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Landslide Monitoring in S.F. Elk River, Humboldt County 2010 Report

Pursuant to Monitoring and Reporting Program (MRP) No. R1-2008-0092

Submitted: December 28, 2010

Prepared By:
Green Diamond Resource Company

1.0 INTRODUCTION

At the time of the development of the WWDR it was proposed that our landslide sampling would coincide with the acquisition of aerial photographs. GDRCo typically purchases aerial photographs every three years and it is still GDRCo's intent to coincide the landslide inventory with the acquisition of aerial photographs. However, our typical purchase of aerial photographs has been postponed due to the impact of the recent economic downturn on GDRCo and the company's decision to proceed with the acquisition of LiDAR. GDRCo intends to resume the acquisition of aerial photographs within the next two years and continue purchasing aerial photos at our regular interval. In the mean time GDRCo has reached an agreement with Humboldt Redwood Company to utilize aerial photographs covering the S.F. Elk property from 2007 which are at a scale of 1:12,000. This will shorten the current gap in our typical coverage of aerial photographs, which GDRCo has utilized for the current landslide inventory analysis.

2.0 SITE SELECTION

Green Diamond Resource Co landslide inventory encompasses our entire S.F. Elk ownership; it is not limited to any specific portion of this area. Therefore our review of the 2007 aerial photographs covered all of our S.F. Elk River ownership. For sampling, GDRCo is required to incorporate a random sampling of a minimum of twenty percent of the newly delineated landslides observed from the 2007 set of aerial photographs. However very few landslides were observed on the 2007 photo set, in fact only 5 slides were observed and two of those were traced back to the 1997 aerial photographs. Since there were so few landslides observed we elected to include each of the landslides observed in the 2007 aerial photographs in our field sampling.

3.0 DATA COLLECTION AND ANALYSIS ACTIVITIES

GDRCo has elected to include landslide data obtained from the AHCP Steep streamside Slope (SSS) Delineation Project. However, at this time we have not completed our SSS Delineation survey within the South Fork Elk River basin. When these data have been collected and analyzed, it shall be included in the WWDR year end report following completion of the SSS project. Those landslides observed during our review of the 2007 aerial photographs are shown on Figure 1.

As previously mentioned we observed 5 landslides from the 2007 photo set; two of which were traced back to the 1997 aerial photographs. Table 1 illustrates the number of landslides observed historically through aerial photographs within the S.F. Elk River portion of GDRCo's ownership.

Table 1. Number of landslides observed by photo year.

Photo Year	1954	1966	1974	1987	1997	2000	2007
Number of slides Observed	5	13	24	3	13*	2	3

Note: *Only 11 landslides were observed by PWA on the 1997 aerial photographs. We added 2 landslides which we observed on the 2007 aerial photographs that fist appear on the 1997 set making a total of 13 slides for that year.

Of the 5 landslides we surveyed in the field the two largest were the slides observed on the 1997 aerial photographs, which are located in the northeastern corner of our ownership. These were fairly thick (14 feet) landslides that occurred in somewhat dissected terrain that is overgrown with an advanced stand of second growth. Each slide contributed to a debris torrent that extends downstream some 1,800 feet to the South Fork of Elk River. Causal factors were difficult to determine as these slides failed at least 13 years ago. The larger landslide appears to have been triggered or at least influenced by cut and fill slopes associated with a historic skid trail crossing through the middle of the source area. No obvious causal factors were associated with the smaller of the two debris flows. The other three slides we observed were fairly small landslides, two of which did not deliver sediment to a watercourse.

Overall, there appears to be a downward trend in landslide occurrence observed on our ownership. It should be noted that this takes into account only landslides observed in aerial photographs. It is well known that landslides are commonly covered by overstory canopy and can not be seen in aerial photographs. None the less, there is a downward trend in observable landslides within the basin over the last 30 years with the exception of those observed on the 1997 aerial photographs. This may however be largely attributed to the heavy rain storm events that occurred the winter prior to the 1997 aerial photographs in this region. Intense storms during the 1996-1997 El Nino resulted in 21 inches of rain falling in December of 1996 (NOAA rainfall records for Eureka). As a result elevated landslide occurrence was observed throughout the region, which can be seen on the 1997 aerial photographs that cover the area.

