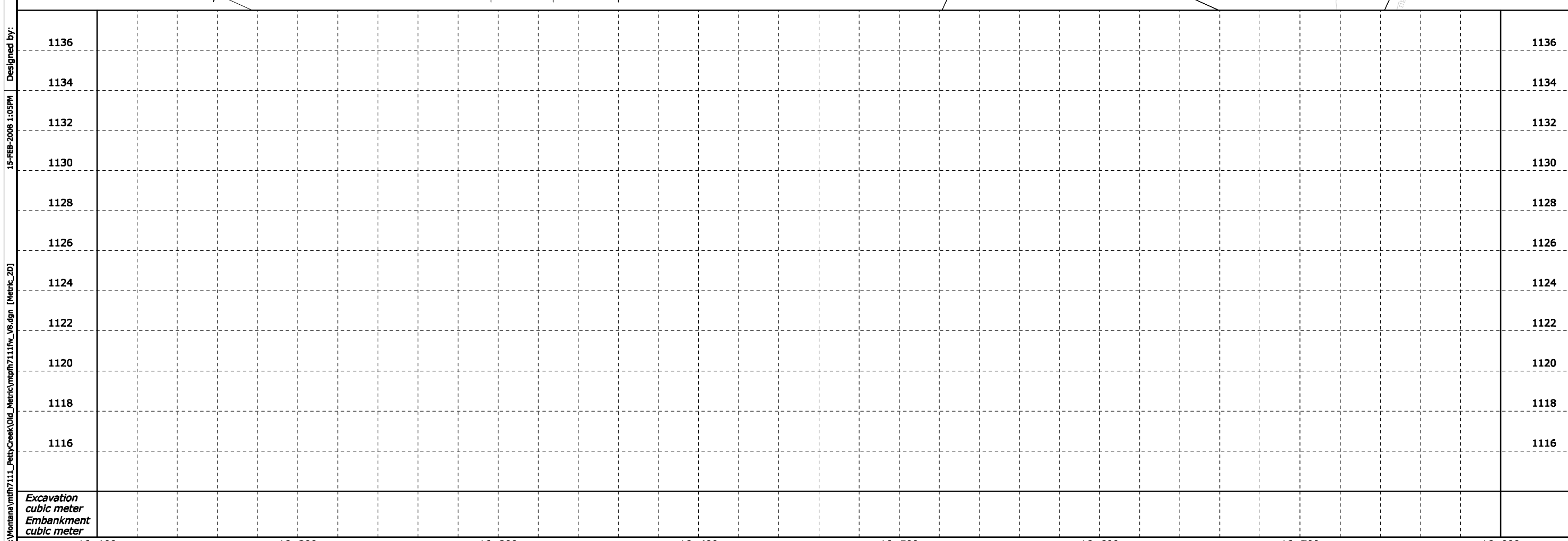
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.24 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22082 | 303810.578 | 223048.903 | 1120.928 |
| 22083 | 303607.186 | 223030.204 | 1124.755 |
| 22084 | 303441.269 | 223022.329 | 1126.384 |
| 22085 | 303349.017 | 223111.142 | 1126.910 |

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Checked by:
15-FEB-2008 1:05PM
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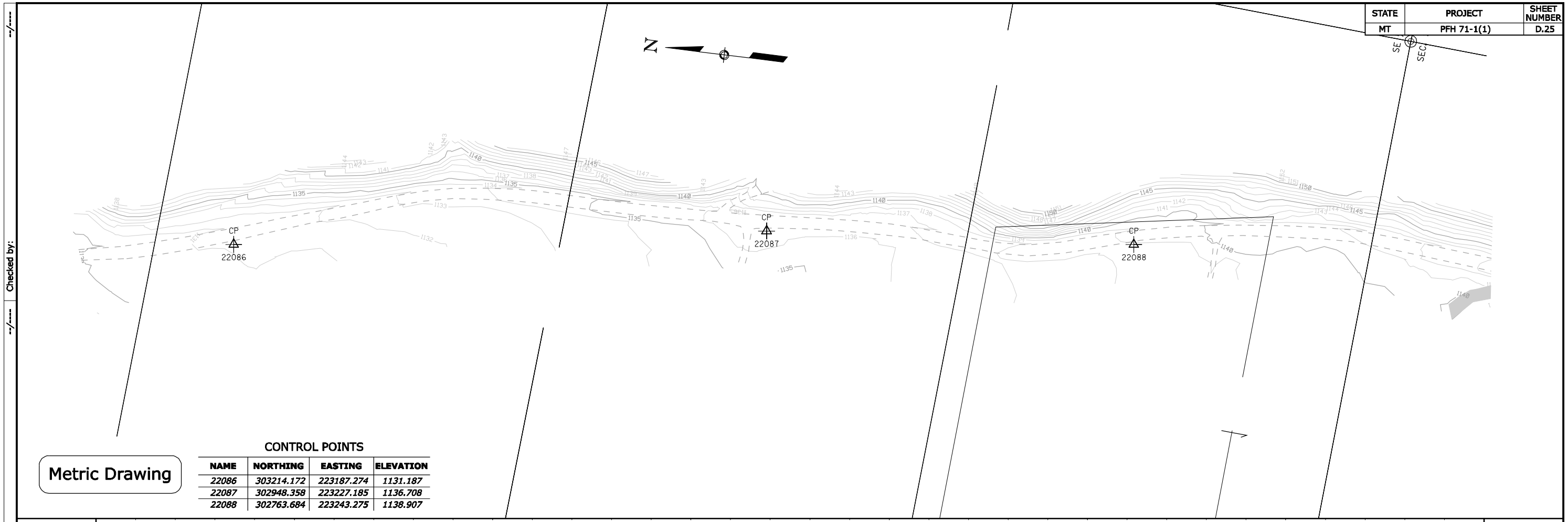
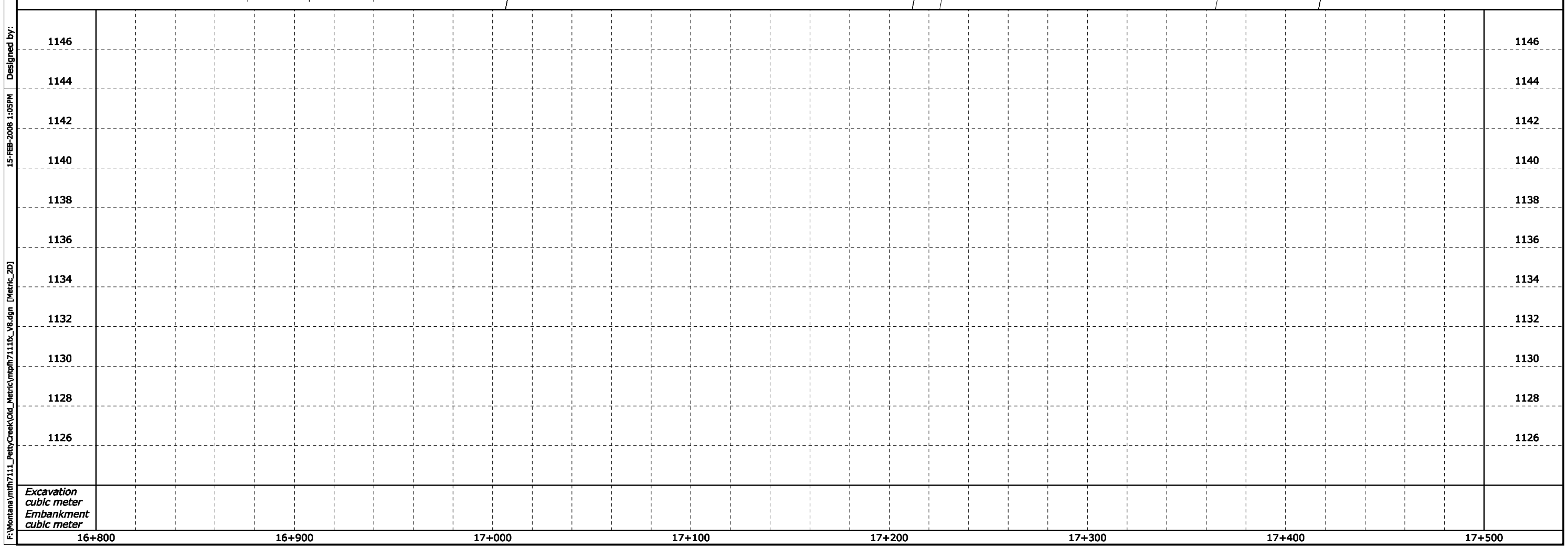
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.25 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22086 | 303214.172 | 223187.274 | 1131.187 |
| 22087 | 302948.358 | 223227.185 | 1136.708 |
| 22088 | 302763.684 | 223243.275 | 1138.907 |

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15-FEB-2008 1:05PM

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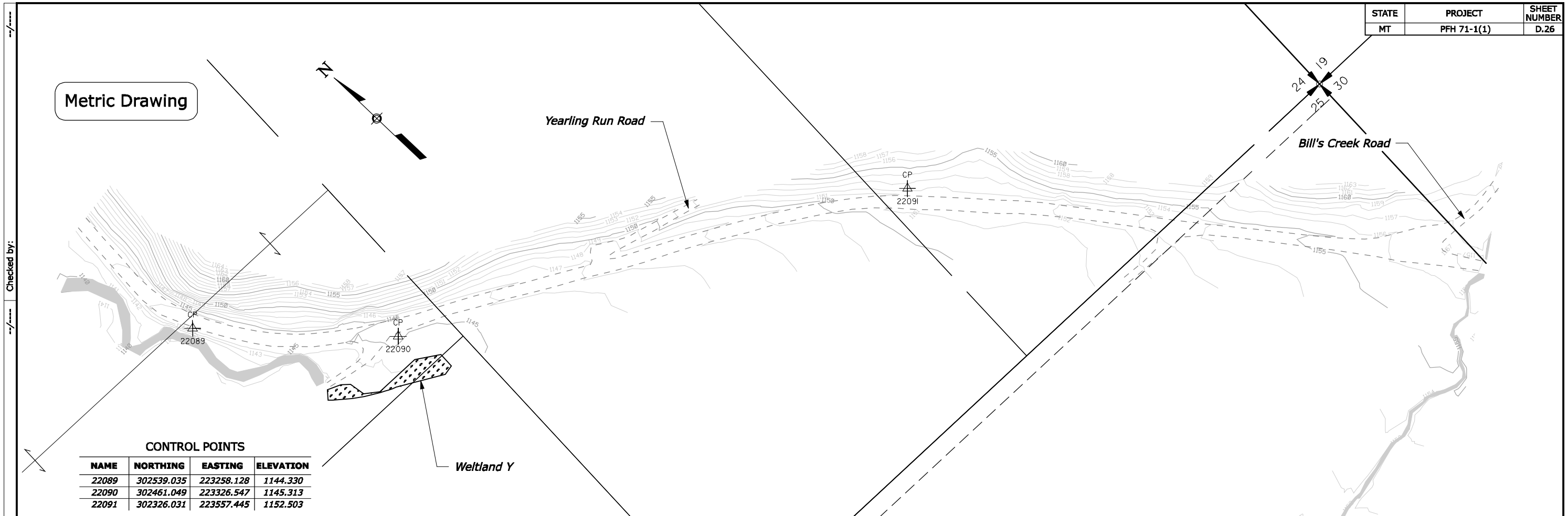
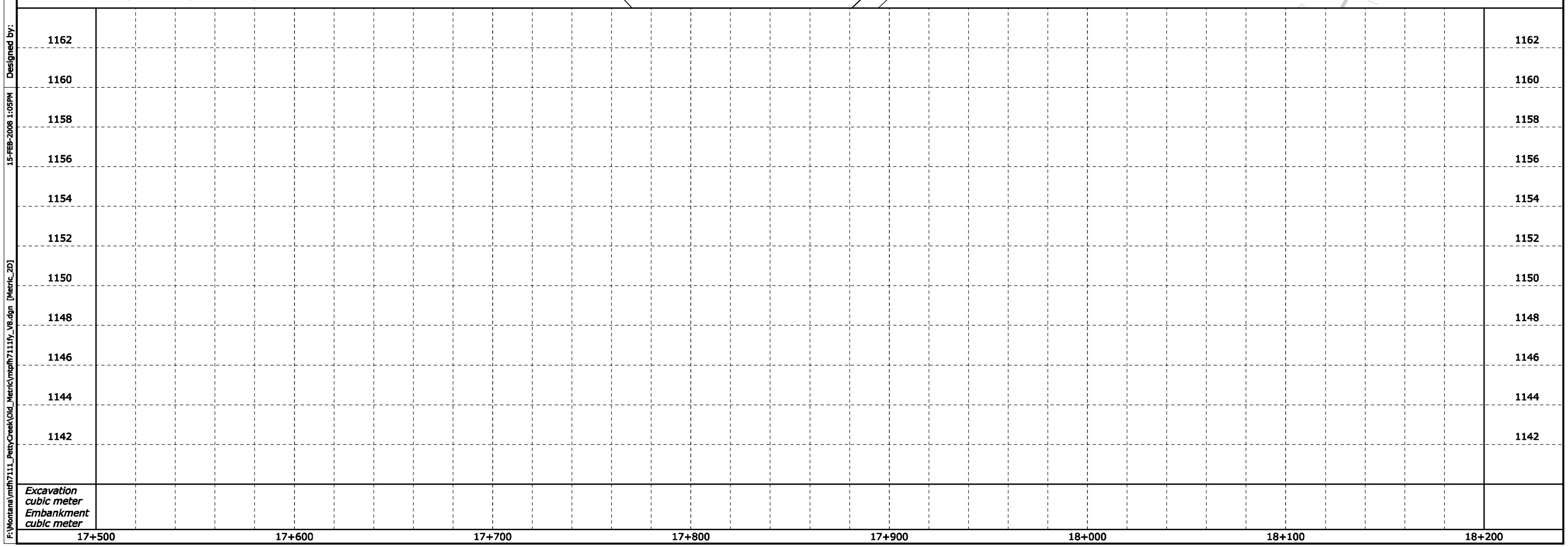
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.26 |




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22089 | 302539.035 | 223258.128 | 1144.330 |
| 22090 | 302461.049 | 223326.547 | 1145.313 |
| 22091 | 302326.031 | 223557.445 | 1152.503 |

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15-FEB-2008 1:05PM
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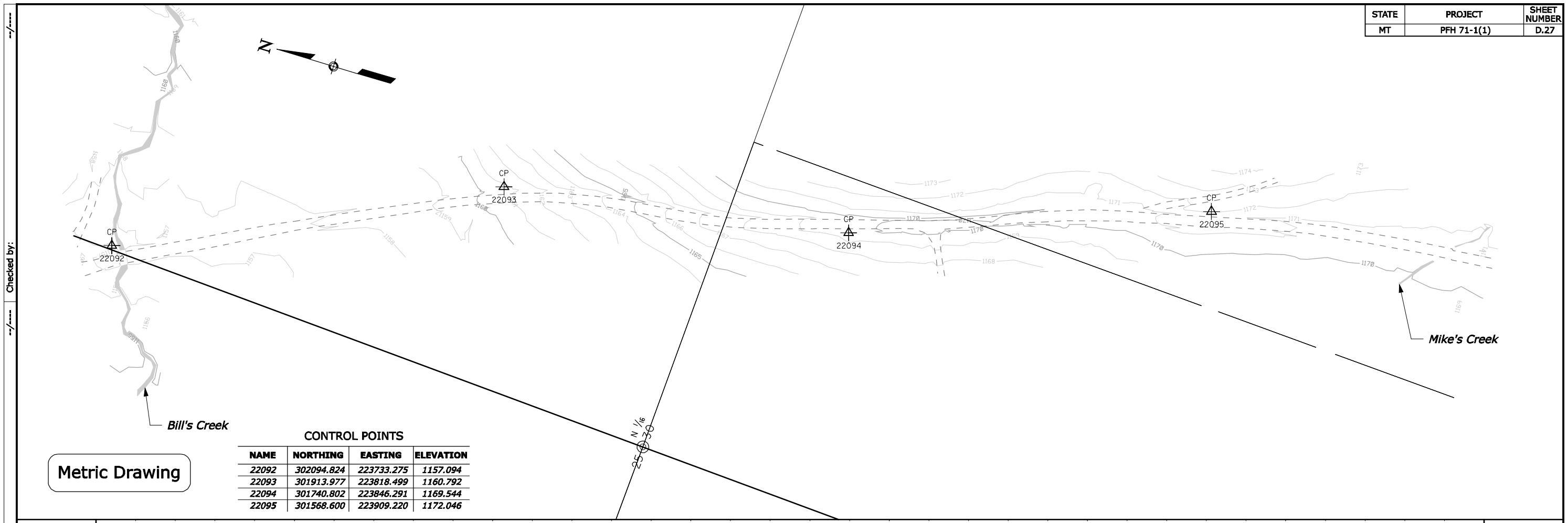
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.27 |




Metric Drawing

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22092 | 302094.824 | 223733.275 | 1157.094 |
| 22093 | 301913.977 | 223818.499 | 1160.792 |
| 22094 | 301740.802 | 223846.291 | 1169.544 |
| 22095 | 301568.600 | 223909.220 | 1172.046 |

