In the Nehalem River basin to the north of the project area, there is an extensive infestation of Japanese knotweed, a very aggressive invader of riparian habitats. A heavy knotweed infestation is not currently believed to have gained foothold in the watershed. But the Miami River valley is a prime vector corridor for the spread of knotweed into the interior of the watershed and critical habitat on ODF lands. Early control measures have a high potential for success if they are implemented prior to an intense infestation. As such, an opportunity exists to prevent the spread of knotweed into the Miami watershed.

4.4 Erosion Processes and Sediment Sources

In the Coast Range, important erosion processes commonly considered when regarding land uses and their potential effects on the environment include landslide erosion and fluvial erosion. In the project area, they are the primary inherent sediment-producing processes that occur naturally. Surface erosion is another process of concern. Generally, it is not considered to have been a dominant, inherent sediment-producing factor in western Oregon forests. However, with a loss of vegetation resulting from natural or human disturbances soils can become exposed, which increases their susceptibility to erosive forces. Evaluating the inherent potential or risk of erosion provides an understanding of the relative susceptibility of the project area to disturbance. An increase in the rate of erosion above the normal range of variation as a result of disturbance is considered to be accelerated erosion.

4.4.1 Hillslope Erosion.

Moderate to heavily dissected, steep mountain terrain typifies the majority (93%) of the project area. About 35 percent of its area is characterized as steep or very steep (slopes >60%), and about 39 percent moderately steep (slopes 30-60%). Only 27 percent of the area exhibits slope angles less than 30 percent. Table 16 portrays the estimated distribution of four select slope classes by ownership and subwatershed. The greatest proportion of steep and very steep slopes is in the Upper Miami subwatershed, followed by the Lower Miami subwatershed.

Table 1. Estimated Percent Area by Slope Class and Shallow Rapid Landslide Hazard Rating

			Percent of Subwatershed Area								
Pct Slope	Percent Total Area	Hazard Rating	Lower Miami			Upper Miami			Tillamook Bay		
			PI	PNI	State	PI	PNI	State	PI	PNI	State
<30	27	Low	13	7	6	1	1	9	1	47	16
30-59	37	Moderate	29	2	14	2	0	30	2	9	19
60-79	21	High	11	1	7	2	0	30	1	1	3
>79	14	V. High	5	0	4	2	0	23	<1	<1	<1

Key: PI = Private Industrial, PNI = Private Non Industrial

Steep slopes tend to exhibit the greatest potential for landslide occurrence, particularly with shallow-rapid types of failures that commonly occur throughout much of the Coast Range. Two general categories of landslide erosion that naturally occur in the project area include shallow rapidly moving landslides and deep-seated landslides. The potential for both is highly dependent upon slope angle, among a variety of other factors.

Geologic hazard maps typically categorize the steepest slopes as the most susceptible to landslide occurrence (Beaulieu and Hughes 1974 and ODF 2001). As slope gradient increases, driving forces increase and slope stability decreases. Various Coast Range studies indicate that the incidence of debris slides increases dramatically where slope angles are steep or very steep, particularly on concave slopes and when soils are saturated (Beaulieu and Hughes 1974, Burroughs et al. 1976, Harr and Yee 1975, Ketcheson 1978, Robison et. al. 1999, and others).

Using slope class as a first approximation of the relative hazard for shallow rapid landslides, it is estimated that roughly 36 percent of the project area is rated as exhibiting a high or very high hazard for shallow, rapidly moving landslides. Of the total area rated as a high or very high hazard, 74 percent is located on ODF land, 24 percent on private industrial lands, and 2 percent on private non industrial lands (Figure 13).