As for the downward trend in landsliding, this is likely due to the changes in timber harvesting over this time period. Early logging in this area took place largely in the 1960's and 1970's at which time intense ground-based harvesting was the main practice. This involved clear cutting of the basin followed by broadcast burning. Also side-cast road construction was the common practice for road construction which alone lead to significant landsliding. Road building practices began to change on Green Diamond lands in the early 1980's which reduced and eventually eliminated side-cast road construction. Canopy retention areas such as Riparian Management Zones and Habitat Retention Areas were implemented in the early 1990's as part of GDRCo's Northern Spotted Owl Habitat Conservation Plan.

Harvesting itself has also changed significantly with the common practice of cable yarding on steeper slopes and ground-based shovel yarding which no longer requires the need for skid trails. Each of these factors resulted in reduced ground disturbance and has certainly played a key role in the reduction of landslide occurrence in the area.

Sediment delivery estimates

At present it is not feasible to estimate sediment delivery rates due to the few landslides observed in our review of the 2007 aerial photographs. It would not be prudent to derive delivery rates from five landslides. Historic landslide data obtained from Palco was collected by Pacific Watershed Associates. This data was obtained by review of historic aerial photographs. The estimates of sediment delivery obtained from that project are not comparable to our field derived sediment delivery estimates. Our sediment delivery estimates are derived from a much more meticulous review of landslides in the field (which is discussed in our S.F. Elk Landslide Monitoring S.O.P.). Once we are able to include the landslides observed from our SSS Delineation study we believe we will have enough landslide data to address sediment delivery rates in this basin.

4.0 PROBLEMS ENCOUNTERED AND RESOLUTION

As noted above we currently do not have enough landslide data to evaluate sediment delivery rates. Data from the SSS Delineation study should likely be available by the time of the next aerial photograph review. Once the SSS Delineation study for the S.F. Elk River basin is complete we will be prepared to more accurately characterize sediment delivery rates in this basin.

5.0 SUMMARY OF MONITORING ACTIVITIES

Our landslide monitoring included a review of the 2007 aerial photographs obtained from the Humboldt Redwood Company. Compared with historical data there appears to be a downward trend in observable landslides within the GDRCo portion of the S.F. Elk River drainage. At present we are unable to address sediment delivery rates due to a lack of landslide data. We anticipate having ample landslide data by the time of our next landslide inventory due to the addition of landslide data from our SSS Delineation study which is currently underway.

6.0 SUMMARY OF TRAINING & CERTIFICATION

Our geologic technicians are continually collecting landslide data in the field. Training of new technicians includes several weeks of field work with the oversight of trained field technicians. During our field training individuals learn to identify landslide features such as ground cracks, scarps, back-tilted stumps, skewed trees,

hummocky topography, as well as develop cross sections of landslides. In 2010 we trained three new geologic technicians for the purpose of landslide delineation.

We have completed our work in accordance with generally accepted professional geology and forest geology practices for the nature and conditions of the work done in the same, or in similar, localities at the time the work was performed. Should you have any questions about this work feel free to contact us at any time.

Respectfully submitted,
GREEN DIAMOND RESOURCE CO, GEOLOGY DIVISION

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FIGURES

1 Geologic Site Index Map

APPENDICES

A Shapefiles of landslides observed on 2007 aerial photographs
B Copies of field data sheets.

