

**HYDRAULIC EXCAVATOR STUMP REMOVAL  
PRODUCTIVITY STUDY**

by

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## FOREWORD

This report is one of a series of internal reports distributed by Forest Protection Branch, B.C. Ministry of Forests, to record accomplishments and interim or provisional results for the information of staff, colleagues, and others.

In the Canada-British Columbia Forest Resources Development Agreement (FRDA) 1985 to 1990, over 100 pest control projects were directly funded by the province and administered by protection staff. To facilitate application of the results, and development of improved forest health management strategies, the contractors reports have been edited and distributed as internal reports. Accordingly, any opinions and recommendations expressed are those of the contractor, and not necessarily those of the ministry or the FRDA management committee.

For details or more information about the report or project, please contact forest health staff at Protection Branch or at the forest region offices.

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Acting Manager  
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The guidelines for internal reports outlined in the Protection Manual were adhered to as closely as possible. All manuscripts were altered to comply with a common format, but entire reports were not rewritten to conform to a standardized outline.

Most Executive Summaries were the work of Graham Hawkins of MoF Inventory Branch (formerly with Pacific Coast Forest Biology). All word processing was accomplished by Catriona Kaufman of Top Kat Services. Will Gordon of R. White Woods inc. prepared all maps and figures.

R. White, editor  
R. White Woods inc.

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## **1 INTRODUCTION**

A stump removal project was conducted by the Protection Branch of the MoF under the direction of Dr. J.A. Muir between December 9, 1985 and March 4, 1986. One of the main objectives of this study was to investigate the operational performance of a hydraulic excavator/bucket and thumb combination. This study was carried out with the guidance of the Silviculture and Engineering Branches of the MoF using funds provided by the Forest Resource Development Agreement pest control program. The ministry's disease prevention program includes the development of economically and silviculturally acceptable means for controlling root diseases.

## 2 MATERIAL AND METHODS

### 2.1 Scope and Development

The machine utilized was a Caterpillar 235, supplied by Chew Excavating Ltd. of Victoria, equipped with a standard bucket and thumb. The operators were experienced in the machine's operation and familiar with removing stumps.

The excavator worked on two different sites during the study period. Both areas were infected with *Phellinus weirii*. Site 1 was located approximately 40km north of Victoria, near Shawnigan Lake in the CDF biogeoclimatic zone. The area treated was approximately 12 hectares in size, and had been hand-felled and skidder-logged in 1984-85. Some large first growth stumps were present in certain sections of the area. Thirty-seven days of stump removal were carried out on Site 1.

The second site was located approximately 40km north of Duncan, also in the CDF biogeoclimatic subzone. The area treated was approximately four hectares in size, and had been logged by highlead cable in 1984-85. Seven days of stump removal were carried out on Site 2. A different operator was used on Site 2.

A productivity study was conducted to measure production rates of the excavator working under different site conditions. The data were analyzed, and cost rates were estimated. Due to insufficient data collected on Site 2, the analysis was done on Site 1 data only. This report presents the results of the analysis.

### 2.2 Time Study and Analysis Methods

The productivity data were collected using the detailed time study method. The time study data were broken down into elements as defined in Appendix A. Timing plots were established, and values for slash, slope and stump dimensions were recorded for each plot. Fifty-six plots were established on Site 1 and averaged 0.04ha in size. Detailed timing was confined to stump removal within the plots; when the machine was working outside of plots, only major work activities were timed. Each plot was classified into a difficulty rating of good, moderate and difficult, as determined by partial correlation regression analysis. Linear regression analysis was done to determine the relationship between productivity and number of stumps per hectare for different difficulty ratings.

### 2.3 Stump Removal Operations

The machine removed all visible stumps and piled them in windrows approximately five metres wide, and of various lengths depending on the ground layout. The work cycle consisted of positioning excavator; pulling stump out of ground; lifting and

windrowing of stump with a brief shake to remove soil; moving forward and clearing slash or preparing path if required; repositioning excavator and repeating cycle.

The method of operation varied depending on ground conditions. On relatively flat ground, the excavator pulled stumps from the front and each side of the machine and piled them to one side as it moved forward. After completing one row, the machine worked around to the other side of the windrow and continued the stump removal process. On steeper ground, the excavator worked upslope and piled accessible stumps to one side; when a row was finished, the excavator moved back to the starting point and began an adjacent row.