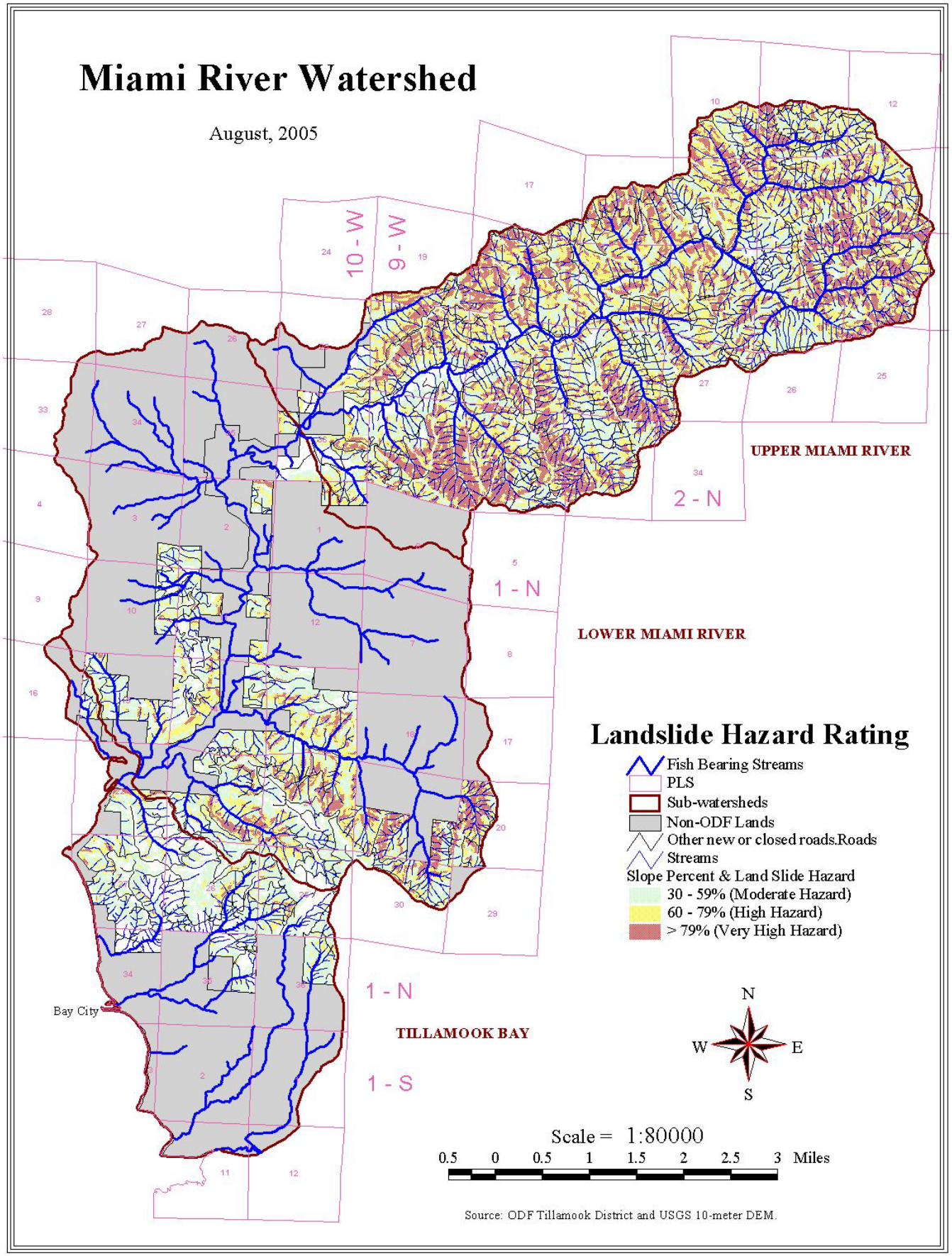

Figure 1. Map of shallow rapid landslide risk on ODF lands in the Miami River Watershed Project Area.

The natural occurrence of rapidly moving landslides in the Coast Range is predominantly associated with steep, confined drainage ways, or streams on steep slopes. Very steep slopes and channels prone to debris flows are landforms where future landslide occurrence can be expected over the long-term. These represent important sources and pathways for the potential transport and delivery of sediment, LWD, and coarse substrate to the stream and riparian network (OWEB 1999).

There are no known comprehensive landslide studies that are specific to the project area, and debris flow-prone channels have not been collectively mapped across ODF lands. An exercise using GIS was conducted in an attempt to predict which channels might be prone to shallow-rapid types of landslides. In Figure 14, the estimated distribution of channels potentially prone to debris flows is displayed. On the map, debris flow-prone channels are those stream segments estimated to have a gradient of at least 60 percent for the majority of their total length. This approach is an assessment of general terrain characteristics, namely stream channels and slope angle that is best suited for the landscape scale. Its intent is to display where the potential for shallow-rapid types of landslides is the greatest across the watershed. Its scale and resolution are not suited for predicting slide runout or site specific hazards.

Using data generated from the map, the majority (65%) of channels potentially prone to debris flows are in the Upper Miami subwatershed, 32 percent are within the Lower Miami subwatershed, and only 3 percent are in the Tillamook Bay frontal subwatershed. Debris flow-prone channels are located in every primary drainage in the upper Miami. About 75 percent of the channels identified as prone to debris flows are located on ODF lands. The majority of steep slopes and steep channels are on ODF land.