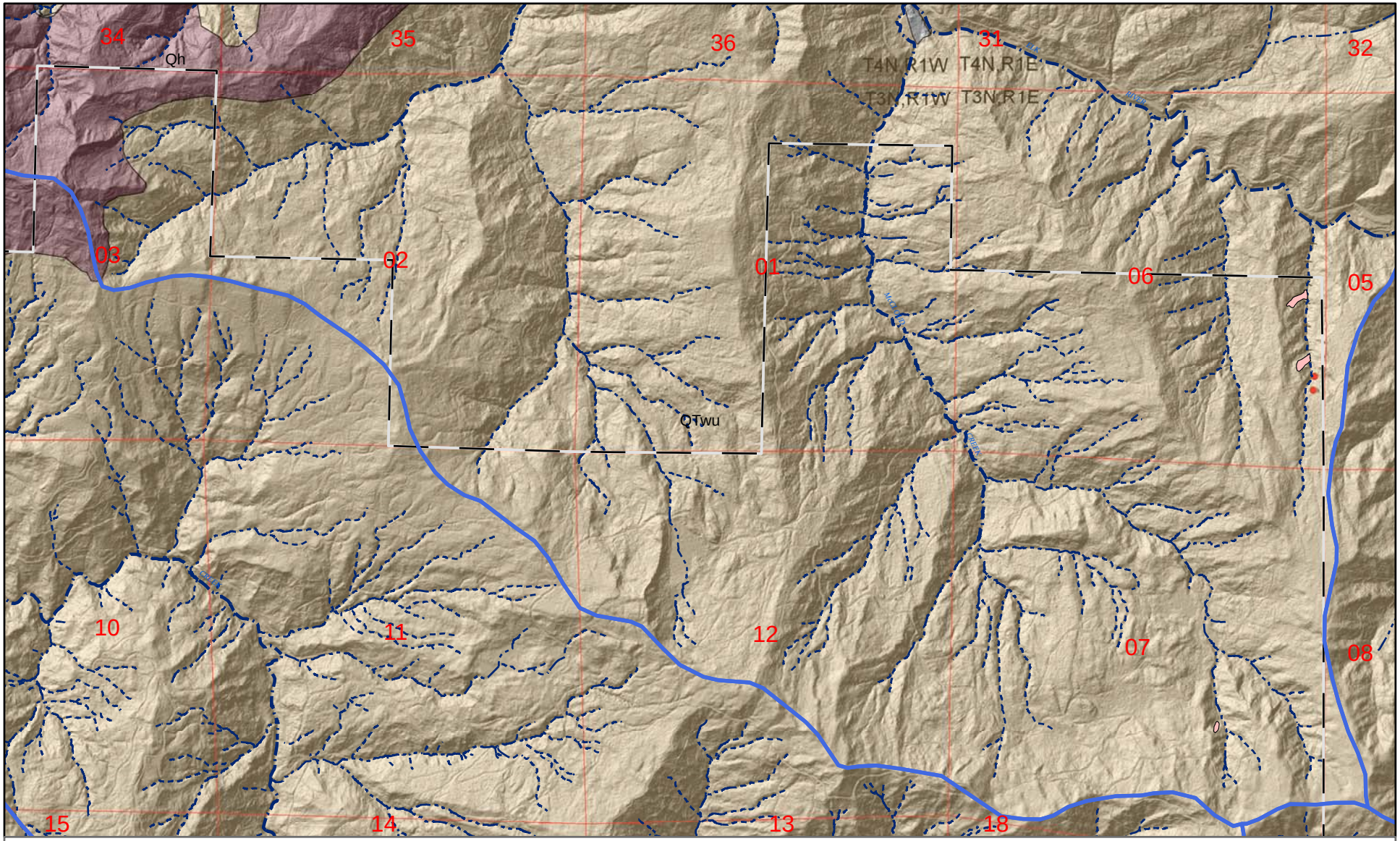

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FIGURE 1, GEOLOGIC SITE INDEX MAP
South Fork Elk River WWDR 2010 Landslide Report
MRP No R1-2008-092

1:24,000
1 inch = 2,000 feet
T3N R1W & T3N R1E

EXPLANATION

Earth Materials

Qh - Hooton Formation
QTwu - Wildcat Group undifferentiated

Watercourses

- Class I
- Class II (II-1, II-2)
- Class III (IIIA, IIIB)

Symbols

- Approximate Watershed boundary
- GDRCo Ownership
- Landslide
- Landslide too small to map