When significant slash was encountered, the operator spent additional time clearing slash to improve visibility and trafficability. On steeper ground, the operator expended more time preparing a path to work uphill.

The excavator pulled all stumps under 50cm in diameter in less than one minute. Larger stumps took longer to remove (less than five minutes). The excavator removed stumps up to 250cm in diameter. However, a few of the very large stumps were not removed when they were found to be sound.

Almost all stumps removed by the hydraulic excavator were complete with fine root structure down to six millimetres in diameter. Larger stumps often split into several pieces during the initial removal attempt. In these circumstances, the excavator picked up the pieces and threw them onto the windrow individually.

At the beginning of the operation the machine spent several hours pulling stumps and placing them upside down in the stump holes. This process, however, was discontinued since it was found to be slower than windrowing. The data were excluded from the productivity analysis.

### 3 RESULTS

Figure 1 (not included) shows the relationship between the predicted normal productivity of the excavator and the number of removed stumps per hectare for three site difficulty ratings. Normal productivity values ranged from 0.15 - 0.045 hectares/hour, depending on the difficulty rating and number of removed stumps per hectare. Figure 2 (not included) displays a summary of the statistical analysis. The adjusted R-square value of 81% affirms that the predictor model is significant for the site conditions studied. The mean machine utilization was calculated as 83%.

A cost analysis based on the above data and a \$116.50/hour all-found rental rate for a hydraulic excavator indicated that:

1. On good sites, the cost ranged from \$936 for 300 stumps per hectare to \$1 200 for 700 stumps per hectare. Average cost = \$2.10/stump, based on 500 stumps per hectare;
2. On moderate sites, costs ranged from \$1 300 for 300 stumps per hectare to \$1 898 for 700 stumps per hectare. Average cost = \$3.07/stump, based on 500 stumps per hectare;
3. On difficult sites, costs ranged from \$1 823 for 300 stumps per hectare to \$3 120 for 700 stumps per hectare. Average cost = \$4.53/stump, based on 500 stumps per hectare.

These values are based on scheduled operating time (i.e., normal operating time x machine utilization). The cost figures given are on-site costs, and do not include overhead or transport costs.

#### **4 RECOMMENDATIONS**

This study provided productivity values for a hydraulic excavator removing stumps under given sets of site conditions. Further studies should be extended in order to determine productivity values for excavators working under a wider range of site conditions. These studies would enable the confirmation or modification of the predictor model presented in this report.

In future studies, greater emphasis should be placed on the silvicultural effectiveness of the treatment rather than on the productivity and costs of the prime mover.

## **APPENDIX A    DEFINITIONS OF TIME STUDY TERMS**

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**Work cycle elements** - work functions regularly occurring during a work cycle.

**NORMAL TIME** - that part of the scheduled operating time when the machine is performing the function for which it is scheduled.

**Productive delays** - work elements required for the activity being studied, but which do not occur regularly.

**MECHANICAL DELAY TIME** - that part of the scheduled operating time during which work ceases due to repair or service.

**Mechanical repairs** - the first 30 minutes of repair time (pro-rated for eight hours of scheduled operating time), including waiting for parts.

**Refuelling and in-shift servicing** - service required for the continuation of a specific shift which cannot be performed out of shift.

**NON-MECHANICAL DELAY TIME** - that part of the scheduled operating time during which a machine is not doing productive work for reasons other than repair or service.

**Instruction and planning** - the time during which an operator receives instructions or plans his activities.

**Personal** - the time the operator attends to personal needs.

**Coffee breaks** - pro-rated to a maximum of 30 minutes per eight hours of scheduled operating time (e.g., stuck)

**SCHEDULED OPERATING TIME** - that part of the total time during which a machine is performing the function for which it was scheduled (**Normal Time + Mechanical Delay Time + Non-mechanical Delay Time**).

**EXCLUDED NON-OPERATING TIME** - that part of the total time during which no production of the primary phase being evaluated is scheduled for the machine.

**Lost time** - specified excluded time, such as extended coffee breaks, injuries, unnecessary in-shift servicing, etc.

**Repair time excluded** - that portion of the maintenance and repairs in excess of the allowable 30 minutes per eight hours of scheduled operating time.