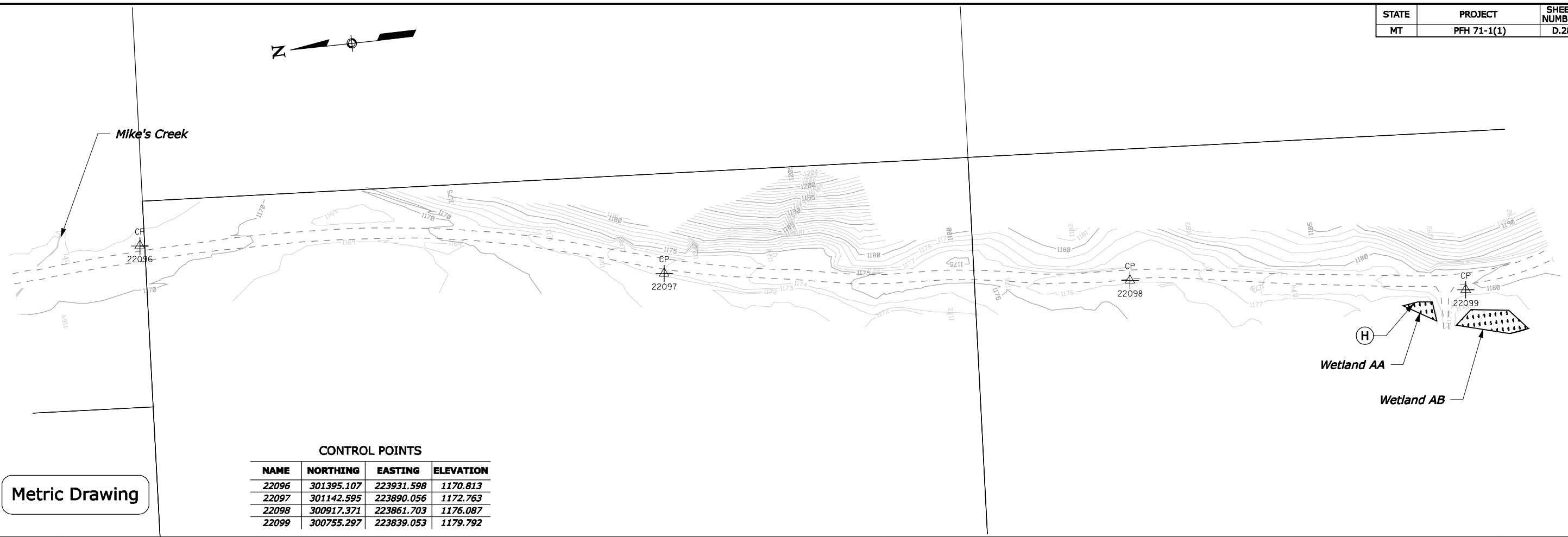
1174
1172
1170
1168
1166
1164
1162
1160
1158
1156
1154

Excavation cubic meter
Embankment cubic meter

18+200 18+300 18+400 18+500 18+600 18+700 18+800 18+900

Designed by: | Checked by: | 15-FEB-2008 1:06PM | F:\Montana\mdfh7111_PettyCreek\Old_Metric\mtpfh7111f_V8.dgn [Metric_2D]

| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.28 |




CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22096 | 301395.107 | 223931.598 | 1170.813 |
| 22097 | 301142.595 | 223890.056 | 1172.763 |
| 22098 | 300917.371 | 223861.703 | 1176.087 |
| 22099 | 300755.297 | 223839.053 | 1179.792 |

Metric Drawing

1186
1184
1182
1180
1178
1176
1174
1172
1170
1168
1166

Excavation cubic meter
Embankment cubic meter

18+900 19+000 19+100 19+200 19+300 19+400 19+500 19+600

Designed by: Checked by:

15-FEB-2008 1:06PM

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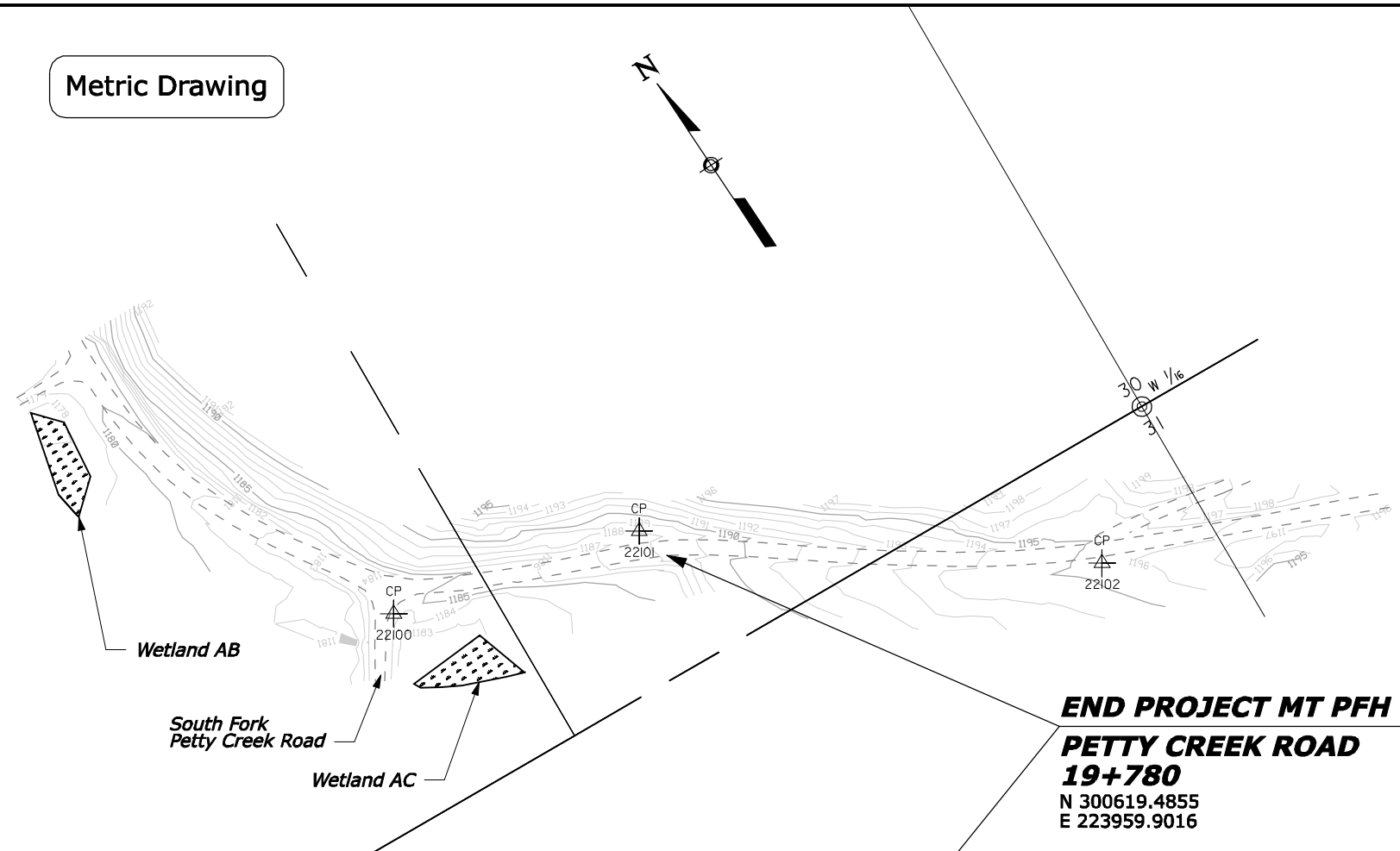
| STATE | PROJECT | SHEET NUMBER |
|---|---|---|
| MT | PFH 71-1(1) | D.29 |

Metric Drawing

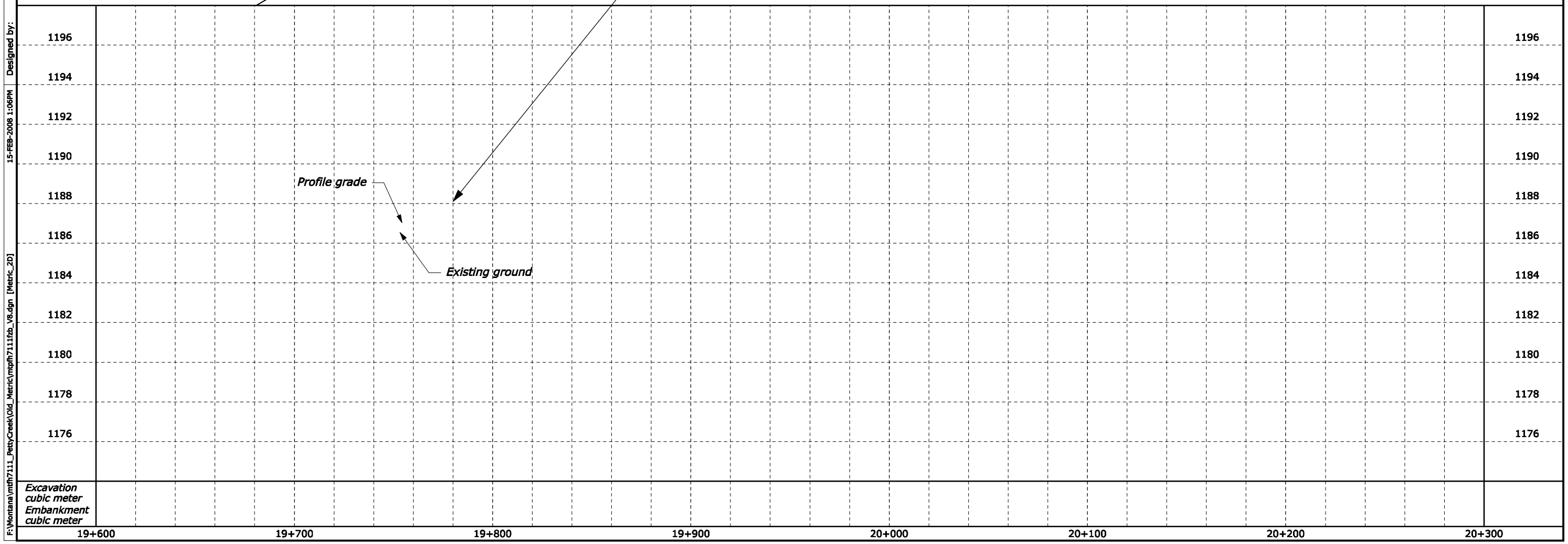



***END PROJECT MT PFH 71-1(1)***

***PETTY CREEK ROAD***
***19+780***
N 300619.4855
E 223959.9016

CONTROL POINTS

| NAME | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| 22100 | 300648.848 | 223881.103 | 1184.452 |
| 22101 | 300628.391 | 223957.815 | 1188.179 |
| 22102 | 300541.677 | 224070.795 | 1195.216 |

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15-FEB-2008 1:06PM
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# Appendix 3. Biological Opinion

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
585 SHEPARD WAY
HELENA, MONTANA 59601
PHONE (406) 449-5225, FAX (406) 449-5339


M.17 FHWA Petty Creek Road

September 14, 2006

Terry Schumann
Federal Highway Administration
Western Federal Lands Highway Division
610 East 5th Street
Vancouver, Washington 98661-3801

Dear Mr. Schumann:

This letter transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the road improvement work proposed by the Federal Highway Administration (Administration) to be conducted along an 11.8-mile section of the Petty Creek Road (Montana Forest Highway 71) in Missoula County, Montana (MT PFH 71-1(1)) and its effects on the threatened Columbia River basin population of bull trout (*Salvelinus confluentus*) and its designated critical habitat. This document was prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

In a letter to the Service dated December 15, 2005, the Administration originally submitted a biological assessment (BA) and requested formal consultation relative to this project's effects to bull trout. In subsequent discussions, it was determined that the BA needed to be revised to include an evaluation of project effects to recently designated bull trout critical habitat in Petty Creek. Consequently, in a letter to the Service dated May 18, 2006, the Administration transmitted a revised BA for this project and formal consultation was continued.

Section 7(b)(3)(A) of the Act requires that the Secretary of Interior issue biological opinions on Federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of critical habitat, if any has been designated. This biological opinion addresses only impacts to federally-listed species and does not address the overall environmental acceptability of the proposed actions.

This biological opinion is based on information provided in this project's revised BA, dated April 2006, conversations with State and Federal agency personnel, and other sources of information. A complete administrative record of this consultation is on file in this office.

The BA also determined that this proposed project would not be likely to adversely affect threatened bald eagles (*Haliaeetus leucocephalus*), threatened Canada lynx (*Lynx canadensis*), or endangered gray wolves (*Canis lupus*). The Service concurs with this determination and, therefore, formal consultation is not required for these species. The Service bases its concurrence on information displayed in the BA, and in particular on the conservation measures that would be implemented as a part of this project to assure that these species are not adversely affected by road reconstruction activities. The Service acknowledges the Administration's determination that this proposed project would have no effect on candidate yellow-billed cuckoos (*Coccyzus americanus*).

Your patience and cooperation in meeting our joint responsibilities under the Act are appreciated. If you have questions regarding this consultation, please contact Scott Jackson, of my staff, at (406)449-5225, extension 201.

Sincerely,

R. Mark Wilson

R. Mark Wilson
Field Supervisor

Enclosure

Copies (w/enclosure) to:
AES, R-6, MS-60120 (Bridget Fahey)
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File 7759

# ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

## BIOLOGICAL OPINION

for the effects to threatened bull trout (*Salvelinus confluentus*)
and designated bull trout critical habitat
from the reconstruction of the Petty Creek Road
(Montana Forest Highway 71)
in Missoula County, Montana

Petty Creek Road Improvement Project
MT PFH 71-1(1)

**Agency**: Federal Highway Administration
Western Federal Lands Highway Division
Vancouver, Washington

**Consultation Conducted by**: U.S. Fish and Wildlife Service
Montana Field Office
Helena, Montana

September 14, 2006

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## BIOLOGICAL OPINION

### I. Introduction

This document represents the U.S. Fish and Wildlife Service's (Service, USFWS) biological opinion based on our review of the proposed Petty Creek Road Improvement Project Biological Assessment (BA). This biological opinion addresses project related effects to threatened bull trout (*Salvelinus confluentus*) and designated bull trout critical habitat in accordance with the Endangered Species Act (Act) of 1973 as amended (16 U.S.C. 1531 et seq.).

Section 7(b)(3)(A) of the Act requires that the Secretary of Interior issue biological opinions on Federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of critical habitat, if any has been designated.

The Service defines destruction or adverse modification as "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." However, recent decisions by the 5th and 9th Circuit Court of Appeals have invalidated this definition. Pursuant to current national policy and the statutory provisions of the Act, destruction or adverse modification is determined on the basis of whether, with implementation of the proposed action, the affected critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species.

This biological opinion addresses only impacts to bull trout and designated bull trout critical habitat and does not address the overall environmental acceptability of the proposed action.

### II. Description of proposed action

The Western Federal Lands Highway Division (WFLHD) of the Federal Highway Administration (Administration, FHWA), in cooperation with the Lolo National Forest, Montana Department of Transportation (MDT) and Missoula County, is planning to improve portions of Petty Creek Road, also known as Montana Forest Highway 71. This road provides access to the eastern portion of the Ninemile Ranger District of the Lolo National Forest, and to several trailheads, commercial interests and private residences. The entire Petty Creek Road route begins at the junction of Interstate 90 and connects to Graves Creek Road at approximately milepost (MP) 13.0. Graves Creek Road then continues approximately five more miles to U.S. Highway 12, for a total of approximately 18 miles between Interstate 90 and Highway 12. The proposed project would improve 11.8 miles of this total Petty Creek Road length, between MP

0.0 near the intersection with South Side Road and MP 11.8 near the intersection with South Fork Petty Creek Road (FHWA 2006).

The project corridor can be characterized as a narrow riverine valley oriented north-south and bounded by forested slopes with abundant rock outcroppings and scree slopes. Between approximately MP 6.0 and MP 11.0, the valley broadens and is characterized by irrigated, agricultural lands. In addition, extensive private land and associated residences are found within the project corridor. Recreation areas are characterized by unimproved pullouts that lead to trails or that provide access to Petty Creek (FHWA 2006).

The proposed project terminates at MP 11.8 for several reasons: a) traffic is very light south of the project terminus, and the grade becomes steeper as the road ascends the divide between Petty Creek and Graves Creek. The lighter traffic and steeper grade, which requires travel at slower speeds, create a safer travel experience; b) South Fork Petty Creek Road is the southern-most road that provides access to private residences from Petty Creek Road. School bus service and mail delivery terminate at Bill's Creek road, approximately 0.9 miles north of South Fork Petty Creek Road, reducing traffic needs past this point; and c) traffic volumes beyond this portion of the road are projected to remain low into the foreseeable future, reducing the potential need for future improvements. Neither Missoula County nor the Forest Service anticipate the need to improve Petty Creek Road south of South Fork Petty Creek Road (towards Graves Creek Road) within the next 20 years, and there are currently no plans to improve that segment of the road (FHWA 2006).

The primary uses of Petty Creek Road are residential and recreational; the principal commercial use on public and private lands is timber harvest and hauling. The route provides the only access to approximately 78 private property parcels along the Petty Creek Road and approximately 59 parcels along West Fork Petty Road. It is also used for mail delivery, emergency vehicles, and school buses to these parcels. The road corridor is reported to receive some use as a link between U.S. Highway 12 and Interstate 90. The amount of such use is currently unknown, and cannot be differentiated from recreational and residential uses (FHWA 2006).

The purpose of the proposed project is to improve the existing roadway sufficiently to provide safe and efficient transportation for road users more consistent with accepted standards. The project would provide uniform roadway width to improve safety, reasonably provide for current and future traffic demands, facilitate snowplowing and other maintenance, reduce dust, and flatten sharp curves. Alignment modifications are proposed to move the roadway away from Petty Creek where possible, replace undersized or inadequate bridges and culverts, and would improve the vertical alignment to elevate the road above the 100-year floodplain. Curbs and guardrails would be constructed on all bridges. These improvements would provide safe travel conditions while reducing surface runoff to Petty Creek, providing aquatic and terrestrial organism passage, reduce impacts to riparian vegetation, and accommodate 50-year flood events. The intent of the project is to decrease existing unsafe driving conditions along Petty Creek Road while also reducing existing negative environmental effects resulting from current road conditions. It is anticipated that this project would require at least two construction seasons to complete (FHWA 2006).

The road has an existing paved surface from MP 0.0 to 1.3. This road segment is located on private land up to the National Forest boundary. The proposed project would overlay this segment with hot asphalt pavement. The remaining 10.5 miles of the road, from MP 1.3 to MP 11.8, are gravel and lie within the exterior boundaries of the Lolo National Forest. This segment would receive an aggregate base layer followed with a hot asphalt pavement layer over it. The alignment would follow the existing road except in those areas where the alignment can be moved away from Petty Creek to reduce potential sedimentation and create a vegetative buffer along the creek. In other areas substandard curves would be adjusted to meet standards for a 35 mile-per-hour road, but still minimize the impacts to the environment. There are four curves along the route where standards would not be met. Through those areas the road would be posted with warning signs and lower speed limit signs, and guardrail would be installed where warranted (FHWA 2006).