**Out of shift moving** - that part of the non-operating time during which a machine is moving or being transported.

**Out of phase working** - that part of the non-operating time during which a machine is used for work allowed in other phases (e.g., road building).

**LUNCH** - self-explanatory.

**TOTAL ON-SITE RECORDED TIME** - total of recorded time elements.

**AREA TREATED** - the area treated during a given time period.

**MACHINE AVAILABILITY** - the percentage of the scheduled operating time during which the machine is mechanically fit and is capable of doing productive work.

$$M.A. = \frac{\text{Scheduled Operating Time} - \text{Mechanical Delay Time}}{\text{Scheduled Operating Time}} \times 100$$

**MACHINE UTILIZATION** - the percentage of the scheduled operating time that the machine is performing productive work.

$$M.U. = \frac{\text{Normal Time}}{\text{Scheduled Operating Time}} \times 100$$

**PRODUCTIVITY** - the area treated per unit of scheduled operating time.

$$\text{Productivity} = \frac{\text{Area Treated}}{\text{Scheduled Operating Time}}$$

$$\text{Normal Productivity} = \frac{\text{Area Treated}}{\text{Normal Time}} = \frac{\text{Productivity}}{\text{Machine Utilization}}$$

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

\* Adapted from: Canadian Pulp and Paper Association, Woodlands Section.  
Index No. 2428(BI).

## APPENDIX B    PARTIAL CORRELATION REGRESSION ANALYSIS AND SITE CLASS DIFFICULTY RATING

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An SAS analysis was carried out to evaluate each combination of a dependent variable (productivity) with the independent variables (site parameters). The results are printed beginning with the model containing the fewest independent variables and producing the smallest  $R^2$  value. Results for other models with the same number of variables are then printed in order of increasing  $R^2$  value, and so on for models with larger numbers of variables. For each model considered, the procedure prints out the number of independent variables used in each model; R-Square, the square of the multiple correlation coefficient; the adjusted R-Square; Mallows'  $C(P)$ , a measure of total squared error; and the names of the independent variables included in the model.

From the printout, the four variable model containing SLASH, SCPLUS (stump class greater than 50cm diameter), SPH and SLOPE variables was selected. This model was the most significant for four variables, as determined by the R-Square and  $C(P)$  values.

A site class difficulty rating table comprised of the variables slash, slope and stump class greater than 50cm diameter was then prepared. All plots were designated by a difficulty rating. The productivity and stumps per hectare values for each plot were run through a linear regression analysis. A graph showing the relationship between the predicted normal productivity of the hydraulic excavator and the removed stumps per hectare for the three site difficulty ratings was produced.

**PARTIAL CORRELATION ANALYSIS OF ALTERNATIVE REGRESSIONS**  
**n = 56**

| Number in Model | R-Square | Adjusted R-Square | C(P)   | Variables in Model              |
|-----------------|----------|-------------------|--------|---------------------------------|
| 1               | 0.004    | -.014             | 61.560 | SC25                            |
| 1               | 0.005    | -.014             | 61.536 | SC50                            |
| 1               | 0.012    | -.006             | 60.710 | Terrain                         |
| 1               | 0.014    | -.004             | 60.441 | Vet                             |
| 1               | 0.035    | 0.017             | 58.118 | Stumps                          |
| 1               | 0.038    | 0.020             | 57.754 | SPH                             |
| 1               | 0.069    | 0.052             | 54.164 | Slope                           |
| 1               | 0.110    | 0.094             | 49.515 | SCPLUS                          |
| 1               | 0.286    | 0.273             | 29.462 | Slash                           |
| 2               | 0.185    | 0.154             | 43.008 | SCPLUS SPH                      |
| 2               | 0.186    | 0.155             | 42.848 | SCPLUS Slope                    |
| 2               | 0.286    | 0.259             | 31.453 | Slash SC50                      |
| 2               | 0.286    | 0.260             | 31.386 | Slash Terrain                   |
| 2               | 0.287    | 0.260             | 31.290 | Slash SC25                      |
| 2               | 0.288    | 0.261             | 31.204 | Slash Vet                       |
| 2               | 0.299    | 0.272             | 29.981 | Slash Stump                     |
| 2               | 0.328    | 0.302             | 26.664 | Slash Slope                     |
| 2               | 0.332    | 0.307             | 26.207 | Slash SPH                       |
| 2               | 0.416    | 0.394             | 16.583 | Slash SCPLUS                    |
| 3               | 0.352    | 0.315             | 25.867 | Slash SPH SC25                  |
| 3               | 0.359    | 0.322             | 25.106 | Slash SPH Stumps                |
| 3               | 0.368    | 0.332             | 24.042 | Slash SPH Slope                 |
| 3               | 0.416    | 0.383             | 18.582 | Slash SCPLUS SC50               |
| 3               | 0.417    | 0.384             | 18.453 | Slash SCPLUS Terrain            |
| 3               | 0.418    | 0.385             | 18.363 | Slash SCPLUS Vet                |
| 3               | 0.426    | 0.393             | 17.413 | Slash SCPLUS Stumps             |
| 3               | 0.449    | 0.417             | 14.888 | Slash SCPLUS SC25               |
| 3               | 0.463    | 0.432             | 13.240 | Slash SCPLUS Slope              |
| 3               | 0.507    | 0.479             | 8.221  | Slash SCPLUS SPH                |
| 4               | 0.464    | 0.422             | 15.147 | Slash SCPLUS Slope SC50         |
| 4               | 0.468    | 0.427             | 14.637 | Slash SCPLUS Slope Stumps       |
| 4               | 0.474    | 0.432             | 14.040 | Slash SCPLUS Slope Terrain      |
| 4               | 0.488    | 0.448             | 12.423 | Slash SCPLUS Slope SC25         |
| 4               | 0.508    | 0.469             | 10.164 | Slash SCPLUS SPH SC25           |
| 4               | 0.509    | 0.471             | 9.965  | Slash SCPLUS SPH Vet            |
| 4               | 0.509    | 0.471             | 9.964  | Slash SCPLUS SPH Terrain        |
| 4               | 0.526    | 0.489             | 8.027  | Slash SCPLUS SPH SC50           |
| 4               | 0.536    | 0.500             | 6.900  | Slash SCPLUS SPH Stumps         |
| 4               | 0.546    | 0.511             | 5.741  | Slash SCPLUS SPH Slope          |
| 5               | 0.533    | 0.486             | 9.253  | Slash SCPLUS SPH SC50 Vet       |
| 5               | 0.538    | 0.491             | 8.746  | Slash SCPLUS SPH Stumps Vet     |
| 5               | 0.540    | 0.494             | 8.425  | Slash SCPLUS SPH Stumps SC25    |
| 5               | 0.543    | 0.497             | 8.144  | Slash SCPLUS SPH Stumps Terrain |
| 5               | 0.546    | 0.501             | 7.768  | Slash SCPLUS SPH Stumps SC50    |
| 5               | 0.546    | 0.501             | 7.739  | Slash SCPLUS SPH Slope Vet      |
| 5               | 0.548    | 0.503             | 7.551  | Slash SCPLUS SPH Slope SC25     |
| 5               | 0.558    | 0.513             | 6.400  | Slash SCPLUS SPH Slope SC50     |

**SITE CLASS DIFFICULTY RATING\***

|                                                                       |                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Good</b>                                                           | <ol style="list-style-type: none"> <li>1. Light Slash</li> <li>2. Slope less than 20%</li> <li>3. Less than 20% of stumps greater than 50cm in diameter</li> </ol>                                                                             |
| <b>Moderate</b>                                                       | <ol style="list-style-type: none"> <li>1. Medium Slash</li> <li>2. Slope less than 20%</li> <li>3. Less than 35% of stumps greater than 50cm in diameter</li> </ol>                                                                            |
| <b>Difficult</b><br>(if any one<br>of these<br>conditions<br>present) | <ol style="list-style-type: none"> <li>1. Heavy slash</li> <li>2. Slope greater than 35%</li> <li>3. 35 - 50% of stumps greater than 50cm in diameter</li> <li>4. Significant boulders/exposed rock to adversely affect prime mover</li> </ol> |

**Note:** Pick Difficulty Class most similar to area of operation.

**Other Site Conditions**

|                      |                 |
|----------------------|-----------------|
| Terrain              | Even/Rolling    |
| Average Stump Height | 20 - 40cm       |
| Vegetation Class     | Light           |
| Humus Depth          | 0 - 5cm         |
| Moisture Class       | Moist - Wet     |
| Soil Type            | Sandy Clay Loam |

\* See Appendix C for definitions of site classification.