A uniform roadway width of 24.0 feet with 10-foot lanes and 2-foot shoulders would be attained. The existing roadway width varies between 21.0 feet and 25.0 feet with little to no shoulders from MP 0.0 to MP 1.3. From MP 1.3 to MP 11.8 the road is narrow and gravel surfaced with a width varying from 20.0 feet to 24.0 feet. The existing right-of-way varies between 60 feet and 100 feet in width (FHWA 2006).

Substandard stream crossing structures would be replaced at existing locations (no major new alignment changes or stream crossings). These include crossings at Madison Gulch, Spring Gulch, West Fork Petty Creek, Ed's Creek, Gus Creek, John's Creek, Upper Petty Creek, Bill's Creek, Mike's Creek, and East Fork Petty Creek. All new crossing structures would be designed to provide fish and amphibian passage. The lower Petty Creek Bridge meets current standards and will not be replaced. Table 1 lists the sizes of existing and proposed crossing structures for the project (FHWA 2006).

**Table 1. Existing and proposed crossing structure sizes (FHWA 2006).**

| Crossing | Existing Structure | Proposed Structure |
|---|---|---|
| Madison Gulch (north culvert) | 0.9meter (m) diameter | 1.2m diameter/buried 0.3m |
| Madison Gulch (south culvert) | 1.0m x 0.7m arch | 1.2m diameter/buried 0.3m |
| Spring Gulch | 0.9m diameter | 1.8m diameter/buried 0.8m |
| West Fork Petty Creek | 1.8m x 1.3m arch | 2.75m diameter/buried 1.0m |
| Ed's Creek | 1.1m x 0.7m arch | 2.83m x 1.90m pipe arch/ buried 0.6m |
| Gus Creek | 1.2m diameter | 1.8m diameter/buried 0.3m |
| John's Creek | 0.9m diameter | 2.2m x 1.6m pipe arch/buried 0.3m |
| Upper Petty Creek | 3.0m span timber bridge | This structure will be designed to allow aquatic and semi-aquatic passage by constructing a natural bankfull stream configuration and substrate within the crossing. |
| Bill's Creek | 3.0m span timber bridge | 3.0m x 1.8m box culvert/buried 0.6m |
| Mike's Creek | 0.6m diameter | 0.9m or 1.2m diameter/buried 0.3m |
| East Fork Petty Creek | 2.0m diameter | 2.4m diameter/buried 0.6m |

To accommodate new culvert/bridge installations, temporary detours and diversion channels would be constructed within existing right-of-way or temporary easements. The detours would consist of pipe culverts placed in the water body with fill placed over the culverts for traffic to

pass. The channel diversions would be constructed parallel to the existing channel and lined with plastic or riprap. At the West Fork Petty Creek culvert, Ed's Creek culvert, Gus Creek culvert, and John's Creek culvert temporary detours would be placed approximately 33 feet west of the existing structures. At Bill's Creek a detour would be placed approximately 33 feet east of the existing structure. Culvert replacements at Madison Gulch, Spring Gulch, Mike's Creek, and East Fork Petty Creek would likely be constructed without detours; however, detours similar to the other crossings may be necessary. A new structure would be built adjacent to the Upper Petty Creek bridge on its northeast side. The existing bridge would be used as a detour until the new structure is constructed (FHWA 2006).

From station 17+545 to 17+565 and station 17+600 to 17+615 Petty Creek is cutting into the existing roadbed/streambank. To stabilize the bank and reduce sediment into the creek, streambank/road embankment reinforcement is proposed through a bioengineered riprap design. This design protects the toe of the bank with riprap to the bankfull elevation. It also provides a short floodplain generally above the bankfull elevation on which to plant shrubs before tapering to the top of the bank. The bank will also be vegetated (FHWA 2006).

The proposed roadway construction would require geotechnical drilling for preparation of the crossing designs at Upper Petty Creek and Bill's Creek, and approximately 25 subgrade test pits to be investigated to determine pavement rehabilitation alternatives. In addition to this, several cutslope sites would need test pits dug with a backhoe in order to investigate materials. Drilling, subgrade test pits, and cutslope test pits would be within the existing right-of-way for the roadway, and no additional clearances are required. For the subgrade test pits, drilling would be needed for about 25 conventional pavement borings every one-half mile to sample the existing pavement and subgrade. These borings would be shallow, to a maximum 5-foot depth. Backhoe test pits in the cutslopes would be less than 15 feet deep, and would be excavated from the shoulder of the road. Material excavated would be replaced and compacted once identification of the materials is recorded (FHWA 2006).

Water would be used as a drilling fluid if casing and core drilling is necessary. If needed, approximately 1,500 gallons-per-day, over a 10-day period would be pumped. As the test hole(s) is advanced, samples would be taken from within the augers/casing (FHWA 2006).

In areas where drilling occurs in proximity to water, there is a chance of loose sediment and other pollutants reaching Petty Creek. To prevent this, mitigation measures, which may include silt fencing, certified weed-free straw bales, sediment cloth and other sediment containment measures, would be used in areas where drilling occurs close to the water. Drilling would not be conducted during the fall spawning season (FHWA 2006).

All contractor equipment would be required to be cleaned before use in the area, and a hazardous spill plan would be developed prior to the start of work. Containment measures would be implemented in the event of a spill during project work in the area. All test holes would be sealed when augers/casing is removed and the holes abandoned in accordance with Montana state regulations (FHWA 2006).

Two paved parking areas are proposed along the lower half of Petty Creek Road to provide recreational users easier access to the Petty Pasture Trail and the Petty Creek Sheep Viewing Trail. These proposed parking areas would be 20 feet wide extending out from the east side of the existing road and would be about 100 feet long. Both sites are currently flat, rocky areas between the road and the hillside with little vegetation (FHWA 2006).

The Petty Creek Road has been designated by the County and the Forest Service as a primary access corridor and is managed accordingly. Missoula County owns the right-of-way or has easements for the existing road corridor and will be responsible for maintenance and jurisdiction of the route (FHWA 2006).

Conservation and Mitigation Measures: Efforts to minimize potential project impacts on biological resources began at the project planning stage. Additional project design refinements will be considered and incorporated where feasible to prevent or reduce potential adverse impacts to protected species and their habitat. The design of this proposed project was not final at the time consultation was initiated for this project (FHWA 2006).

Potential conservation and mitigation for fish and wildlife include measures to avoid disturbance to wildlife during sensitive periods such as breeding and nesting, minimizing impacts to habitat by controlling erosion and sedimentation, minimizing loss of vegetation, and reducing potential impacts to wildlife from construction activities by using best management practices. General mitigation measures incorporated into this project are described in the following two lists (FHWA 2006).

Mitigation for construction-phase and operational impacts to fisheries resources includes:

- Work in streams within the project corridor will comply with work windows that are protective of species as determined by the natural resource agency biologists.
- No vehicle fueling or refueling operations, or storage of hazardous materials that could accidentally enter a stream, will be permitted within 300 feet from the top of the bank of any intermittent or perennial stream channel.
- Ensure that culvert replacements or extensions in fish-bearing streams allow fish passage. These culverts will contain adequate water depth, velocity and outfall distance.
- Use bioengineering techniques to stabilize stream banks where appropriate instead of placing riprap.
- Provide drainage facilities that allow ground infiltration and provide sediment filtration from stormwater runoff.
- Minimize the amount of fill material placed in water bodies and floodplains.
- Avoid the need to relocate, realign, or recreate the Petty Creek stream channel where it flows close to the roadway corridor.
- There are several locations where Petty Creek Road is proximate to Petty Creek. To alleviate existing or potential road sediment problems, where feasible the road alignment would be shifted away from the creek, leaving existing fill/riprap in place and providing a vegetative buffer between the road and the creek. In areas where it is not feasible to shift the road, riprap protection would be utilized. Potential improvements would occur at the following locations:

| | | | |
|---|---|---|---|
| 1+560 to 1+720; | 2+620 to 2+680; | 3+100 to 3+200; | 3+320 to 3+360; |
| 5+100 to 5+180; | 5+280 to 5+340; | 5+900 to 6+080; | 6+260 to 6+300; |
| 6+440 to 6+500; | 6+760 to 6+840; | 10+580 to 10+650; | 10+800 to 10+900; |

8+920 to 8+980 no shift due to wetlands on east side of the road;
9+120 to 9+300 no shift due to talus slope on east side of the road;
17+500 to 17+620 area of proposed streambank/road embankment reinforcement (FHWA 2006).

Mitigation for construction-phase and operational impacts to wildlife resources include:

- The abundant disturbed areas that are already present within the project corridor will be used as staging areas for construction equipment to avoid the disturbance of additional areas within the project corridor.
- If electrical facilities need to be relocated because of construction activities, they will be raptor-proofed to avoid electrocution of birds.
- Modifying culverts, where feasible, to allow small mammal passage underneath the roadway.
- Posting warning signs to caution drivers about wildlife crossing the roadway (FHWA 2006).

## III. Status of the species and critical habitat

### Bull trout

Current known range: Please refer to the *Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Chapter 1 - Introduction*, pages 6- 7 (US Department of Interior (USDI) 2002).

Listing history: Please refer to the *Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Chapter 1 - Introduction*, page 7 (USDI 2002a).

Species description and life history: Please refer to the *Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Chapter 1 - Introduction*, pages 8-12 (USDI 2002a).

Population dynamics: Please refer to the *Bull Trout (Salvelinus confluentus) Draft Recovery Plan, Chapter 1- Introduction,* pages 47-54 (USDI 2002a). See also *Bull Trout Recovery Planning: A review of the science associated with population structure and size* (Whitesel et al. 2004).

Status and distribution: Range-wide, local populations of bull trout within their respective core areas are often isolated and remnant. Migratory life histories have been lost or limited throughout major portions of the range (Ratliff and Howell 1992; Pratt and Huston 1993; Rieman and McIntyre 1993, 1995; Goetz 1994; Jakober 1995; Montana Bull Trout Scientific Group (MBTSG) 1998; USDI 2002b; USDI 2005a) and fluvial bull trout populations in portions of the upper Columbia River basin appear to be nearly extirpated (USDI 2002b, 2005a). Resident

populations existing in headwater tributary reaches are isolated and generally low in abundance (Thomas 1992).

Whitesel et al. (2004) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003) best summarized genetic information on bull trout population structure. Spruell et al. (2003) analyzed 1,847 bull trout from 65 sampling locations, 4 located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence between populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or lineages) of bull trout (Spruell et al. 2003). They were characterized as:

- "**Coastal**", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

- "**Snake River**", which also included the John Day, Umatilla, and Walla Walla Rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

- "**Upper Columbia River**" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell and the biogeographic analysis of Haas and McPhail (2001). Both Taylor et al. (1999) and Spruell et al. (2003) concluded that the Deschutes River represented the most upstream limit of the Coastal lineage in the Columbia River Basin.

The Service recognizes 121 bull trout core areas rangewide in Idaho, Montana, Oregon, Nevada and Washington (USDI 2002b). Core areas are defined as approximating interacting biological units for bull trout (USDI 2002b). Within the Columbia River basin, a total of 98 core areas are described. Bull trout are threatened by habitat loss and degradation, passage restrictions at dams, and competition from non-native species, especially brook trout (*S. fontinalis*) and lake trout (*S. namaycush*). The American Fisheries Society listed bull trout as a species of concern in all of its range (California, Idaho, Montana, Nevada, Oregon, Washington, Alberta, and British Columbia) except Alaska, because of present or threatened destruction, modification, or

curtailment of its habitat or range and introduction of exotic species (Williams et al. 1989). Bull trout have been categorized as an indicator species of forest and ecosystem health as they are particularly sensitive to environmental change (Rieman and McIntyre 1993).

Generally, where status is known and population data exists, bull trout populations throughout the Columbia River basin are at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993; USDI 2005a). Presently, bull trout in the Columbia basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). Many of the bull trout core areas occur as isolated watersheds in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout core areas are considered strong in terms of relative abundance and core area stability (USDI 1998c; USDI 2005a). Strong core areas are generally associated with large areas of contiguous habitat.

Please refer to the "*Bull Trout Cores Area Templates Complete Core Area by Core Area Analysis*" for a complete review of the status of bull trout core areas in the Upper Columbia River bull trout population, pages 12 to 208 (USDI 2005a). We hereby incorporate the information found in those pages into our analysis. Below we examine the Middle Clark Fork River core area within which the proposed action would occur.

**Middle Clark Fork River (Section 2 – Flathead River to Milltown Dam):** More intensive bull trout surveys have been conducted in recent years, primarily by Montana Fish, Wildlife and Parks (MFWP), in this portion of the Clark Fork River drainage. Local spawning populations in Cedar Creek, Fish Creek, Rattlesnake Creek, and the St. Regis River have been monitored sporadically (MFWP 2004). The surveys have identified up to 17 redds in Cedar Creek (2002), 20 redds in Fish Creek (2003), 33 redds in Rattlesnake Creek (2003), and 18 redds in the St. Regis River (2003). Counts in the high single digits or low double digits have also occurred in most systems. These results indicate adult bull trout numbers in this core area range from roughly 100-200 fish, although there's uncertainty in that estimate. No trend is indicated by the short period of record. Most local populations are well below historical levels of natural abundance and are inadequate to maintain long-term genetic viability.

Milltown Dam, which has blocked fish passage at the upper boundary of this core area since 1908, is slated for complete removal within the next few years. While benefits are more likely to accrue to the next core area upstream, by allowing bull trout that migrate to return to natal headwaters, tangible benefits to this core area will accrue as well. Benefits of restoring fish passage throughout the system, over four major dams as a result of both the Avista and Thompson Falls projects as well as the Milltown Dam removal, cannot be fully anticipated, nor will they be fully realized for several bull trout generations.

The status and trend of bull trout in this core area were both considered "unknown" based on information available at the time of listing (USDI 1998c). That is still largely the case, though since that time MFWP has conducted extensive monitoring efforts in significant portions of this core area. Preliminary conclusions are that the abundance of adult bull trout in Reach 2 of the Clark Fork River ranges from roughly 100-200 fish, although there's uncertainty in that estimate. Most local populations are well below historical levels of natural abundance, with juvenile bull

trout widely distributed but at low densities. With fish passage now provided at Rattlesnake Dam and the pending removal of Milltown Dam and additional efforts, past fragmentation of this core area is being improved. However, significant habitat limitations remain (e.g., dewatering, thermal enrichment, nonnative species, impacts of whirling disease, expanding recreational use) and full recovery of bull trout is at best an uncertain prospect. Potentially, this core area should be able to support 1,000 or more adult bull trout. Thus, the emphasis has been placed on connectivity to restore this core area as a functioning portion of a larger complex of core areas (USDI 2005a).

Six local populations have been identified within this core area, including one in Petty Creek where this project would occur (the other local populations are found in Rattlesnake Creek, Fish Creek, Trout Creek, Cedar Creek and the St. Regis River). Migratory bull trout have been observed in Petty Creek during the spawning period and this stream was identified by the MBTSG (1996) as one of the most important spawning tributaries for migratory bull trout in this reach of the Clark Fork. In addition to supporting migratory bull trout, the Petty Creek drainage supports resident bull trout populations of moderate to low density. Resident bull trout have been found in the mainstem of Petty Creek at various locations and in Spring Gulch Creek, a tributary of Petty Creek (MBTSG 1996).

**Designated bull trout critical habitat**

On September 26, 2005, the final rule for bull trout critical habitat was published for the Klamath River, Columbia River, Jarbidge River, Coastal Puget Sound, and Saint Mary-Belly River populations of bull trout (USDI 2005b). This final designation encompasses approximately 3,828 miles of streams, 143,218 acres of lakes in Idaho, Montana, Oregon, and Washington, and 985 miles of shoreline paralleling marine habitat in Washington. The lateral extent for rivers and streams is defined by the ordinary high water line or the bankfull elevation. The lateral extent of designated lakes is defined by the perimeter of the water body mapped on 1:24,000 scale topographic maps.

All areas designated as critical habitat for bull trout are within the species' historic geographic range and contain enough of the primary constituent elements (PCEs) identified as essential to its conservation in the area designated to enable the bull trout to carry out normal behavior. Much of what is known about the specific physical and biological requirements of bull trout are described in the proposed designation of critical habitat rule (USDI 2002c). PCEs include, but are not limited to: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance (USDI 2004). Based on our current knowledge of the life history, biology, and ecology of the species and the requirements of the habitat to sustain the essential life history functions of the species, we have determined that the bull trout's PCEs are:

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may

vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation;

2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;

3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.

4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;

5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;

6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;

7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and

8. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited (USDI 2005b).

This designation protects PCEs necessary to support the life history functions which were the basis for the designation. Because not all life history functions require all the PCEs, not all habitat will contain all the PCEs (USDI 2005b).

The Petty Creek Road reconstruction effort affects designated bull trout critical habitat in Petty Creek within the Clark Fork River basin bull trout critical habitat unit. Project related effects to critical habitat in Petty Creek are addressed in this biological opinion.

**Effects of past and ongoing projects**

No new threats have been identified through section 7 consultation across the Columbia River bull trout population. Effects of projects that have been analyzed through section 7 consultation as reported in a biological opinion are summarized in this section. These effects are an important component of objectively characterizing the current status of the species and its habitat. To

assess the effects of these actions on bull trout we reviewed all of the biological opinions received by the Service's Region 1 and Region 6 offices, from the time of listing until August 2003; this summed to 137 biological opinions (USFWS 2003). Of these, 124 biological opinions (91 percent) applied to activities affecting bull trout in the Columbia River population, 12 biological opinions (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population, 7 biological opinions (5 percent) applied to activities affecting bull trout in the Klamath River population, and 1 biological opinion (<1 percent) applied to activities affecting the Jarbidge and St. Mary Belly populations. (Note: these percentages do not add up to 100 because several biological opinions applied to more than one population). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

This analysis showed that the Service consulted on a wide array of actions which had varying levels of effects. No actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout. Furthermore no actions that have undergone consultation were anticipated to result in the loss of any subpopulation identified during listing (USFWS 2003).