## **APPENDIX C    DEFINITIONS OF SITE CLASSIFICATION**

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### **Terrain Classification\***

#### Even Terrain

No elevation or depression along the most severe 75m radial arm from a plot centre is greater than three metres, and local relief has slopes not exceeding 10%.

#### Rolling Terrain

At least one elevation or depression along the most severe 75m radial arm from a plot centre is either:

- a)     more than three metres and has an incline of no more than an average 30%; or
- b)     no more than three metres with an average incline between 10 and 80%.

### **Slash\*\***

#### Light

- Covers less than one-third of surface
- Less than 30cm high
- Logs and windthrow not significant

#### Medium

- Covers up to two-thirds of surface
- Over 30cm high
- Logs and windthrow will impede machine

#### Heavy

- Covers more than two-thirds of surface
- Over 30cm high
- Logs and windthrow are major obstacles

\* From Appendix 6-12 of the MoF Cruising Manual.

\*\* From MoF Silviculture Branch.

# APPENDIX D DATA SUMMARY

| Block No. | Ka     | Stump Diameter Class |          |        |      | Ave. Stump Ht. (cm) | Number of Stumps | SPH | Ave. Slope (%) | Slash Terrain Class |       | Stump Class | Vegetation Class | Stumps (cm) | Moisture Class | Difficulty Class | Productivity (kg/hr) |
|-----------|--------|----------------------|----------|--------|------|---------------------|------------------|-----|----------------|---------------------|-------|-------------|------------------|-------------|----------------|------------------|----------------------|
|           |        | 0-25 cm              | 25-50 cm | 50+ cm | Vets |                     |                  |     |                | Class               | Class |             |                  |             |                |                  |                      |
| 1         | 0.04   | 8                    | 14       | 03     | 0    | 31                  | 25               | 625 | 5              | 1                   | 1     | 3           | 1                | 2           | 2              | 1                | 0.102                |
| 2         | 0.04   | 16                   | 13       | 02     | 02   | 32                  | 33               | 825 | 23             | 1                   | 1     | 3           | 1                | 02          | 2              | 1                | 0.125                |
| 3         | 0.04   | 12                   | 12       | 03     | 00   | 41                  | 26               | 675 | 35             | 2                   | 2     | 3           | 1                | 03          | 2              | 2                | 0.077                |
| 4         | 0.04   | 06                   | 12       | 06     | 00   | 36                  | 24               | 600 | 25             | 1                   | 2     | 3           | 1                | 02          | 2              | 1                | 0.115                |
| 5         | 0.04   | 09                   | 15       | 05     | 01   | 36                  | 30               | 750 | 29             | 2                   | 1     | 3           | 1                | 04          | 2              | 2                | 0.067                |
| 6         | 0.04   | 10                   | 12       | 01     | 01   | 29                  | 24               | 600 | 23             | 1                   | 2     | 2           | 1                | 04          | 2              | 1                | 0.095                |
| 7         | 0.04   | 05                   | 22       | 03     | 00   | 28                  | 30               | 750 | 13             | 1                   | 1     | 3           | 1                | 02          | 2              | 1                | 0.126                |
| 8         | 0.04   | 04                   | 09       | 03     | 01   | 35                  | 17               | 425 | 30             | 1                   | 1     | 3           | 1                | 03          | 2              | 1                | 0.129                |
| 9         | 0.04   | 02                   | 06       | 03     | 04   | 43                  | 15               | 375 | 14             | 1                   | 1     | 3           | 1                | 05          | 2              | 1                | 0.150                |
| 10        | 0.625  | 21                   | 23       | 00     | 00   | 31                  | 44               | 704 | 05             | 1                   | 1     | 3           | 1                | 02          | 2              | 1                | 0.125                |
| 11        | 0.04   | 04                   | 07       | 00     | 00   | 30                  | 11               | 275 | 02             | 1                   | 1     | 1           | 3                | 1           | 03             | 2                | 0.166                |
| 12        | 0.523  | 01                   | 12       | 04     | 00   | 17                  | 325              | 13  | 21             | 1                   | 1     | 2           | 1                | 04          | 3              | 2                | 0.109                |
| 13        | 0.04   | 04                   | 05       | 09     | 00   | 18                  | 450              | 06  | 1              | 1                   | 2     | 1           | 1                | 04          | 2              | 2                | 0.059                |
| 14        | 0.03   | 09                   | 09       | 02     | 00   | 20                  | 667              | 14  | 1              | 1                   | 3     | 1           | 1                | 05          | 2              | 1                | 0.096                |
| 15        | 0.04   | 01                   | 07       | 02     | 01   | 11                  | 275              | 22  | 1              | 2                   | 2     | 2           | 1                | 04          | 2              | 1                | 0.143                |
| 16        | 0.04   | 04                   | 14       | 00     | 00   | 30                  | 18               | 450 | 33             | 2                   | 2     | 2           | 1                | 04          | 2              | 3                | 0.063                |
| 17        | 0.04   | 09                   | 14       | 00     | 00   | 23                  | 575              | 17  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 1                | 0.122                |
| 18        | 0.04   | 03                   | 18       | 04     | 02   | 27                  | 675              | 13  | 1              | 1                   | 3     | 1           | 1                | 03          | 2              | 3                | 0.056                |
| 19        | 0.04   | 07                   | 10       | 00     | 00   | 17                  | 425              | 28  | 1              | 1                   | 2     | 1           | 1                | 04          | 2              | 2                | 0.113                |
| 20        | 0.04   | 09                   | 11       | 00     | 00   | 30                  | 20               | 500 | 23             | 2                   | 1     | 3           | 1                | 04          | 2              | 2                | 0.103                |
| 21        | 0.04   | 07                   | 16       | 00     | 00   | 23                  | 23               | 575 | 27             | 2                   | 1     | 2           | 1                | 04          | 2              | 2                | 0.061                |
| 22        | 0.04   | 06                   | 16       | 00     | 00   | 28                  | 22               | 550 | 29             | 2                   | 1     | 2           | 1                | 04          | 2              | 2                | 0.069                |
| 23        | 0.04   | 12                   | 12       | 01     | 01   | 23                  | 26               | 650 | 15             | 2                   | 1     | 2           | 1                | 03          | 2              | 2                | 0.094                |
| 24        | 0.0659 | 02                   | 12       | 05     | 03   | 22                  | 22               | 334 | 03             | 2                   | 1     | 2           | 1                | 02          | 2              | 2                | 0.083                |
| 25        | 0.04   | 07                   | 03       | 04     | 02   | 38                  | 16               | 400 | 13             | 2                   | 1     | 2           | 1                | 03          | 2              | 3                | 0.069                |
| 26        | 0.04   | 01                   | 13       | 01     | 01   | 16                  | 400              | 13  | 2              | 1                   | 2     | 1           | 1                | 04          | 2              | 2                | 0.100                |
| 27        | 0.04   | 10                   | 11       | 01     | 00   | 22                  | 550              | 10  | 1              | 1                   | 2     | 1           | 1                | 02          | 2              | 1                | 0.119                |
| 27        | 0.04   | 10                   | 11       | 01     | 00   | 22                  | 550              | 10  | 1              | 1                   | 2     | 1           | 1                | 02          | 2              | 1                | 0.119                |
| 28        | 0.0625 | 09                   | 26       | 00     | 00   | 35                  | 560              | 06  | 1              | 1                   | 3     | 1           | 1                | 03          | 2              | 1                | 0.160                |
| 29        | 0.04   | 04                   | 14       | 02     | 01   | 21                  | 525              | 18  | 2              | 1                   | 3     | 1           | 1                | 04          | 2              | 3                | 0.065                |
| 30        | 0.04   | 02                   | 16       | 03     | 01   | 22                  | 550              | 32  | 2              | 1                   | 3     | 1           | 1                | 02          | 2              | 3                | 0.049                |
| 31        | 0.04   | 03                   | 10       | 00     | 00   | 13                  | 325              | 15  | 3              | 1                   | 3     | 1           | 1                | 04          | 2              | 2                | 0.104                |
| 32        | 0.045  | 01                   | 19       | 01     | 01   | 12                  | 489              | 03  | 2              | 1                   | 3     | 1           | 1                | 03          | 2              | 1                | 0.161                |
| 33        | 0.04   | 00                   | 05       | 05     | 03   | 13                  | 325              | 23  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 3                | 0.086                |
| 34        | 0.04   | 12                   | 12       | 00     | 01   | 24                  | 600              | 13  | 2              | 1                   | 3     | 1           | 1                | 04          | 2              | 2                | 0.066                |