Since August 2003, Region 6 of the Service has issued an additional 25 biological opinions relative to bull trout under section 7 for the Montana portion of the Clark Fork management unit. After review of these opinions, the Service determined that actions that had undergone consultation were not anticipated to result in the loss of any core area or listing subpopulation of bull trout. Twenty-one of the 25 biological opinions resulted in short-term adverse effects with long-term benefits for bull trout. To date, in Regions 1 and 6 of the Service, no actions that have undergone section 7 consultation for adverse effects to bull trout have resulted in a jeopardy finding (i.e., an appreciable reduction in the likelihood of both the survival and recovery of bull trout). Similarly, none have resulted in a destruction or adverse modification finding for designated bull trout critical habitat. Taken in sum, the impact of all these actions adversely affected a small portion of the overall range of the species in the Clark Fork management unit.

**Analysis of the species/critical habitat likely to be affected**

Bull trout are listed as threatened under the Act. The proposed action would occur within the Clark Fork River - Section 2 (Flathead River to Milltown Dam) bull trout core area. Six local populations have been identified within this core area, including one in Petty Creek. The proposed action would result in adverse effects to bull trout in the Petty Creek drainage (FHWA 2006).

Bull trout critical habitat has been designated under the Act and was divided into 29 Critical Habitat Units. The proposed action would occur in Critical Habitat Unit 2: Clark Fork River Basin. Within this project's action area, Petty Creek was included in the final rule designating bull trout critical habitat. Petty Creek from its confluence with the Clark Fork River upstream 11.6 miles provides spawning and rearing habitat for the Petty Creek local population (USDI 2002c). The proposed action would result in adverse effects to bull trout critical habitat in Petty Creek (FHWA 2006).

### Other listed species

In addition to bull trout, other federally-listed species that may be present in the project area include the threatened bald eagle (*Haliaeetus leucocephalus*), endangered gray wolf (*Canis lupus*), and threatened Canada lynx (*Lynx canadensis*). Based on information provided in the BA for this project, including implementation of the stated design features and conservation measures, the Service concurs with the Administration that the proposed project may affect, but would not be likely to adversely affect bald eagles, gray wolves, and Canada lynx. Therefore, further consultation under the Act is not required relative to these species and they will not be considered further in this biological opinion. The Service acknowledges the Administration's determination that this proposed project would have no effect on the candidate yellow-billed cuckoo (*Coccyzus americanus*). If an occurrence of a listed species is newly discovered in the proximity of this project corridor as construction progresses, the Administration should consult with the Service regarding that new information.

## IV. Environmental baseline

Regulations implementing the Act, as amended (16 U.S.C. 1531 et seq.) (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area, which have already undergone section 7 consultation, and the impacts of State and private actions in the action area, which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, previous timber harvest, road construction, residential development and other land management activities.

### Status of the species and critical habitat within the action area

Action area, as defined by the Act, includes the entire area that would be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. For the purposes of this biological opinion, the action area is defined as a 0.5 mile swath on either side of the Petty Creek Road along the length of this road reconstruction project.

The action area has been defined by the potential for project-generated sediment and related impacts to influence the movement, habitat use and persistence of bull trout. The action area upstream from the proposed instream work sites would be affected by temporary disturbance of fish passage due to instream activities (e.g., culvert and bridge removal and replacement, bank stabilization, stream diversions). The action area downstream of project activities would be affected by turbidity and sediment deposition. Downstream effects are unlikely to extend far out into the Clark Fork River. The action area serves primarily as bull trout rearing and migratory habitat, although spawning activity in the mainstem of Petty Creek has been reported in the past

The subpopulation of bull trout in Petty creek is depressed compared with historic levels, however its numbers are not alarmingly low nor are they in a rapid state of decline. The two life-

history forms of bull trout, migratory and resident, may coexist; however, Petty Creek provides habitat for mostly resident populations of bull trout. Migratory bull trout from the main stem of Clark Fork River do spawn in Petty Creek. However, the number of fish entering Petty Creek is low because bull trout are rare in the main stem Clark Fork River. Fish enter Petty Creek in June during low flows to base flows (below the ground surface). Fluvial fish travel upstream and stay in the upper reaches and tributaries to spawn in the fall (FHWA 2006).

Most tributaries to Petty Creek are accessible to fish, and bull trout may be present in these systems as well. Low levels of presence in South Fork, East Fork and West Fork Petty Creek are presumed because bull trout, although rare, are in the main stem of Clark Fork River. Electroshock fish surveys conducted in 1987, 1992 and 1994 identified bull trout, but resulted in no estimate of population density (FHWA 2006).

The existing crossing structures along Petty Creek and its tributaries allow fish passage in some form. However, some structures do not allow passage for all life stages of fish, restricting available habitat for fish at some life stages. These structures include Madison Gulch, Spring Gulch, West Fork Petty Creek, Ed's Creek, Gus Creek, John's Creek, Mike's Creek, and East Fork Petty Creek (FHWA 2006).

Baseline conditions for bull trout habitat in the action area were assessed using information in the *Bull Trout Core Area Templates* (USDI 2005a), *Section 7 Consultation Watershed Baseline: Middle Clark Fork River* (US Department of Agriculture (USDA) 2000), the biological assessment (FHWA 2006), draft recovery plan (USDI 2002a; USDI 2002b), and other sources of information. These reports indicate that road construction, forestry practices, non-native species, and rural residential development all have affected bull trout habitat and populations in the action area. The impacts from these activities are reflected in the four population and 19 habitat indicators defined in *A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale* (matrix) (USDI 1998a). An evaluation of these four population and 19 habitat indicators was conducted at the sub-watershed scale to establish the environmental baseline. Table 2 displays the baseline conditions and the effects of the proposed action for the project area.

As referenced above, Table 2 displays the results of the "Matrix of Diagnostics / Pathways and Indicators" (matrix), the objective of which is to integrate the biological and habitat conditions to arrive at a determination of the potential effect of land management activities on a listed species. The columns in the matrix correspond to levels of condition of the indicator. There are three condition levels: "functioning appropriately;" "functioning at risk;" and "functioning at unacceptable risk." These three categories of function are defined for each indicator in the matrix. In concept, indicators in a watershed are "functioning appropriately" when they maintain strong and significant populations that are interconnected and promote recovery of a listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations. When the indicators are "functioning at risk," they provide for persistence of the species but in more isolated populations and may not promote recovery of a listed species or its critical habitat without active or passive restoration efforts. "Functioning at unacceptable risk" suggests the listed species continues to be absent from historical habitat, or is rare or is being

**Table 2. Bull Trout Matrix of Diagnostics/Pathways and Indicators for the Petty Creek drainage (FHWA 2006)..**

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Subpopulation Characteristics | | | | |
| Subpopulation size | FAR | Subpopulation size is depressed relative to historic levels, but the subpopulation is not at alarmingly low numbers. | Maintain | Implementation of the proposed project is not expected to negatively affect the subpopulation size in Petty Creek because construction impacts will be temporary, best management practices (BMPs) will be employed, and instream work will be restricted to work windows determined through coordination with the USFWS. In addition, some indicators such as sediment and substrate embeddedness will likely be improved in the long term, which will likely help to maintain and potentially raise the subpopulation size. |
| Growth and survival | FAR | Population is depressed, but is not in a rapid state of decline. | Maintain | With application of BMPs and adherence to construction windows, the proposed project will not measurably affect bull trout growth and survival, recruitment or the recovery rate of the Petty Creek subpopulation. |
| Life history diversity and isolation | FAR | Migratory fish enter Petty Creek from the Clark Fork River and some genetic exchange is possible with subpopulations in Fish Creek and Ninemile Creek. | Maintain | New stream crossing structures will improve fish passage, but this is not expected to affect bull trout life history diversity or bull trout subpopulation isolation because the new structures are not opening up previously inaccessible portions of Petty Creek or its tributaries, but rather improving passage to include all life stages of fish. |
| Persistence and genetic integrity | FAR | Clark Fork contributes a fair number of fluvial fish to Petty Creek, but populations within Clark Fork River are fragmented. Some genetic exchange is possible with subpopulations in Fish Creek and Ninemile Creek. Rainbow and brook trout present threats to genetic integrity. | Maintain | New stream crossing structures will improve fish passage, which could enhance connectivity between the Petty Creek bull trout subpopulation and subpopulations in Fish Creek and Ninemile Creek, as well as with other trout populations. However, because the new structures are not opening up previously inaccessible portions of Petty Creek or its tributaries, but rather improving passage to include all life stages of fish, it is not expected that the proposed project will change existing genetic exchange. |
| Water Quality | | | | |
| Temperature | FAR | Actual stream temperatures were not available. This indicator was based on 5 to 25 percent of the stream not having tree cover. | Maintain | Loss of minor amounts of vegetation including shrubs and grasses in disturbed areas will not measurably affect water temperatures in Petty Creek. Additionally, the establishment of vegetation along the creek in select areas where vegetation is currently lacking and revegetation of disturbed areas will help offset temperature changes and may improve the water temperatures in the long term. |
| Sediment | FUR | This indicator was evaluated based on road density, presence of mining sites, and number of culverts in the watershed. This watershed has greater than 1.7 miles per square mile road density; greater than 30 percent of stream length with roads within 300 feet, and extensive grazing. | Degrade in short term<br><br>Maintain/improve in long term | The proposed project would contribute to the degradation of this indicator during construction due to expected increases in sedimentation to streams. Implementation of BMPs would reduce but not eliminate this risk.<br>A paved road surface with stormwater runoff directed to drainage ditches would maintain and likely improve this indicator in the long term. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Chemical contamination/nutrients | FUR/FAR | Lower Petty Creek functions at an unacceptable risk because there are one or more reaches with impaired water quality. Within upper Petty Creek this indicator is functioning appropriately and there are no systems on the state list of streams with impaired water quality. | Maintain | Due to the extent of construction activities planned it is likely that chemicals will enter Petty Creek, however, levels will be minimal with the implementation of BMPs and spill control plans. |
| Habitat Access | | | | |
| Physical barriers | FAR | This indicator was evaluated based on known barriers and culverts on fish bearing streams, however, the condition of all culverts is not known. Upper and lower Petty Creek have no known permanent barriers. Some culverts do not provide fish passage for all life stages of fish. | Maintain | Implementation of the proposed project will not create any permanent barriers to upstream and downstream fish passage. Temporary barriers to fish movement may be created during the establishment and removal of diversion channels. |
| Habitat Elements | | | | |
| Substrate embeddedness | FUR | This indicator was evaluated the same as for sediment. | Degrade in short term<br><br>Maintain/improve in long term | Structure removal, fill removal and construction of a new structure and roadway over upper Petty Creek as well as work along Petty Creek and in Petty Creek's tributaries will likely result in delivery of sediment to the stream during construction. If excess amounts of sediment reach the channel, increased substrate embeddedness may occur. However, this will be reduced with BMPs and sediment control measures in place. Also, a paved road surface with stormwater runoff directed to drainage ditches would maintain and likely improve this indicator in the long term. |
| Large woody debris | FUR/FAR | This indicator was evaluated based on tree cover along stream banks, number of roads within 300 feet of the stream and number of crossings in the stream. Based on these criteria, lower Petty Creek is functioning at unacceptable risk (greater than 25 percent tree cover; greater than 30 percent of roads are within 300 feet of streams; greater than 2 crossings). Based on these criteria, upper Petty Creek is functioning at risk (less than 10 to 25 percent tree cover; 15 to 30 percent of roads are within 300 feet of streams; less than 2 crossings). | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is expected that very little forested riparian areas will be disturbed. Additionally, any disturbed areas will be revegetated, and some currently non-vegetated riprap areas will be planted with native saplings. Therefore, the project is expected to maintain the existing large woody debris element. |
| Pool frequency and quality | FA/FAR | Within lower Petty Creek, this indicator is functioning appropriately and within upper Petty Creek, it is functioning at risk. | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is not expected that habitat features contributing to the formation of pools (such as large woody debris) will be significantly impacted. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Large pools | FUR | This indicator was based on ratings for sediment, large woody debris, and stream bank condition. This system is functioning at unacceptable risk for the following reasons: large woody debris is functioning at risk or unacceptable risk; stream bank condition and sediment are functioning at unacceptable risk. | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is not expected that forested riparian areas or vegetation will be significantly impacted. Streambank condition is expected to be maintained since the existing road is in close proximity to Petty Creek. Sediment will increase during construction, but this will be reduced with BMPs and sediment control measures in place. Also, a paved road surface with stormwater runoff directed to drainage ditches would likely reduce sediment in the long term. |
| Off-channel habitat | FUR/FAR | This indicator was based on the percentage of low-gradient streams in the watershed with roads within 300 feet of the stream. Therefore the lower and upper reaches Petty Creek are functioning at unacceptable risk and at risk, respectively. | Maintain/Improve | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator.<br>With slight road realignments away from the creek and providing vegetation where vegetation is currently lacking, it is expected there will be a minor improvement in this indicator. |
| Refugia | FUR | There are no habitat refugia within the subpopulation boundary. | Maintain | Implementation of the proposed project will not affect bull trout refugia. |
| Channel Condition and Dynamics | | | | |
| Wetted width/Maximum depth ratio | FUR/FAR | This indicator was evaluated the same as for sediment unless certain conditions were met. | Maintain | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator. A paved road surface with stormwater runoff directed to drainage ditches would maintain and possibly improve this indicator in the long term. |
| Stream bank condition | FUR/FAR | This indicator was evaluated the same as for width/depth ratios. | Maintain | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator. Also, slight shifts in the alignment away from the creek and providing vegetation where vegetation is currently lacking may improve the indicator. |
| Floodplain connectivity | FUR/FAR | This indicator was evaluated the same as for width/depth ratios. However, the C type channel in upper Petty Creek would contribute to stream instability and downcutting, so this indicator is at risk. | Maintain | Because the road is already in close proximity to the stream, road improvements on the existing alignment would likely maintain this indicator. |
| Flow Hydrology | | | | |
| Change in peak/base flows | FUR/FAR | This indicator was based on road density in the watershed (described below) and amount of regeneration harvest less than 30 years old. Lower Petty Creek is functioning at unacceptable risk (road density is at unacceptable risk and regeneration harvest is present on greater than 25 percent of the watershed). Upper Petty Creek is at risk (road density is at risk and regeneration harvest covers 10 to 25 percent of the watershed). | Maintain | Implementation of the proposed project will not result in changes to peak/base flows. Regeneration harvest is not expected to change, and while the project will include road widening, no additional miles would be added to existing road densities. |
| Drainage network increase | FUR/FAR | Road densities were used to evaluate this indicator (see below). | Maintain | While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Watershed Conditions | | | | |
| Road density and locations | FUR/FAR | Lower Petty Creek includes road densities greater than 1.7 miles per square mile and greater than 30 percent of the stream length in the watershed within 300 feet of the stream and is therefore at unacceptable risk.<br>Upper Petty Creek includes road densities between 0.7 and 1.7 miles per square mile and between 15 and 30 percent of the stream length in the watershed within 300 feet of the stream and is therefore at risk. | Maintain | While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. Because the road is already in close proximity to the stream, road improvements on the existing alignment would likely maintain this indicator. |
| Disturbance history | FUR/FAR | This indicator is based on road density within sensitive landtypes and peak/base flow patterns. | Maintain | Implementation of the proposed project will not alter the existing disturbance history. While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |
| Riparian conservation area | FUR/FAR | This indicator is based on road density and location (described above) and tree cover on stream banks (see Temperature above). | Maintain | Implementation of the proposed project would likely maintain this indicator. Minor degradation may occur if forested riparian areas are lost, however, slight shifts in the alignment away from the creek and providing vegetation where vegetation is currently lacking may help improve the indicator. |
| Disturbance regime | FUR/FAR | This indicator is based on road density (described above) and amount of sensitive landtypes in the watershed. Based on these criteria, lower Petty Creek is functioning at unacceptable risk (greater than 30 percent of the watershed is composed of sensitive landtypes).<br>Upper Petty Creek is at risk (15 to 30 percent of the watershed is sensitive landtypes). | Maintain | It is not expected that implementation of the proposed project will alter the current disturbance regime in the project area. While the project will include some road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |
| Species and Habitat | | | | |
| Integration of species and habitat condition | FUR | The subpopulation size is small, habitat is degraded and fragmented.<br>With no active restoration, habitat conditions will not improve within two generations (5 to 10 years). Some connectivity remains among subpopulations. | Maintain | Implementation of the proposed project would maintain this indicator. Degradation of habitat conditions may occur in the short term under sediment and substrate embeddedness, but conditions may improve in the long term under off-channel habitat, sediment, and substrate embeddedness. |

a. Analysis of baseline conditions is summarized from USDA 2000, and from coordination with USFS, MFWP, US Corps of Engineers, Environmental Protection Agency, and USFWS.
FA = indicators are functioning appropriately.
FAR = indicators are functioning at risk.
FUR = indicators are functioning at unacceptable risk

maintained at a low population level. Although the habitat may maintain the species at this low persistence level, active restoration is needed to begin recovery of the species.

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Act to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. To that end, agency biologists use the four biological indicators and the 19 physical habitat indicators in the matrix for bull trout to assess the environmental baseline conditions and determine the likelihood of take per interagency guidance and agreement on section 7 consultations on the effects of actions to bull trout (USDI 1998a, 1998b). Take could occur as direct harm or harassment of individuals or indirectly through adverse impacts to bull trout habitat. The majority of the matrix analysis consists of specific consideration of the 19 habitat indicators. Analysis of the matrix habitat indicators relative to project effects provides a very thorough assessment of the existing habitat conditions and potential impacts to bull trout habitat. A description of the status of each indicator within this project area is provided in Table 2.

While assessing the environmental baseline and potential effects to bull trout as a species, agency biologists concurrently provide a companion analysis of effects to the PCEs for designated critical habitat and related habitat indicators (Appendix A). Based on the matrix crosswalk, at least one habitat indicator in each of the eight PCEs is rated as "functioning at risk" or "functioning at unacceptable risk." Therefore, in summary, based on the site specific environmental baseline of bull trout habitat conditions provided in the biological assessment for this project, linkage to the PCEs considering those habitat indicators described in Appendix A, and other factors as necessary, all PCEs in Petty Creek within the project corridor are functioning in less than optimal condition.

**Factors affecting species environment within the action area**

Five to 25 percent of Petty Creek does not have tree cover, contributing to increased water temperatures. Lower Petty Creek includes road densities greater than 1.7 miles per square mile, and greater than 30 percent of the stream length in the watershed is within 300 feet of the stream. Upper Petty Creek includes road densities between 0.7 and 1.7 miles per square mile, and between 15 and 30 percent of the stream length in the watershed is within 300 feet of the stream. These conditions, coupled with the fact that the majority of the roads are graveled, have contributed to undesirable levels of sediment in the creek and toward an impaired water quality designation by the Montana Department of Environmental Quality (FHWA 2006).

For over 100 years, forestry practices have caused major impacts to bull trout habitat throughout the Clark Fork River basin. Past forestry practices (i.e., road construction, log skidding, harvest in riparian areas, clear-cutting, splash dams, and terracing) were often damaging to watershed conditions and were major contributing causes of bull trout decline. While the primary effects of these practices have been reduced by the development of more progressive techniques, the legacy effects of the past century have included lasting impacts to bull trout habitat, including increased sediment in streams, increased peak flows, thermal modifications, loss of instream

woody cover, channel instability, and increased accessibility for anglers and poachers. These impacts will continue and are irreversible in some drainages (USDI 2002b).

Transportation systems were a major contributor to the decline of bull trout in this recovery unit. Separating the direct effect of the roads and railroads from the development associated with their construction is difficult. Likewise, separating the effects of transportation corridors in forested habitat from the legacy effects of forest management is also difficult. Construction methods during the late 19th and early 20th centuries, primarily channelization and meander cutoffs, caused major impacts on many of these streams; impacts that are still being manifested. Such impacts seldom occur with new roads. However, significant problems remain and are associated with passage barriers, sediment production, unstable slopes, improper maintenance, and high road densities (USDI 2002b).

The impacts of residential development in the Clark Fork River watershed vary by location, but where impacts occur, they can be severe. Ultimately, unmanaged growth and residential sprawl may be among the biggest threats to the recovery of bull trout in this recovery unit. The entire drainage holds many of the attributes that are increasingly attractive to people seeking relief from the urban environment, and human population growth in western Montana has accelerated. The way in which this growth is managed and our ability to limit the impacts of growth, in particular on bull trout spawning and rearing streams, are pivotal to the success of the bull trout recovery effort. Increasing human populations have a direct impact on all of the other categories of risk that affect bull trout (USDI 2002b).

Of all the threats to bull trout recovery, the expanding presence of nonnative species may prove to be the most intractable. In particular, brook trout and lake trout, the two common species most closely related to bull trout, are believed to represent the greatest threat to bull trout in the Clark Fork River basin as a whole. Brook trout are present in nearly all mainstem Clark Fork River tributaries. Bull trout hybridize with brook trout, and their offspring are generally sterile. The available data indicate that brook trout presence can create an unstable situation, resulting in a dramatic decline or replacement of bull trout (USDI 2002b).

Brown trout are also suspected to adversely affect bull trout. At this point, the nature of the negative interaction between bull trout and brown trout is not well understood, but is thought to include elements of competition and predation. However, the result of the species' interaction is suspected to be detrimental to bull trout, given the apparent overlap in niches for the two species (USDI 2002b).

Scientists currently have limited tools available to deal with these intruders, and in many cases, there is strong public opposition to controlling or eliminating other salmonids that provide sport fisheries. The impacts of introductions of nonnative species in most cases may be permanent. While the status of stream habitat for bull trout in many watersheds throughout this recovery unit has had an improving trend, the effects of nonnative species introductions may permanently reduce the capacity of these waters to support bull trout. Intact native fish ecosystems are increasingly rare, and we must allocate substantial resources to protecting and restoring those that remain (USDI 2002b).

## V. Effects of the action

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that would be added to the environmental baseline. Direct effects are considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation. The effects of the action are added to the environmental baseline to determine the future baseline and to form the basis for the determination in this opinion. Should the Federal action result in a jeopardy situation and/or adverse modification conclusion, the Service may propose reasonable and prudent alternatives that the Federal agency can take to avoid violation of section 7(a)(2). The effects discussed below are the result of direct and indirect impacts of implementing the proposed project.

### General effects of transportation projects on bull trout and critical habitat

Effects associated with major transportation systems on rivers and lakes include sedimentation, loss of riparian habitat, channel modification, and chemical contamination. Effects vary widely depending on factors such as number, magnitude, and proximity of the transportation system, type of water body affected, surrounding topography, and level of use of the system. Effects from transportation systems can lead to degradation of aquatic habitat. For example, channel modifications such as bank hardening, constriction, channelization, and relocation can lead to stream instability, bank erosion, sediment deposition, and lateral stream movement (MDT 2005).

The major effects from transportation systems on bull trout and their habitat include sedimentation, channelization, bank instability, and loss of riparian vegetation. These effects generally lead to degraded habitat by increasing water temperature and reducing habitat complexity, pool quality, large woody debris recruitment, and bank stability (MDT 2005).

Direct effects are impacts caused by specific projects that occur at the same time and place and have immediate effects on the species or its habitat (e.g., construction equipment destroys eggs by running across a redd in the river channel, or fill material deposited in the stream kills a fish). Transportation improvement projects can potentially have direct impacts on bull trout in five ways: 1) direct mortality of individual fish at all life stages; 2) major disturbance of fish in the project area; 3) major temporary displacement of fish species in the vicinity of the project area; 4) major elimination of supporting aquatic and/or riparian habitat in the project area (important habitat features); and 5) project activities causing substantial, long-term reductions water quality due to excessive sedimentation and toxic substances, resulting in reduced availability of prey or increased toxicity of prey through bio-accumulation of contaminants (MDT 2004).

Indirect effects are impacts caused by or resulting from actions of specific projects that are later in time and space and are reasonably certain to occur (e.g., degradation of aquatic and riparian

habitat or water quality to the point where fish survival and/or production is substantially reduced during any life stage). Indirect effects, with the exception of direct mortality of fish, can be similar to direct effects, but are less severe and immediate in observable impacts to sensitive fish species and their habitat. Indirect impacts can also manifest themselves after completion of project activities, and can change long-term human use and resource condition. Transportation improvement projects can potentially have indirect impacts on bull trout in four ways: 1) increased seasonal disturbance of fish in the project area; 2) temporary displacement of fish in the vicinity of the project area; 3) elimination of supporting vegetation in the project area; and 4) project activities causing substantial, long-term reductions to water quality and stream habitat, due to excessive sedimentation and persistent, toxic substances (MDT 2004).

Project related activities could create disturbed areas that, over the long-term, could increase sediment loads into the water body, thereby reducing availability, quality, and abundance of substrate needed for macroinvertebrate production. Also, refueling and equipment storage areas would pose risks through possible leaks of chemical contaminants into the river, which could have long-term effects on fish production by reducing egg survival and macroinvertebrate production in stream gravel (MDT 2004).

**Project specific effects on bull trout and critical habitat**

As described earlier, to aid in determining the potential affects the project would have on bull trout in the Petty Creek drainage, the bull trout matrix was employed (Table 2). The matrix evaluates biological and habitat conditions through 24 indicators grouped under eight diagnostics/pathways. Project related effects of the proposed action relative to these indicators are also described in Table 2.

Removal of vegetation, exposed soils, embankment reconstruction, and replacing stream-crossing structures would result in increased sediment delivery to and turbidity in streams. Suspended and deposited sediment in streams can affect adult trout by causing changes in their behavior, reducing available habitat, increasing stress, and reducing food supply. High levels of suspended sediment can result in the loss of visual capability, leading to reduced feeding and a depressed growth rate. Large amounts of deposited sediment can deplete benthic invertebrate populations, reducing the food supply for fish. They can fill pools and blanket the structural cover for fish, reducing the available habitat for adult salmonids. They can also affect habitat for juvenile salmonids by filling pools and intergravel spaces. Fine sediments in stream gravels affects incubating eggs and developing alevins (recently hatched embryos that still have a yolk sac) by inhibiting dissipation of metabolic wastes. Fine sediments in stream gravels may also abrade or dislodge developing embryos and emerging fry, delay the rate of egg hatching, and reduce survival during incubation. Additionally, increased turbidity and sediment movement in streams could displace adult fish to other unaffected portions of the stream (FHWA 2006).

Most of these increases in sedimentation will be temporary, occurring during construction and until vegetation is established. To lessen the impacts of construction related sediment, appropriate sediment and erosion control best management practices (BMPs) will be put into

place before construction begins and will be maintained in working order throughout the construction period and until vegetation is established (FHWA 2006).

The existing gravel road has a relatively high surface runoff coefficient compared with the surrounding natural vegetation; however, paving the road will likely increase this surface runoff, potentially increasing road bank erosion and sedimentation in that respect. Conversely, paving the road and providing drainage facilities that allow ground infiltration and sediment filtration from stormwater runoff will reduce sedimentation. Additionally, where feasible and where the two are in close proximity, the road will be realigned slightly away from the creek and a vegetated buffer planted. Existing riprap will be left undisturbed to avoid unnecessary sedimentation and native saplings will be planted within the riprap. In the long term, these elements are expected to reduce overall sedimentation in the Petty Creek drainage (FHWA 2006).

Cool water temperature is an important characteristic for bull trout as mentioned above, and tree cover is important to keeping those temperatures low. Five to 25 percent of Petty Creek is not tree covered, however, because the proposed road will be using the existing road alignment, it is expected that this percentage, and therefore water temperature, will not be significantly impacted (FHWA 2006).

Accidental spills or leaks of materials used during construction may result in impacts on fish and stream habitat. Materials that could accidentally enter a stream or wetland during construction include petroleum fuels, lubricants, or concrete leachate and other substances used for roadway paving. The entry of these substances into a stream or wetland could result in temporary displacement of fish or fish mortality if a lethal concentration of the substance reaches the stream or wetland. BMPs and spill control plans will be developed and implemented as part of the Section 404 and Montana Pollution Discharge Elimination System permitting processes (FHWA 2006).

While there are no absolute barriers to fish passage in Petty Creek, several of the existing crossing structures inadequately provide passage for all life stages of fish. To improve habitat, all new structures will be designed for passage of all life stages. Table 1 exhibits the existing and new structure sizes. Additionally, a natural bankfull stream configuration and substrate will be constructed within the crossing. No additional stream crossing structures will be constructed (FHWA 2006).

Detours and diversion channels will result in temporary displacement of fish, loss of habitat, and possible creation of a migration barrier during construction. The duration of these events will be made as brief as possible. These effects would be temporary and should result in only short-term effects on fish (FHWA 2006).

**Summary**: Because construction activities associated with the proposed road improvements will require in-water work resulting in temporary sedimentation to Petty Creek and its tributaries, and although implementation of BMPs will reduce the effects of sedimentation on bull trout, road construction activities are still likely to have adverse effects on bull trout and bull trout habitat.

Long-term adverse impacts resulting from the proposed project are unlikely because all crossing structures in fish-bearing streams will be designed to allow passage during all life stages of fish, drainage facilities will be improved, and where feasible, the roadway will be moved away from Petty Creek and a vegetative buffer planted. It is likely that these design elements will have overall positive long-term effects on bull trout in Petty Creek and its tributaries (FHWA 2006).

In addition, the BA for this project used the population and habitat indicators from the bull trout matrix in Table 2 as the basis for determining effects to bull trout and critical habitat as a result of the proposed action. PCE analysis is based on the linkage between the PCEs and the matrix (Appendix A) and any other factors pertinent to the project analysis.

Analysis of the Petty Creek Road Improvement Project indicates that the activities associated with this project are likely to affect the matrix habitat indicators *sediment* and *substrate embeddedness*, as described in Table 2. The project-related activities are expected to result in short-term degradation of these habitat elements and subsequently PCEs 3 and 8. With paving of the roadway corridor, improvement of drainage facilities, and where feasible, moving the roadway away from Petty Creek and planting a vegetative buffer, a long-term improvement of the *sediment* and *substrate embeddedness* indicators and associated PCEs 3 and 8 is anticipated. However, the temporary impacts associated with the proposed action are not discountable, insignificant, or entirely beneficial. Therefore, the project is likely to adversely affect designated critical habitat for bull trout in Petty Creek (FHWA 2006).

**VI. Cumulative effects**

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they will require separate consultation pursuant to section 7 of the Act.

Past and present state or private activities that are reasonably expected to continue into the foreseeable future in the project area, which may contribute to impacts to bull trout include: road maintenance activities; logging activities; agricultural practices; recreational activities; gravel/materials mining to accommodate new development and roads; and residential construction, including increased sewage effluent and utilities/pipelines associated with increased development. Land use changes, population growth and traffic have increased in the past and will likely continue, exacerbating previously discussed impacts to bull trout. Ultimately, careful planning of land use and development in this area would limit potential threats from sedimentation to bull trout using this area.

Cumulative effects of the watershed will be reflected in bull trout population numbers and life history forms. Overall the population is expected to remain viable during the short-term impacts of this project.

## VII. Conclusion

### Jeopardy analysis for bull trout

The implementing regulations for section 7 (50 CFR 402) define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

After reviewing the current status of the Columbia Basin DPS of bull trout, the environmental baseline for the action area, the effects of the road paving and reconstruction, and bridge and culvert replacement activities associated with the proposed Petty Creek Road Improvement Project in Missoula County, Montana, and the cumulative effects, it is the Service's biological opinion that this project, as proposed, would not be likely to jeopardize the continued existence of the Columbia Basin DPS of bull trout, nor any recovery subunit thereof. The Service's rationale for this conclusion includes, but is not limited to, the following factors:

1. Implementation of the proposed action is not anticipated to reduce the reproduction, numbers, or distribution of bull trout within the Clark Fork River Section 2 core area or action area to the degree that the likelihood of the local population survival or recovery is reduced.

2. The proposed action, once implemented, will reduce the amount of sediment entering Petty Creek and will decrease encroachment of the road onto Petty Creek. In addition, substandard stream crossing structures to be replaced as part of this project will allow for the passage of all life stages of bull trout, which will be an improvement from the existing condition.

3. Due to project design features and conservation measures, the proposed action is not likely to have any population level effects, or core area effects, and is not expected to affect any adjacent core areas of bull trout.

4. As implementation of the proposed action is not likely to appreciably reduce the likelihood of survival or recovery of this core area, it is unlikely that the proposed action would jeopardize the continued existence of the bull trout in the Clark Fork River – Section 2 core area or the Columbia River bull trout population and the coterminous listing of bull trout.

### Adverse modification analysis for designated bull trout critical habitat

After reviewing the current status of the Clark Fork River Section 2 core area of bull trout and its relationship to the Upper Columbia River bull trout population, the status of bull trout critical habitat in Petty Creek within the Clark Fork River basin bull trout critical habitat unit, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's biological opinion that the actions, as proposed, are not likely to

destroy or adversely modify designated bull trout critical habitat. The Service defines destruction or adverse modification as "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." However, recent decisions by the 5th and 9th Circuit Court of Appeals have invalidated this definition. Pursuant to current national policy and the statutory provisions of the Act, destruction or adverse modification is determined on the basis of whether, with implementation of the proposed action, the affected critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species.

Given the design elements proposed for the Petty Creek Road and its stream crossing structures, along with the construction techniques and conservation measures that would be utilized during project implementation (i.e., best management practices and sediment control measures), adverse effects to PCEs 3 and 8 in Petty Creek would be short-term. Therefore, PCEs 3 and 8 are likely to retain their ability to be functionally established. Overall, even though some short-term construction-related impacts are anticipated, the proposed action would maintain or improve the long-term condition of bull trout critical habitat in Petty Creek within the project area in the Clark Fork River basin bull trout critical habitat unit.

Although PCEs 3 and 8 are currently not in optimal condition in Petty Creek, they are functioning and would remain functional after implementation of this proposed project. Petty Creek is considered spawning and rearing habitat for bull trout. This project would not change the functioning status of PCEs in Petty Creek, nor in the Clark Fork River basin bull trout critical habitat unit. Therefore, no destruction or adverse modification of bull trout critical habitat would occur as a result of the implementation of this proposed action.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission that creates the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Federal Highway Administration so that they become binding conditions of any grant, permit or contract issued to the construction contractors who are selected to construct this project, as appropriate, for the exemption in section 7(o)(2) to apply. The Administration has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Administration: (1) fails to assume and implement the terms and conditions; or (2) fails to require the chosen construction contractors to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, grant or contract document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Administration must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

**Amount or extent of take anticipated**

The Service anticipates that activities associated with the proposed Petty Creek Road Improvement Project would result in incidental take of bull trout in the form of harm, harassment or mortality that would result from instream activities primarily related to the replacement of crossing structures over Petty Creek and its tributaries and other road reconstruction activities. Increases in sediment to the Petty Creek drainage are anticipated to adversely affect and likely result in take of bull trout life history stages by harming or impairing feeding, breeding and sheltering patterns of adult and juvenile bull trout. Direct mortality of bull trout is possible as a result of instream construction activities. The amount of take that may result from implementation of the proposed action is difficult to quantify for the following reasons:

1. identification and detection of dead or impaired individuals is unlikely;

2. aquatic habitat modifications are often difficult to ascribe to particular sources, especially in areas already degraded by other activities and facilities;

3. losses to bull trout in any life stage may be masked by wide seasonal fluctuations in numbers; and

4. measures proposed by the Administration to minimize the impacts to bull trout and bull trout habitat in the action area will likely be effective to varying degrees.