| 35        | 0.04   | 11                   | 12       | 00     | 01   | 24                  | 600              | 13  | 2              | 1                   | 3     | 1           | 1                | 04          | 2              | 2                | 0.091                |
| 36        | 0.04   | 07                   | 15       | 00     | 00   | 22                  | 550              | 13  | 1              | 1                   | 3     | 1           | 1                | 03          | 2              | 2                | 0.083                |
| 37        | 0.04   | 09                   | 16       | 02     | 00   | 27                  | 675              | 17  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 1                | 0.102                |
| 38        | 0.04   | 06                   | 13       | 01     | 00   | 20                  | 500              | 17  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 2                | 0.093                |
| 39        | 0.0635 | 00                   | 19       | 05     | 01   | 24                  | 378              | 01  | 2              | 1                   | 3     | 1           | 1                | 04          | 2              | 3                | 0.068                |
| 40        | 0.04   | 09                   | 11       | 02     | 04   | 26                  | 650              | 03  | 2              | 1                   | 3     | 2           | 1                | 03          | 2              | 2                | 0.082                |
| 41        | 0.04   | 05                   | 10       | 00     | 05   | 20                  | 500              | 02  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 1                | 0.156                |
| 42        | 0.04   | 06                   | 18       | 02     | 02   | 28                  | 700              | 02  | 2              | 1                   | 3     | 1           | 1                | 02          | 2              | 2                | 0.076                |
| 43        | 0.04   | 06                   | 21       | 00     | 01   | 28                  | 700              | 02  | 2              | 1                   | 3     | 1           | 1                | 02          | 2              | 2                | 0.086                |
| 44        | 0.04   | 00                   | 10       | 06     | 04   | 20                  | 500              | 11  | 2              | 2                   | 2     | 2           | 1                | 04          | 2              | 3                | 0.050                |
| 45        | 0.0565 | 01                   | 16       | 06     | 03   | 26                  | 460              | 03  | 2              | 1                   | 3     | 1           | 1                | 05          | 3              | 16               | 0.065                |
| 46        | 0.1011 | 04                   | 34       | 08     | 01   | 47                  | 465              | 20  | 2              | 2                   | 3     | 1           | 1                | 05          | 2              | 2                | 0.078                |
| 47        | 0.045  | 00                   | 08       | 04     | 02   | 14                  | 311              | 29  | 2              | 1                   | 3     | 1           | 1                | 04          | 2              | 3                | 0.077                |
| 48        | 0.0208 | 00                   | 07       | 01     | 00   | 08                  | 385              | 01  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 1                | 0.149                |
| 49        | 0.0753 | 04                   | 16       | 05     | 00   | 25                  | 332              | 22  | 1              | 1                   | 3     | 1           | 1                | 02          | 2              | 2                | 0.115                |
| 50        | 0.04   | 01                   | 10       | 05     | 01   | 17                  | 425              | 13  | 2              | 1                   | 3     | 1           | 1                | 02          | 2              | 3                | 0.063                |
| 51        | 0.0246 | 00                   | 12       | 00     | 00   | 12                  | 488              | 28  | 2              | 1                   | 3     | 1           | 1                | 03          | 2              | 2                | 0.103                |
| 52        | 0.0571 | 00                   | 12       | 05     | 0    | 17                  | 298              | 04  | 1              | 1                   | 3     | 1           | 1                | 01          | 2              | 1                | 0.136                |
| 53        | 0.04   | 00                   | 17       | 01     | 00   | 18                  | 450              | 12  | 2              | 2                   | 3     | 1           | 1                | 02          | 2              | 2                | 0.097                |
| 54        | 0.04   | 02                   | 21       | 01     | 01   | 25                  | 625              | 14  | 2              | 2                   | 3     | 1           | 1                | 03          | 2              | 2                | 0.090                |
| 55        | 0.04   | 00                   | 16       | 02     | 02   | 20                  | 500              | 08  | 2              | 1                   | 3     | 1           | 1                | 03          | 2              | 2                | 0.091                |
| 56        | 0.0384 | 01                   | 18       | 01     | 02   | 22                  | 573              | 20  | 2              | 1                   | 3     | 1           | 1                | 02          | 3              | 2                | 0.083                |