For these reasons, the actual amount or extent of the anticipated incidental take of bull trout is difficult to quantify. In cases such as these, the Service uses surrogate measures to determine the amount or extent of incidental take and whether the amount of take anticipated has been exceeded. In this biological opinion we use project design and project related construction techniques for these purposes. Thus, if the design and construction of the portions of this project that are expected to impact Petty Creek or its tributaries are not implemented as indicated in the biological assessment submitted to the Service for consultation, including implementation of the conservation measures listed on pages 10-11 of the biological assessment, the level of incidental take anticipated in this biological opinion may be considered to have been exceeded. Such

incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Administration must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

The Service anticipates that incidental take of bull trout would occur within the Petty Creek Road corridor in the vicinity of instream work activities, and would occur in Petty Creek as well as in the lower portions of tributaries crossed by this proposed road improvement project. Instream work (bridge and culvert replacement, temporary stream diversions, stream bank stabilization, etc.) is proposed to occur at numerous sites all along this road corridor. The Petty Creek drainage is used by bull trout for spawning and rearing habitat in this core area, and contains low densities of bull trout. Incidental take of bull trout is anticipated to occur during, and for a short time after, the period during which instream activities associated with this road improvement project are occurring during a minimum of two construction seasons.

Because the incidental take provisions of the Act (sections 7(b)(4) and 7(o)(2)) do not apply to designated critical habitat, no take of designated bull trout critical habitat is expected, or exempted, for this project.

**Effect of the take**

In the accompanying biological opinion, the Service determined the anticipated level of adverse impacts from this project would not substantially reduce the potential for persistence or recovery of the Clark Fork River – Section 2 core area encompassing the action area, and thus would not be likely to result in jeopardy to the Columbia Basin DPS of bull trout.

**Reasonable and prudent measures**

Incidental take statements typically provide reasonable and prudent measures which are expected to reduce the amount of incidental take. Reasonable and prudent measures are those measures necessary and appropriate to minimize the incidental take resulting from the proposed action. These reasonable and prudent measures are non-discretionary and must be implemented by the Administration in order for the exemption in section 7(o)(2) to apply.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the potential of incidental take of bull trout that is anticipated to result from implementation of the Petty Creek Road Improvement Project.

1. The Administration shall identify and implement means to reduce the potential for incidental take of bull trout from direct mortality and from increases in the amount of sediment and other pollutants entering Petty Creek and its tributaries as a result of construction-related activities associated with this project.

2. The Administration shall monitor highway reconstruction and bridge and culvert replacement activities to ensure that these activities comply with the biological

assessment, supporting documentation, and biological opinion for this project. The Administration shall also implement the reporting requirement as described in the terms and conditions below.

**Terms and conditions**

In order to be exempt from the prohibitions of section 9 of the Act, the Administration must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

1. To fulfill reasonable and prudent measure #1, the following terms and conditions shall be implemented:

   a) Instream work shall occur only during the period July 1 - September 15 and shall be accomplished in the shortest possible amount of time. Culverts replaced in perennial streams shall allow and promote adequate passage of all life stages of bull trout. Culvert replacement activities shall include embedding the culverts into the substrate. Temporary stream diversions shall remain in place for the shortest possible amount of time. If at all possible, schedule instream construction activities such that as many of the necessary construction activities as possible occur "in the dry."

   b) Best management practices for erosion control shall be applied to this project, including:

   - constructing silt fencing to prevent sediment from reaching water bodies;
   - using straw bales in borrow ditches to prevent erosion and sediment transport;
   - quickly reseeding and revegetating all disturbed areas with native vegetation, including embankments and borrow ditches, and adding a woody vegetation component to the riparian revegetation plans;
   - using bank stabilization measures for disturbed channel banks; and
   - maintaining and protecting riparian vegetation to the maximum extent possible within the construction zone.

   c) All waste fuels, lubricating fluids, herbicides, and other chemicals will be collected and disposed of in a manner that ensures that no adverse environmental impact will occur. Construction equipment will be inspected daily to ensure hydraulic, fuel and lubrication systems are in good condition and free of leaks to prevent these materials from entering any stream. Vehicle servicing and refueling areas, fuel storage areas, and construction staging and materials storage areas will be sited and contained properly to ensure that spilled fluids or stored materials do not enter any stream.

   d) Stream bank sections that are disturbed by construction activities shall be successfully revegetated with native riparian shrubs, trees, and grasses to the maximum extent possible. The intent of this would primarily be to retard sediment and pollutant transport,

but also to help stabilize banks, provide shade and potential large woody debris recruitment, and replicate brushy streambank cover.

2. To fulfill reasonable and prudent measure #2, the following terms and conditions shall be implemented:

   a) Structures designed to minimize sediment and pollutant runoff from sensitive areas such as settling ponds, vehicle and fuel storage areas, hazardous materials storage sites, and erosion control structures shall be visually monitored daily, especially following precipitation events, to ensure these structures are functioning properly.

   b) Upon locating dead, injured or sick bull trout, notification must be made within 24 hours to the Service's Montana Field Office at (406)449-5225. Record information relative to the date, time and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that take of bull trout will be limited to harm or harassment and the resulting impacts to instream habitat associated with instream construction activities. If, during the course of the action, term and condition #1 outlined above is not adhered to, the level of incidental take anticipated in this biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Administration must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. To assist in meeting the Administration's responsibilities under Section 7(a)(1) of the Act, and to utilize authorities granted within the recent transportation funding laws, the Service strongly recommends that the Administration work proactively with the Service, U.S. Forest Service, MFWP, and others to identify and remedy impacts to salmonids, including bull trout, within the Clark Fork River – Section 2 core area that are the result of transportation systems. Within this area, many streams were channelized during road and railroad construction, resulting in shortening of stream channels, increased erosion, higher water velocities, and loss of fish habitat.

2. The Service recommends the Administration explore potential opportunities to utilize their expertise and authorities to promote innovative and non-traditional fisheries enhancement projects within the middle Clark Fork River watershed by partnering in some manner with other agencies or groups to share knowledge and resources to restore or enhance fisheries habitat within the middle Clark Fork area that has been degraded by activities other than those related to transportation. The draft Bull Trout Recovery Plan recommends many recovery tasks that need to be accomplished to protect, restore, and maintain suitable habitat conditions for bull trout in this area. These tasks pertain to transportation and non-transportation related impacts to bull trout habitat (USDI 2002b).

3. The Petty Creek watershed is located within a key wildlife linkage area between large blocks of public lands. As human development continues in this drainage, including roadway improvements, this important habitat will likely become fragmented and lose its effectiveness. With that in mind, the Service recommends that the Administration continue to pursue opportunities to partner with organizations that work to conserve wildlife habitat threatened by human development through the use of land use planning tools (e.g., perpetual conservation easements) relative to maintaining and promoting wildlife connectivity at a landscape scale in western Montana.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

## REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

R. Mark Wilson

September 14, 2006

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## Appendix A

**PCEs for bull trout critical habitat and associated matrix habitat indicators.**

**Crosswalk to support PCE analysis through the matrix of pathway indicators for bull trout**

**PCEs for bull trout critical habitat and associated matrix habitat indicators.**

| PCE # | PCE description | Associated matrix habitat indicators |
|---|---|---|
| 1 | Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C), but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation. | - Temperature<br>- Refugia<br>- Average wetted width/maximum depth ratio in scour pools in a reach<br>- Streambank condition<br>- Change in peak/base flows<br>- Riparian conservation areas<br>- Floodplain connectivity |
| 2 | Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures. | - Large woody debris<br>- Pool frequency and quality<br>- Large pools<br>- Off channel habitat<br>- Refugia<br>- Average wetted width/maximum depth ratio in scour pools in a reach<br>- Streambank condition<br>- Floodplain connectivity<br>- Riparian conservation areas |
| 3 | Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (6.3 millimeters) in diameter. | - Sediment<br>- Substrate embeddedness<br>- Large woody debris<br>- Pool frequency and quality |
| 4 | A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operates under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation. | - Change in peak/base flows<br>- Increase in drainage network<br>- Disturbance history<br>- Disturbance regime |
| 5 | Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source. | - Floodplain connectivity<br>- Change in peak/base flows<br>- Increase in drainage network<br>- Riparian conservation areas<br>- Chemical contamination/nutrients |
| 6 | Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows. | - Life history diversity and isolation<br>- Persistence and genetic integrity<br>- Temperature<br>- Chemical contamination/nutrients<br>- Physical barriers<br>- Average wetted width/maximum depth ratio in scour pools in a reach<br>- Change in peak/base flows<br>- Refugia |
| 7 | An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | - Growth and survival<br>- Life history diversity and isolation<br>- Riparian conservation areas<br>- Floodplain connectivity (importance of aquatic habitat condition-indirectly covered by previous 6 PCEs) |
| 8 | Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited. | - Sediment<br>- Chemical contamination/nutrients<br>- Change in peak/base flows |

## Crosswalk to Support Primary Constituent Element Analysis Through the Matrix of Pathway Indicators for Bull Trout

This matrix crosswalk provides information supporting the rationale that the primary constituent elements (PCEs) for bull trout critical habitat are thoroughly addressed and evaluated when the bull trout matrix analysis is utilized. It recognizes that the environmental baseline and determination of effect for bull trout consist of both biological and habitat components that are addressed in the PCEs listed in the Final Rule designating critical habitat (USFWS 2005). Below are the eight PCEs and the supporting rationale:

> **PCE 1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation.**

This PCE is addressed directly by the analysis of *temperature*. It is addressed indirectly through consideration of *refugia*, which by definition is high quality habitat of appropriate temperature. Important components of refugia include pool frequency and quality and large pools. *Average wetted width/maximum depth ratio in scour pools* is an indication of water volume, which indirectly indicates water temperature, (i.e., low ratios indicate deeper water, which in turn indicates possible refugia). This indicator, in conjunction with *change in peak/base flows,* is an indicator of potential temperature and refugia concerns, particularly during low flow periods. *Streambank condition, floodplain connectivity* and *riparian conservation areas* address the components of shade and groundwater influence, both of which are important factors of water temperature. Stable streambanks and intact riparian areas, which include part of the floodplain, typically support adequate vegetation to maintain thermal cover to streams during low flow periods.

> **PCE 2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structure.**

The analysis of *large woody debris*, such as current values and sources available for recruitment, directly addresses this PCE. Large woody debris increases channel complexity and creates pools and undercut banks. *Pool frequency and quality* would also directly address this PCE, showing the number of pools per mile as well as the amount of cover and temperature of water in the pools. *Average wetted width/maximum depth ratio in scour pools in a reach* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. *Large pools,* consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity (USFWS 1998b). An analysis of

*off-channel habitat* would describe side-channels and other off-channel areas. *Streambank condition* would analyze the stability of the banks, including such features as undercut banks. The analysis of both *riparian conservation areas* and *floodplain connectivity* would directly address this PCE. Floodplain and riparian functions include the maintenance of habitat and channel complexity, the recruitment of large woody debris and the connectivity to off-channel habitats or side channels (USFWS 1998b). Complex habitats provide refugia for bull trout and in turn, *refugia* analysis would assess complex stream channels. All of these habitat indicators consider the numerous characteristics of instream bull trout habitat and quantify critical components that are fundamental to creating and maintaining complex instream habitat over time.

**PCE 3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (6.3 millimeters) in diameter.**

This PCE is addressed directly by analysis of *sediment* in areas of spawning and incubation and considers directly the size class composition of instream sediments, particularly fine sediments ≤6.3 mm. This PCE is also addressed directly by analysis of *substrate embeddedness* in rearing areas, which is a function of sediment size class and bedload transport. Both of these indicators would assess substrate composition and stability in relation to the various life stages of bull trout as well as sediment transportation and deposition. *Large woody debris* and *pool frequency and quality* affect sediment transport and redistribution within a stream and would indirectly affect substrate composition and amounts.

**PCE 4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operates under a biological opinion that addresses *bull trout*, or a hydrograph that demonstrates the ability to support *bull trout* populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.**

This PCE is addressed by analysis of *change in peak/base flows*, which considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Considering *increase in drainage network* and *disturbance history* provides further information. Roads and vegetation management both have effects strongly linked to a stream's hydrograph. *Disturbance regime* ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to pre-disturbance conditions.

**PCE 5. Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.**

This PCE is addressed by analysis of *floodplain connectivity* and *riparian conservation areas*. *Floodplain connectivity* considers hydrologic linkage of off-channel areas with the main channel and overbank flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table (USFWS 1998b). The analysis of *changes in peak/base flows* would address subsurface water connectivity.

*Increase in drainage network* would address potential changes to groundwater sources and subsurface water connectivity. *Chemical contamination/nutrients* would address concerns regarding groundwater water quality.

**PCE 6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.**

The biological indicator *life history diversity and isolation* addresses the function of migration and/or subsequent isolation with respect to the population. The biological indicator *persistence and genetic integrity* indirectly reflects the status of migratory corridors. Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including *temperature*, *chemical contamination/nutrients* and *physical barriers*. The analysis of these indicators would assess if barriers have been created due to impacts such as high temperatures, high concentrations of contaminants or physical barriers. Analysis of *change in peak/base flows* and *average wetted width/maximum depth ratio in scour pools in a reach* would assess whether changes in flow might create a seasonal barrier to migration. An analysis of *refugia,* which considers the habitat's ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout, would also be pertinent to this PCE.

**PCE 7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.**

An analysis of *floodplain connectivity* and *riparian conservation areas* would assess these contributions to the food base. Floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provides a forage base to bull trout (USFWS 1998a). This PCE is indirectly addressed through the biological indicator of *growth and survival* and *life history diversity and isolation*. Both of these indicators look at habitat quality and subpopulation condition, which provides information on food base. This PCE is a synthesis of the previous PCEs. It is addressed through the analysis of biological and habitat indicators in that, if a bull trout population either exists or could exist in a watershed, then there is an adequate forage base. A healthy habitat provides a forage base for the target species. Any potential impairment to the forage base has been addressed by way of summarizing the biological and habitat indicators.

**PCE 8. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.**

Flow conditions, such as perennial or ephemeral would be analyzed through *changes in peak/base flows*, and addressed in consideration of current base flows. Changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography would be considered. The level of contaminants is addressed directly by the analysis of *chemical contamination/nutrients* and *sediment*. Current listing under 303(d) status should be considered, as well as the causes for that listing. *Sediment* is considered a contaminant especially in spawning and rearing habitat and analysis would apply to this PCE.

## References Cited

U.S. Fish and Wildlife Service. 1998a. A framework in making endangered species act determinations of effects for individual or grouped action at the bull trout subpopulation watershed scale. Prepared by the U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 1998b. Bull trout interim conservation guidance. Prepared by the U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 2005. Endangered and threatened wildlife and plants; designation of critical habitat for bull trout; final rule. Federal Register 70(185): 56212-56311.

# Appendix 4. Bull Trout Matrix and Matrix to PCE Crosswalk

## Bull Trout Matrix of Diagnostics/Pathways and Indicators for the Petty Creek drainage.

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Subpopulation Characteristics | | | | |
| Subpopulation size | FAR | Subpopulation size is depressed relative to historic levels, but the subpopulation is not at alarmingly low numbers. | Maintain | Implementation of the proposed project is not expected to negatively affect the subpopulation size in Petty Creek because construction impacts will be temporary, best management practices (BMPs) will be employed, and instream work will be restricted to work windows determined through coordination with the USFWS. In addition, some indicators such as sediment and substrate imbeddedness will likely be improved in the long term, which will likely help to maintain and potentially raise the subpopulation size. |
| Growth and survival | FAR | Population is depressed, but is not in a rapid state of decline. | Maintain | With application of BMPs and adherence to construction windows, the proposed project will not measurably affect bull trout growth and survival, recruitment or the recovery rate of the Petty Creek subpopulation. |
| Life history diversity and isolation | FAR | Migratory fish enter Petty Creek from the Clark Fork River and some genetic exchange is possible with subpopulations in Fish Creek and Ninemile Creek. | Maintain | New stream crossing structures will improve fish passage, but this is not expected to affect bull trout life history diversity or bull trout subpopulation isolation because the new structures are not opening up previously inaccessible portions of Petty Creek or its tributaries, but rather improving passage to include all life stages of fish. |
| Persistence and genetic integrity | FAR | Clark Fork contributes a fair number of fluvial fish to Petty Creek, but populations within Clark Fork River are fragmented. Some genetic exchange is possible with subpopulations in Fish Creek and Ninemile Creek. Rainbow and brook trout present threats to genetic integrity. | Maintain | New stream crossing structures will improve fish passage, which could enhance connectivity between the Petty Creek bull trout subpopulation and subpopulations in Fish Creek and Ninemile Creek, as well as with other trout populations. However, because the new structures are not opening up previously inaccessible portions of Petty Creek or its tributaries, but rather improving passage to include all life stages of fish, it is not expected that the proposed project will change existing genetic exchange. |
| Water Quality | | | | |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Temperature | FAR | Actual stream temperatures were not available. This indicator was based on 5 to 25 percent of the stream not having tree cover. | Maintain | Loss of minor amounts of vegetation including shrubs and grasses in disturbed areas will not measurably affect water temperatures in Petty Creek. Additionally, the establishment of vegetation along the creek in select areas where vegetation is currently lacking and revegetation of disturbed areas will help offset temperature changes and may improve the water temperatures in the long term. |
| Sediment | FUR | This indicator was evaluated based on road density, presence of mining sites, and number of culverts in the watershed. This watershed has greater than 2.7 kilometers / 2.6 square kilometers (1.7 miles/square mile) road density; greater than 30 percent of stream length with roads within 90 meters (300 feet), and extensive grazing. | Degrade in short term<br><br>Maintain/improve in long term | The proposed project would contribute to the degradation of this indicator during construction due to expected increases in sedimentation to streams. Implementation of BMPs would reduce but not eliminate this risk.<br>A paved road surface with stormwater runoff directed to drainage ditches would maintain and likely improve this indicator in the long term. |
| Chemical contamination/nutrients | FUR/FAR | Lower Petty Creek functions at an unacceptable risk because there are one or more reaches with impaired water quality. Within upper Petty Creek this indicator is functioning appropriately and there are no systems on the state list of streams with impaired water quality. | Maintain | Due to the extent of construction activities planned it is likely that chemicals will enter Petty Creek, however, levels will be minimal with the implementation of BMPs and spill control plans. |
| Habitat Access | | | | |
| Physical barriers | FAR | This indicator was evaluated based on known barriers and culverts on fish bearing streams, however, the condition of all culverts is not known. Upper and lower Petty Creek have no known permanent barriers. Some culverts do not provide fish passage for all life stages of fish. | Maintain | Implementation of the proposed project will not create any permanent barriers to upstream and downstream fish passage. Temporary barriers to fish movement may be created during the establishment and removal of diversion channels. |
| Habitat Elements | | | | |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Substrate embeddedness | FUR | This indicator was evaluated the same as for sediment. | Degrade in short term<br><br>Maintain/improve in long term | Structure removal, fill removal and construction of a new structure and roadway over upper Petty Creek as well as work along Petty Creek and in Petty Creek's tributaries will likely result in delivery of sediment to the stream during construction. If excess amounts of sediment reach the channel, increased substrate embeddedness may occur. However, this will be reduced with BMPs and sediment control measures in place. Also, a paved road surface with stormwater runoff directed to drainage ditches would maintain and likely improve this indicator in the long term. |
| Large woody debris | FUR/FAR | This indicator was evaluated based on tree cover along stream banks, number of roads within 90 meters (300 feet) of the stream and number of crossings in the stream. Based on these criteria, lower Petty Creek is functioning at unacceptable risk (greater than 25 percent tree cover; greater than 30 percent of roads are within 300 feet of streams; greater than 2 crossings). Based on these criteria, upper Petty Creek is functioning at risk (less than 10 to 25 percent tree cover; 15 to 30 percent of roads are within 90 meters (300 feet) of streams; less than 2 crossings). | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is expected that very little forested riparian areas will be disturbed. Additionally, any disturbed areas will be revegetated, and some currently non-vegetated riprap areas will be planted with native saplings. Therefore, the project is expected to maintain the existing large woody debris element. |
| Pool frequency and quality | FA/FAR | Within lower Petty Creek, this indicator is functioning appropriately and within upper Petty Creek, it is functioning at risk. | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is not expected that habitat features contributing to the formation of pools (such as large woody debris) will be significantly impacted. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Large pools | FUR | This indicator was based on ratings for sediment, large woody debris, and stream bank condition. This system is functioning at unacceptable risk for the following reasons: large woody debris is functioning at risk or unacceptable risk; stream bank condition and sediment are functioning at unacceptable risk. | Maintain | Because the project is proposing to use the existing road alignment with only slight adjustments, it is not expected that forested riparian areas or vegetation will be significantly impacted. Streambank condition is expected to be maintained since the existing road is in close proximity to Petty Creek. Sediment will increase during construction, but this will be reduced with BMPs and sediment control measures in place. Also, a paved road surface with stormwater runoff directed to drainage ditches would likely reduce sediment in the long term. |
| Off-channel habitat | FUR/FAR | This indicator was based on the percentage of low-gradient streams in the watershed with roads within 300 feet of the stream. Therefore the lower and upper reaches Petty Creek are functioning at unacceptable risk and at risk, respectively. | Maintain/Improve | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator. With slight road realignments away from the creek and providing vegetation where vegetation is currently lacking, it is expected there will be a minor improvement in this indicator. |
| Refugia | FUR | There is no habitat refugia within the subpopulation boundary. | Maintain | Implementation of the proposed project will not affect bull trout refugia. |
| Channel Condition and Dynamics | | | | |
| Wetted width/Maximum depth ratio | FUR/FAR | This indicator was evaluated the same as for sediment unless certain conditions were met. | Maintain | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator. A paved road surface with stormwater runoff directed to drainage ditches would maintain and possibly improve this indicator in the long term. |
| Stream bank condition | FUR/FAR | This indicator was evaluated the same as for width/depth ratios. | Maintain | Because the road is already in close proximity to the stream, road improvements would likely maintain this indicator. Also, slight shifts in the alignment away from the creek and providing vegetation where vegetation is currently lacking may improve the indicator. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Floodplain connectivity | FUR/FAR | This indicator was evaluated the same as for width/depth ratios. However, the C type channel in upper Petty Creek would contribute to stream instability and downcutting, so this indicator is at risk. | Maintain | Because the road is already in close proximity to the stream, road improvements on the existing alignment would likely maintain this indicator. |
| Flow Hydrology | | | | |
| Change in peak/base flows | FUR/FAR | This indicator was based on road density in the watershed (described below) and amount of regeneration harvest less than 30 years old. Lower Petty Creek is functioning at unacceptable risk (road density is at unacceptable risk and regeneration harvest is present on greater than 25 percent of the watershed). Upper Petty Creek is at risk (road density is at risk and regeneration harvest covers 10 to 25 percent of the watershed). | Maintain | Implementation of the proposed project will not result in changes to peak/base flows. Regeneration harvest is not expected to change, and while the project will include road widening, no additional miles would be added to existing road densities. |
| Drainage network increase | FUR/FAR | Road densities were used to evaluate this indicator (see below). | Maintain | While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |
| Watershed Conditions | | | | |
| Road density and locations | FUR/FAR | Lower Petty Creek includes road densities greater than 2.7 kilometers/2.6 square kilometers (1.7 miles/square mile) and greater than 30 percent of the stream length in the watershed within 300 feet of the stream and is therefore at unacceptable risk. Upper Petty Creek includes road densities between 1.1 and 2.7 kilometers/2.6 square kilometers (0.7 and 1.7 miles/square mile) and between 15 and 30 percent of the stream length in the watershed within 90 meters (300 feet) of the stream and is therefore at risk. | Maintain | While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. Because the road is already in close proximity to the stream, road improvements on the existing alignment would likely maintain this indicator. |
| Disturbance history | FUR/FAR | This indicator is based on road density within sensitive landtypes and peak/base flow patterns. | Maintain | Implementation of the proposed project will not alter the existing disturbance history. While the project will include road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |

| Indicators | Baseline Condition [a] | Comments [a] | Effects of the Action | Comments |
|---|---|---|---|---|
| Riparian conservation area | FUR/FAR | This indicator is based on road density and location (described above) and tree cover on stream banks (see Temperature above). | Maintain | Implementation of the proposed project would likely maintain this indicator. Minor degradation may occur if forested riparian areas are lost, however, slight shifts in the alignment away from the creek and providing vegetation where vegetation is currently lacking may help improve the indicator. |
| Disturbance regime | FUR/FAR | This indicator is based on road density (described above) and amount of sensitive landtypes in the watershed. Based on these criteria, lower Petty Creek is functioning at unacceptable risk (greater than 30 percent of the watershed is composed of sensitive landtypes).<br>Upper Petty Creek is at risk (15 to 30 percent of the watershed is sensitive landtypes). | Maintain | It is not expected that implementation of the proposed project will alter the current disturbance regime in the project area. While the project will include some road widening, no additional miles would be added and implementation of the proposed project will not result in changes to road densities. |
| Species and Habitat | | | | |
| Integration of species and habitat condition | FUR | The subpopulation size is small, habitat is degraded and fragmented.<br>With no active restoration, habitat conditions will not improve within two generations (5 to 10 years). Some connectivity remains among subpopulations. | Maintain | Implementation of the proposed project would maintain this indicator. Degradation of habitat conditions may occur in the short term under sediment and substrate imbeddedness, but conditions may improve in the long term under off-channel habitat, sediment, and substrate imbeddedness. |

a. Analysis of baseline conditions is summarized from USDA Forest Service 2000, and from coordination with USFS, MTFWP, US Corps of Engineers, Environmental Protection Agency, and USFWS.

FA = indicators are functioning appropriately.

FAR = indicators are functioning at risk.

FUR = indicators are functioning at unacceptable risk.

**Primary constituent elements for bull trout critical habitat and associated habitat indicators.**

| PCE No. | Description of Primary Constituent Element | Associated Habitat Indicators |
|---|---|---|
| 1 | Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72ºF (0 to 22ºC), but are found more frequently in temperatures ranging from 36ºF to 59ºF (2ºC to 15ºC). These temperatures may vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local ground water influence. Stream reaches with temperatures that preclude any bull trout use are specifically excluded from designation. | Temperature; Refugia; Average wetted width/maximum depth ratio in scour pools in a reach; Streambank condition; Change in peak/base flows; Riparian conservation areas; Floodplain connectivity |
| 2 | Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures. | Large woody debris; Pool frequency and quality; Large pools; Off-channel habitat; Refugia; Average wetted width/maximum depth ratio in scour pools in a reach; Stream bank condition; Floodplain connectivity; Riparian conservation areas |
| 3 | Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (6.3 millimeters) in diameter. | Sediment; Substrate embeddedness; Large woody debris; Pool frequency and quality |
| 4 | A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operates under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation. | Change in peak/base flows; Increase in drainage network; Disturbance history; Disturbance regime |
| 5 | Springs, seeps, ground water sources, and subsurface water quality and quantity as a cold water source. | Floodplain connectivity; Change in peak/base flows; Increase in drainage network; Riparian conservation areas; Chemical contamination/nutrients |
| 6 | Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows. | Life history diversity and isolation; Persistence and genetic integrity; Temperature; Chemical contamination/nutrients; Physical barriers, Average wetted width/maximum depth ratio in scour pools in a reach; Change in peak/base flows; Refugia |
| 7 | An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | Growth and survival; Life history diversity and isolation; Riparian conservation areas; Floodplain connectivity (importance of aquatic habitat condition-indirectly covered by previous 6 PCEs) |
| 8 | Permanent water of sufficient quantity and quality such that normal reproduction, growth and survival are not inhibited. | Sediment; Chemical contamination/nutrients; Change in peak/base flows |

PCE = primary constituent element. Effect Determination for Bull Trout Critical Habitat

# Appendix 5. SHPO Concurrence Letter

# MONTANA HISTORICAL SOCIETY

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Friday, February 06, 2004

EDWIN WOOD
FED HIGHWAY ADMIN
WESTERN LANDS HIGHWAY DIV
610 EAST FIFTH ST
VANCOUVER WA 98661-3801

Dear Ted:

Thank you for requesting our comments on Petty Creek Road MT Forest Highway 71 (1).

We have no objection to the proposed finding of No Historic Properties Affected. In the absence of comment to the contrary from the Salish and Kootenai Tribes, we **concur** that 24MO0910 does not appear to be eligible. Should the tree be removed we would suggest that it be sectioned, or cored, in an effort to calculate the time it was cultural modified and that info added to an updated site in our state archaeological data base.

Thank you,

Stan

Stan Wilmoth, Ph.D.
State Archaeologist/Deputy, SHPO

File FED HIGHWAY ADMIN 2004


STATE HISTORIC PRESERVATION OFFICE ❖ 1410 8th Ave ❖ P.O. Box 201202 ❖ Helena, MT 59620-1202
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# Appendix 6. Road Sediment Assessment

# Road Sediment Assessment
# PETTY CREEK ROAD

*Prepared for:*

Western Federal Lands Highway Division
US Department of Transportation - Federal Highway Administration

610 East Fifth Street
Vancouver, Washington 98661

*Prepared by:*

PBSJ

1120 Cedar Street
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*October 23, 2009*

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## INTRODUCTION

This report presents the results of a road sediment assessment conducted on Petty Creek Road for Western Federal Lands Highway Division. The objective of this effort was to assess both the current and the predicted future sediment load from Petty Creek Road following paving.

## METHODS

This assessment was conducted on Petty Creek Road from the location where it crosses the Montana Rail Link tracks to approximately milepost 11 (no sediment delivery locations were observed past Bill's Creek). Two types of locations were evaluated: road segments are those locations where the road is in close proximity to the stream but does not cross it. Stream Crossings are those locations (bridges or culverts) where the road crosses a perennial stream. The assessment method utilized as adapted from the Washington Forest Practice Board Standard Methodology for Conducting Watershed Analysis. The steps in the method are as follows:

### Step 1: Measure Source Area

The source area for sediment load quantification encompasses all areas of road tread, ditches, cut slope, and fill slope from which water could flow to a stream. As an example in determining sediment load, suppose water flow over a road tread and cut slope is diverted by a drain-dip 100 feet from a stream crossing, and then passes into a heavily vegetated, flat area that precludes overland flow from reaching the stream. The area uphill of the drain-dip would not be counted into the sediment load to the stream, since the drain-dip serves to isolate it from the stream.

The length (longitudinally along the road) and width (across the road prism) of the tread, cut slope and fill slope are measured to derive the total areal extent (acres) of source area. If the cut and fill slopes vary significantly in width along a reach of road, the observer must estimate an average width of those features.

### Step 2: Apply Modifying Factors

Several modifying factors which are described below are applied to the measurement of actual eroding surface area. These are applied as average factors over each individual eroding area.

***Cover Factor***
The cover factor is the percent of non-erodible cover on each of three road features: tread, cut slope, and fill slope. Cover percent translates into the modifying factors shown in **Table 1** (Burroughs and King 1989).

**Table 1. Factor for Percent Cover Values**

| Cover Percent | Factor |
|---|---|
| >80% | 0.18 |
| 50% | 0.37 |
| 30% | 0.53 |
| 20% | 0.63 |
| 10% | 0.77 |
| 0% | 1.00 |

***Gravel Factor***
The gravel factor accounts for reduced erosion from roads that have gravel applications. With a gravel lift of 2 to 6 inches in depth, the factor is 0.50. With a gravel lift of greater than 6 inches, the factor is 0.20 (WFPB 1997).

***Traffic and Snow Factors***
The traffic multiplier accounts for the fact that roads receiving heavy truck traffic have higher erosion rates (Reid and Dunne 1984). This factor ranges from 1 to 50, as shown in **Table 2**. The value assigned depends on the use that the road experiences, with heavier traffic volume resulting in a greater multiplier.

The snow factor is the estimated percent of the year that the road feature being assessed is under snow and/or ice. The factor works counter to the traffic multiplier. It accounts for the fact that when a road is covered with snow or ice, the traffic is not dislodging soil particles.

**Table 2. Traffic Factors**

| Traffic Use/Road Category | *Annual Precipitation* | |
|---|---|---|
| | **<1200 mm** | **1200 mm-3000 mm** |
| Heavy Traffic--active mainline | 20 | 50 |
| Moderate Traffic--active secondary | 2 | 4 |
| Light Traffic--not active | 1 | 1 |

***Percent Delivery***
The determination of the percent of eroded fine sediment delivered to a stream is perhaps the most challenging part of this assessment methodology. This factor must take into account the observer's sense of sediment delivery over time and, without an accurate way to characterize historical or potential future sedimentation, it becomes a matter of professional judgment.

Another difficulty in establishing sediment delivery is the potential for "double mitigation". For example, the calculated amount of sediment generated at a given location would be overly reduced if the gravel factor was applied while the percent delivery was simultaneously reduced due to the lack of sediment generation. This would result in a double mitigation. The amount of fine sediment *generated* and the amount of fine sediment *delivered* are two different factors. To

avoid this pitfall, "delivery" is considered as the *potential* for sediment to be carried to a stream once it is eroded. If there is no sediment being eroded, the lack of erosion is accounted for with the modifying factors of cover, gravel, etc.

**Table 3** describes the general categories of sediment delivery to streams. These can be adjusted based on the experience and judgment of the observer.

**Table 3. Categories of Sediment Delivery to Streams**

| Percent Category | Description |
|---|---|
| 100% | Chronic direct delivery under most erosional scenarios. |
| 75% | Direct delivery evident but not chronic; effective buffer (provided by distance, gentle topography, or vegetation) during low intensity erosional events. |
| 50% | Direct sediment delivery, but minor amounts or older events. |
| 25% | Direct delivery unlikely except in moderate to major erosional events. |
| 5% | Effective buffer, but proximity of road to stream makes 5% necessary. |

**Step 3: Calculate Road Sediment Load**

To calculate the volume of sediment contribution from each road location, the following steps should be applied:

1. Assign a base (natural) erosion rate from roads in tons/acre/year. This can be derived from a combination of published values and professional knowledge of the soils in the watershed. Erosion rates from forest roads have been calculated for a number of regions of the country. For the Intermountain West, commonly used references are Megahan and Kidd (1972) and Burroughs and King (1989).
2. Calculate the area of erosion (length times width) for the tread, cut and fill slopes, and convert it to acres.
3. Apply each modifying factor: cover, gravel, traffic, snow (applied to traffic factor directly), and percent delivery.
4. Multiply all of these together to derive the sediment volume from each of these road features (road tread, cut slope and fill slope) individually.
5. Sum these three values for the total delivery for that location, which will yield a figure in tons of sediment per year.

Location totals thus derived can be summed for the entire watershed to arrive at a total fine sediment contribution from roads.

## ASSUMPTIONS AND POTENTIAL ERROR

The following assumptions have been utilized in the completion of this assessment:

1. The primary factor that will reduce sediment reduction is the paving of the road surface as part of the road improvement project.
2. Grade adjustments may also reduce stormwater flow into water bodies but until final design is complete, these cannot factor into a sediment assessment effort.
3. In some locations, the road is near the stream but the graded berm on the outside shoulder of the road was observed to be stable with mature vegetation growing on it. These locations were not tallied in the sediment loading spreadsheet.
4. The sediment loading at each road segment was "modeled" by reducing eroding surface area to just the shoulder and/or ditch on one side of the road. This was estimated to be six feet. It is assumed that the inslope shoulder will be adequately buffered by detention basins, native vegetation, or other mechanisms. It is assumed that the outslope shoulder will continue to be a sediment source. An example of the calculation is that if the total width of eroding road surface was 30 feet at a given location today, following paving, it was assumed to be six feet (just the shoulder). Through the model, this results in a reduction in road sediment. For permitting purposes, following design, this number can be easily refined.
5. There may be substantial error associated with determining drainage patterns on roads with flat grades, such as are present on Petty Creek Road. Oftentimes, subtle differences in grading may make major differences in sediment loading.
6. It is not known if dust control chemicals are utilized on this road or if they are, to what extent. If these chemicals are used, the impact on erosion and sedimentation is unknown and is not factored into this assessment.
7. There may be substantial error associated with the traffic factor. Published studies have indicated that heavy traffic on forest roads actively dislodges sediment particles, making them more easily erodible. In the methods used for this study, a multiplier of five was utilized. This is an estimate based on the fact that, while traffic is somewhat heavy on this road, it is limited to lighter vehicles. At the present time, log truck traffic is assumed to be limited due to reduced timber harvest activities. This multiplier is anticipated to be conservatively low. The Washington Forest Practices Board Manual for Watershed Analysis suggests a factor of 20 for mainline roads with heavy traffic.
8. Delivery ratios are challenging to assess and may be subject to substantial error. While sediment delivery may, in reality, be greater or less than that predicted in this study, the same ratios are used for both before and after the paving project and therefore, the percent of sediment load reduction should remain a valid prediction.
9. No fillslopes were counted in the sediment loading spreadsheet. The rationale was as follows: fillslopes are not to be paved and with such a flat road grade, the distinction between fill and natural ground are difficult to determine. In addition, most of the outslope areas are covered with eroded or side-casted fine sediment which should not be double counted as erosion (it was already counted as erosion from the tread).

10. Some gravel is present from past applications but it is very dispersed and ineffective in reducing erosion. Therefore, the cover and gravel factors were rarely utilized to reduce sediment loading calculated.

## RESULTS

Photos of each road segment and crossing are provided in **Appendix A**. The spreadsheets showing sediment loading calculations are provided in **Appendix B**. **Figure 1** is a map showing the location of each of these segments and crossings. The result of this assessment, using the stated assumptions, indicates that current sediment loading to the Petty Creek will be reduced from 433 tons per year to 27 tons per year.

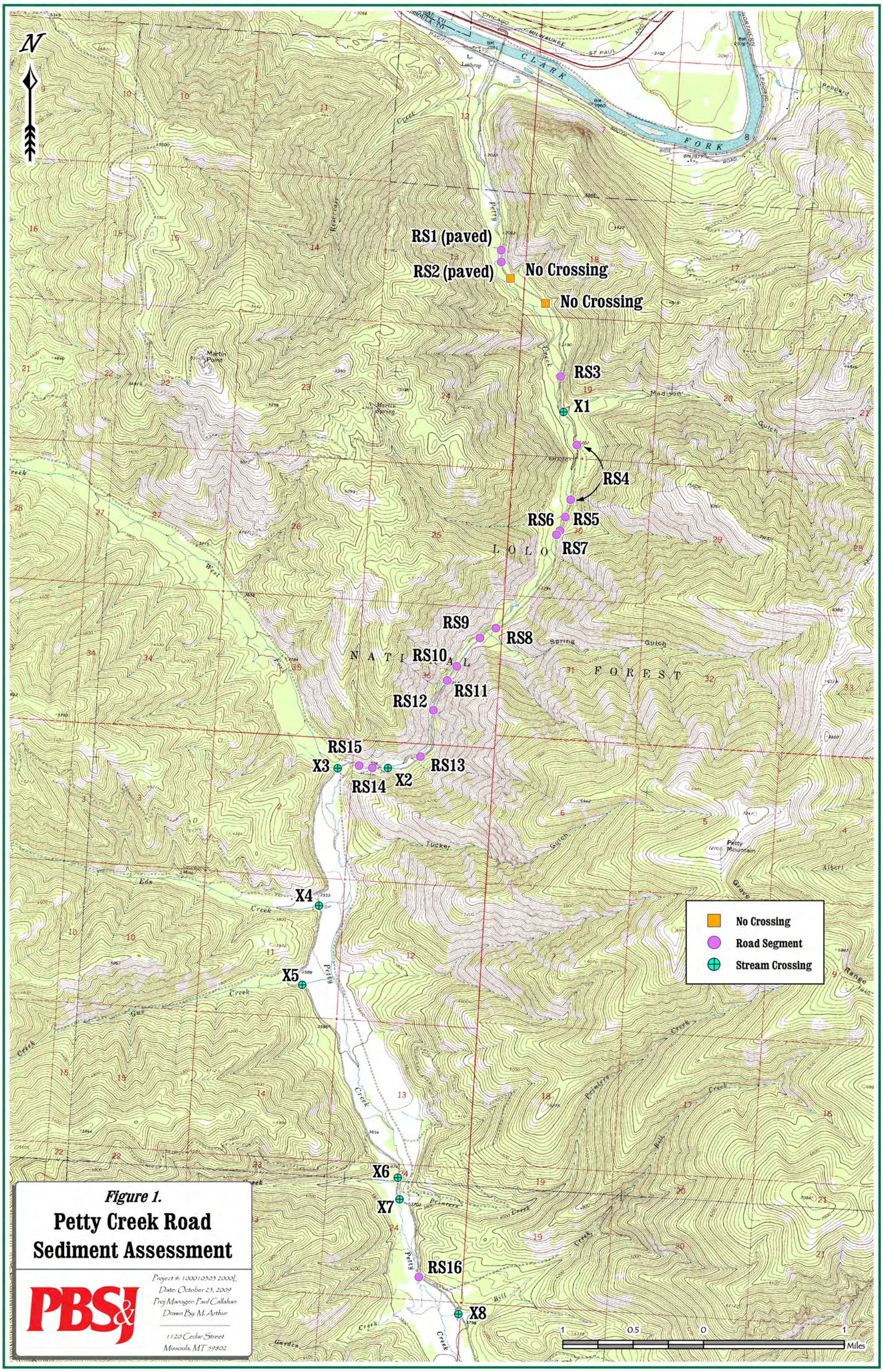


*Figure 1.*

**Petty Creek Road Sediment Assessment**

PBS&J

Project #: 100010303 2000L
Date: October 23, 2009
Proj Manager: Paul Callahan
Drawn By: M. Arthur

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## OBSERVATIONS

The following are general observations related to stormwater and sediment issues that may be factored into design of this project:

There are numerous locations along Petty Creek Road where, during the design of the road improvement, wetland detention basins (vegetated swales) could be constructed to manage both sediment movement from the ditch and stormwater flow from the road surface. This is highly recommended.

Petty Creek Road has a gentle grade through the study reach. In situations such as this, careful, site-specific design and construction monitoring can fine-tune stormwater and sediment management that will greatly reduce impacts.

## REFERENCES

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# APPENDIX A

## Petty Creek Road Segment and Crossing Photo Pages

**Photo 1**: Road Segment 1

**Photo 2**: Road Segment 2

**Photo 3**: Road Segment 3

**Photo 4**: Road Segment 4

**Photo 5**: Road Segment 5

**Photo 6**: Road Segment 6

**Photo 7**: Road Segment 7

**Photo 8**: Road Segment 8

**Photo 9**: Road Segment 9

**Photo 10**: Road Segment 10

**Photo 11**: Road Segment 11

**Photo 12**: Road Segment 12

**Photo 13**: Road Segment 13

**Photo 14**: Road Segment 14

**Photo 15**: Road Segment 15

**Photo 16**: Road Segment 16

**Photo 17**: Stream Crossing 1

**Photo 18**: Stream Crossing 2

**Photo 19**: Stream Crossing 3

**Photo 20**: Stream Crossing 4

**Photo 21**: Stream Crossing 5

**Photo 22**: Stream Crossing 6

**Photo 23**: Stream Crossing 7

**Photo 24**: Stream Crossing 8

# APPENDIX B

## Petty Creek Road Sediment Loading Calculations

## Petty Creek Road Sediment Assessment — CURRENT SEDIMENT LOADING — Data collected 10-17-09

| | TREAD | | | | | | | | | | | CUTSLOPE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location Number | Tread length (ft) | Tread Width (ft) | Acres of Tread | Base Erosion Rate (tons/ac/yr) | Gravel Factor | Traffic Factor | Percent Cover | Cover Factor | Percent Delivery | Delivery Factor | Tread Delivery (tons/yr) | Cutslope Length (ft) | Avg. Cutslope Width (ft) | Acres of Cutslope | Base Erosion Rate (tons/ac/yr) | Percent Cover | Cover Factor | Percent Delivery | Delivery Factor | Cutslope Delivery (tons/yr) | ***Location Total Sediment (tons/yr)*** |
| RS1 | 600 | 30 | 0.413223 | 30 | 1 | 5 | 0 | 1 | 70 | 0.7 | 43.4 | 300 | 12 | 0.0826446 | 30 | 90 | 0.21 | 70 | 0.7 | 0.4 | 43.8 |
| RS2 | 175 | 30 | 0.120523 | 30 | 1 | 5 | 0 | 1 | 80 | 0.8 | 14.5 | | | 0 | 30 | | 0.37 | | 0 | 0.0 | 14.5 |
| RS3 | 315 | 25 | 0.180785 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 27.1 | 100 | 15 | 0.0344353 | 30 | 90 | 0 | 10 | 0.1 | 0.0 | 27.1 |
| RS4 | 1800 | 20 | 0.826446 | 30 | 1 | 5 | 0 | 1 | 70 | 0.7 | 86.8 | | | 0 | 30 | | 0.27 | | 0 | 0.0 | 86.8 |
| RS5 | 1000 | 25 | 0.573921 | 30 | 1 | 5 | 0 | 1 | 25 | 0.25 | 21.5 | | | 0 | 30 | | 0 | | 0 | 0.0 | 21.5 |
| RS6 | 450 | 25 | 0.258264 | 30 | 1 | 5 | 0 | 1 | 25 | 0.25 | 9.7 | | | 0 | 30 | | 0 | | 0 | 0.0 | 9.7 |
| RS7 | 100 | 10 | 0.022957 | 30 | 1 | 5 | 40 | 0.45 | 50 | 0.5 | 0.8 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.8 |
| RS8 | 150 | 28 | 0.096419 | 30 | 1 | 5 | 0 | 1 | 90 | 0.9 | 13.0 | | | 0 | 30 | | 0 | | 0 | 0.0 | 13.0 |
| RS9 | 300 | 15 | 0.103306 | 30 | 1 | 5 | 20 | 0.63 | 80 | 0.8 | 7.8 | | | 0 | 30 | | 0.15 | | 0 | 0.0 | 7.8 |
| RS10 | 400 | 20 | 0.183655 | 30 | 1 | 5 | 10 | 0.77 | 70 | 0.7 | 14.8 | | | 0 | 30 | | 0.41 | | 0 | 0.0 | 14.8 |
| RS11 | 600 | 20 | 0.275482 | 30 | 1 | 5 | 0 | 1 | 20 | 0.2 | 8.3 | | | 0 | 30 | | 0.21 | | 0 | 0.0 | 8.3 |
| RS12 | 800 | 20 | 0.367309 | 30 | 1 | 5 | 0 | 1 | 80 | 0.8 | 44.1 | | | 0 | 30 | | 0 | | 0 | 0.0 | 44.1 |
| RS13 | 400 | 25 | 0.229568 | 30 | 1 | 5 | 0 | 1 | 80 | 0.8 | 27.5 | | | 0 | 30 | | 0 | | 0 | 0.0 | 27.5 |
| RS14 | 400 | 30 | 0.275482 | 30 | 1 | 5 | 0 | 1 | 30 | 0.3 | 12.4 | | | 0 | 30 | | 0 | | 0 | 0.0 | 12.4 |
| RS15 | 300 | 25 | 0.172176 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 25.8 | | | 0 | 30 | | 0 | | 0 | 0.0 | 25.8 |
| X3 | 50 | 25 | 0.028696 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 4.3 | | | 0 | 30 | | 0.15 | | 0 | 0.0 | 4.3 |
| X4 | 225 | 25 | 0.129132 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 19.4 | | | 0 | 30 | | 0 | | 0 | 0.0 | 19.4 |
| X5 | 150 | 20 | 0.068871 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 10.3 | | | 0 | 30 | | 0 | | 0 | 0.0 | 10.3 |
| X6 | 200 | 20 | 0.091827 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 13.8 | | | 0 | 30 | | 0.23 | | 0 | 0.0 | 13.8 |
| X7 | 75 | 25 | 0.043044 | 30 | 1 | 5 | 0 | 1 | 100 | 1 | 6.5 | | | 0 | 30 | | 0 | | 0 | 0.0 | 6.5 |
| X8 | 25 | 20 | 0.011478 | 30 | 1 | 5 | 0 | 1 | 50 | 0.5 | 0.9 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.9 |
| RS16 | 300 | 25 | 0.172176 | 30 | 1 | 5 | 0 | 1 | 75 | 0.75 | 19.4 | 200 | 15 | 0.0688705 | 30 | 80 | 0.37 | 75 | 0.75 | 0.6 | 19.9 |
| | | | | | | | | | | | | | | | | **TOTAL SEDIMENT LOAD (TONS PER YEAR)** | | | | | **432.9** |

| Petty Creek Road Sediment Assessment | | | | | PREDICTED POST-PROJECT SEDIMENT LOADING | | | | | | | | Data collected 10-17-09 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TREAD | | | | | | | | | | | CUTSLOPE | | | | | | | | | |
| Location Number | Tread length (ft) | Tread Width (ft) | Acres of Tread | Base Erosion Rate (tons/ac/yr) | Gravel Factor | Traffic Factor | Percent Cover | Cover Factor | Percent Delivery | Delivery Factor | Tread Delivery (tons/yr) | Cutslope Length (ft) | Avg. Cutslope Width (ft) | Acres of Cutslope | Base Erosion Rate (tons/ac/yr) | Percent Cover | Cover Factor | Percent Delivery | Delivery Factor | Cutslope Delivery (tons/yr) | ***Location Total Sediment (tons/yr)*** |
| RS1 | 600 | 6 | 0.082645 | 30 | 1 | 1 | 0 | 1 | 70 | 0.7 | 1.7 | 300 | 12 | 0.0826446 | 30 | 90 | 0.21 | 70 | 0.7 | 0.4 | 2.1 |
| RS2 | 175 | 6 | 0.024105 | 30 | 1 | 1 | 0 | 1 | 80 | 0.8 | 0.6 | | | 0 | 30 | | 0.37 | | 0 | 0.0 | 0.6 |
| RS3 | 315 | 6 | 0.043388 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 1.3 | 100 | 15 | 0.0344353 | 30 | 90 | 0 | 10 | 0.1 | 0.0 | 1.3 |
| RS4 | 1800 | 6 | 0.247934 | 30 | 1 | 1 | 0 | 1 | 70 | 0.7 | 5.2 | | | 0 | 30 | | 0.27 | | 0 | 0.0 | 5.2 |
| RS5 | 1000 | 6 | 0.137741 | 30 | 1 | 1 | 0 | 1 | 25 | 0.25 | 1.0 | | | 0 | 30 | | 0 | | 0 | 0.0 | 1.0 |
| RS6 | 450 | 6 | 0.061983 | 30 | 1 | 1 | 0 | 1 | 25 | 0.25 | 0.5 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.5 |
| RS7 | 100 | 6 | 0.013774 | 30 | 1 | 1 | 0 | 1 | 50 | 0.5 | 0.2 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.2 |
| RS8 | 150 | 6 | 0.020661 | 30 | 1 | 1 | 0 | 1 | 90 | 0.9 | 0.6 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.6 |
| RS9 | 300 | 6 | 0.041322 | 30 | 1 | 1 | 0 | 1 | 80 | 0.8 | 1.0 | | | 0 | 30 | | 0.15 | | 0 | 0.0 | 1.0 |
| RS10 | 400 | 6 | 0.055096 | 30 | 1 | 1 | 0 | 1 | 70 | 0.7 | 1.2 | | | 0 | 30 | | 0.41 | | 0 | 0.0 | 1.2 |
| RS11 | 600 | 6 | 0.082645 | 30 | 1 | 1 | 0 | 1 | 20 | 0.2 | 0.5 | | | 0 | 30 | | 0.21 | | 0 | 0.0 | 0.5 |
| RS12 | 800 | 6 | 0.110193 | 30 | 1 | 1 | 0 | 1 | 80 | 0.8 | 2.6 | | | 0 | 30 | | 0 | | 0 | 0.0 | 2.6 |
| RS13 | 400 | 6 | 0.055096 | 30 | 1 | 1 | 0 | 1 | 80 | 0.8 | 1.3 | | | 0 | 30 | | 0 | | 0 | 0.0 | 1.3 |
| RS14 | 400 | 6 | 0.055096 | 30 | 1 | 1 | 0 | 1 | 30 | 0.3 | 0.5 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.5 |
| RS15 | 300 | 6 | 0.041322 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 1.2 | | | 0 | 30 | | 0 | | 0 | 0.0 | 1.2 |
| X3 | 50 | 12 | 0.013774 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 0.4 | | | 0 | 30 | | 0.15 | | 0 | 0.0 | 0.4 |
| X4 | 225 | 12 | 0.061983 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 1.9 | | | 0 | 30 | | 0 | | 0 | 0.0 | 1.9 |
| X5 | 150 | 12 | 0.041322 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 1.2 | | | 0 | 30 | | 0 | | 0 | 0.0 | 1.2 |
| X6 | 200 | 12 | 0.055096 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 1.7 | | | 0 | 30 | | 0.23 | | 0 | 0.0 | 1.7 |
| X7 | 75 | 12 | 0.020661 | 30 | 1 | 1 | 0 | 1 | 100 | 1 | 0.6 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.6 |
| X8 | 25 | 12 | 0.006887 | 30 | 1 | 1 | 0 | 1 | 50 | 0.5 | 0.1 | | | 0 | 30 | | 0 | | 0 | 0.0 | 0.1 |
| RS16 | 300 | 6 | 0.041322 | 30 | 1 | 1 | 0 | 1 | 75 | 0.75 | 0.9 | 200 | 15 | 0.0688705 | 30 | 80 | 0.37 | 75 | 0.75 | 0.6 | 1.5 |
| | | | | | | | | | | | | | | | | **TOTAL SEDIMENT LOAD (TONS PER YEAR)** | | | | | **27.2** |

PBSJ