To evaluate the accuracy of Figure 14, the mapped distribution of debris flow-prone channels was compared to conditions observed in the field. Seventy-one different locations were sampled. Five sites (7% of samples) that were designated on the map did not exhibit features consistent with debris flow-prone channels. Two (3% of samples) sites that were *not* designated on the map, exhibited characteristics resembling debris flow-prone channels. Additionally, an aerial photo reconnaissance of ODF lands that was conducted revealed eighteen readily identifiable landslide features. Of these, twelve were observed in the field. All were debris slides that corresponded to a debris flow-prone feature on the map. These validations suggest that the automated (GIS) method that was used to predict debris flow-prone channels is reasonably accurate at the watershed scale, and the map is judged to be useful for planning purposes.

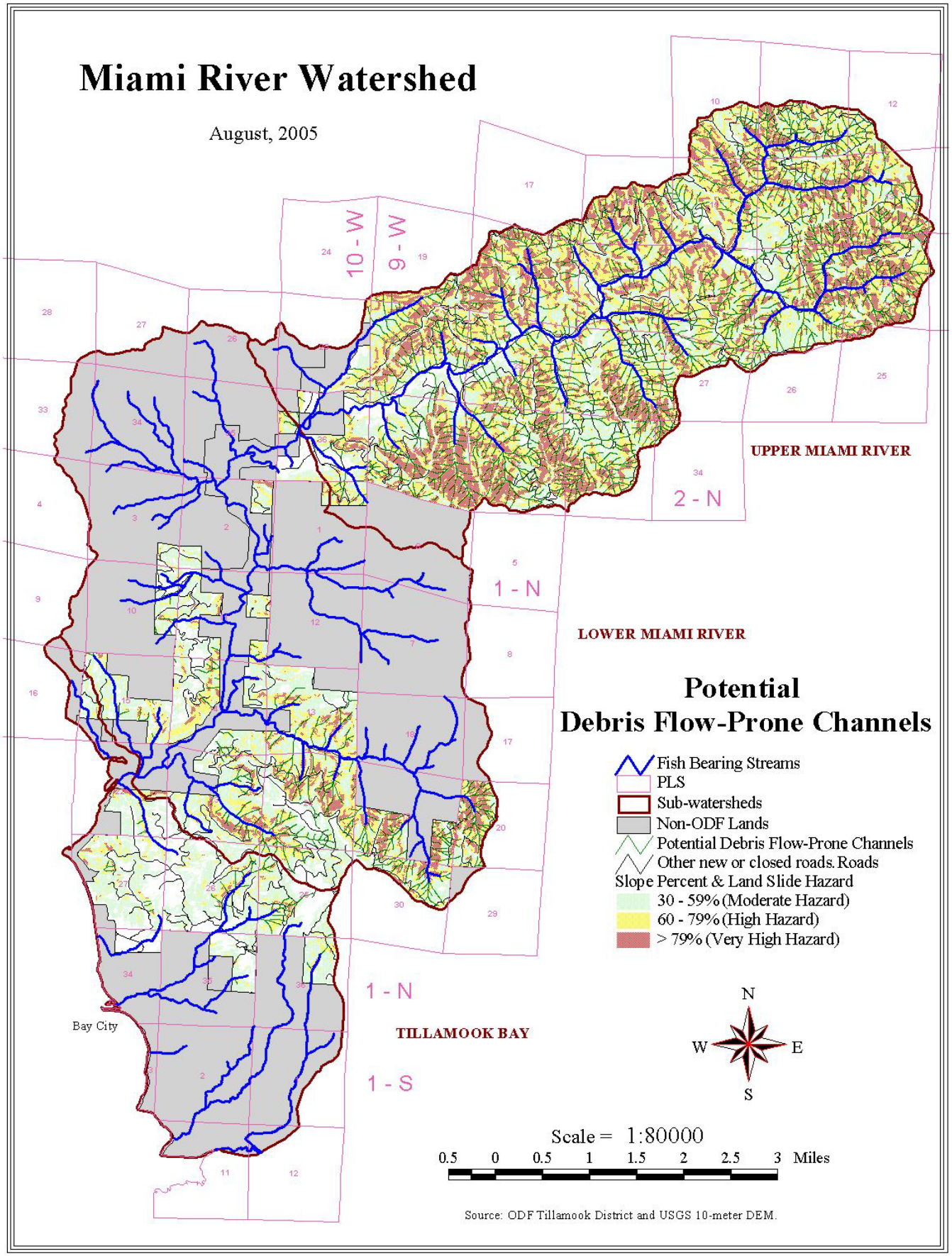

Figure 2. Potential debris flow-prone channels identified on ODF lands in the Miami River Watershed Project Area.

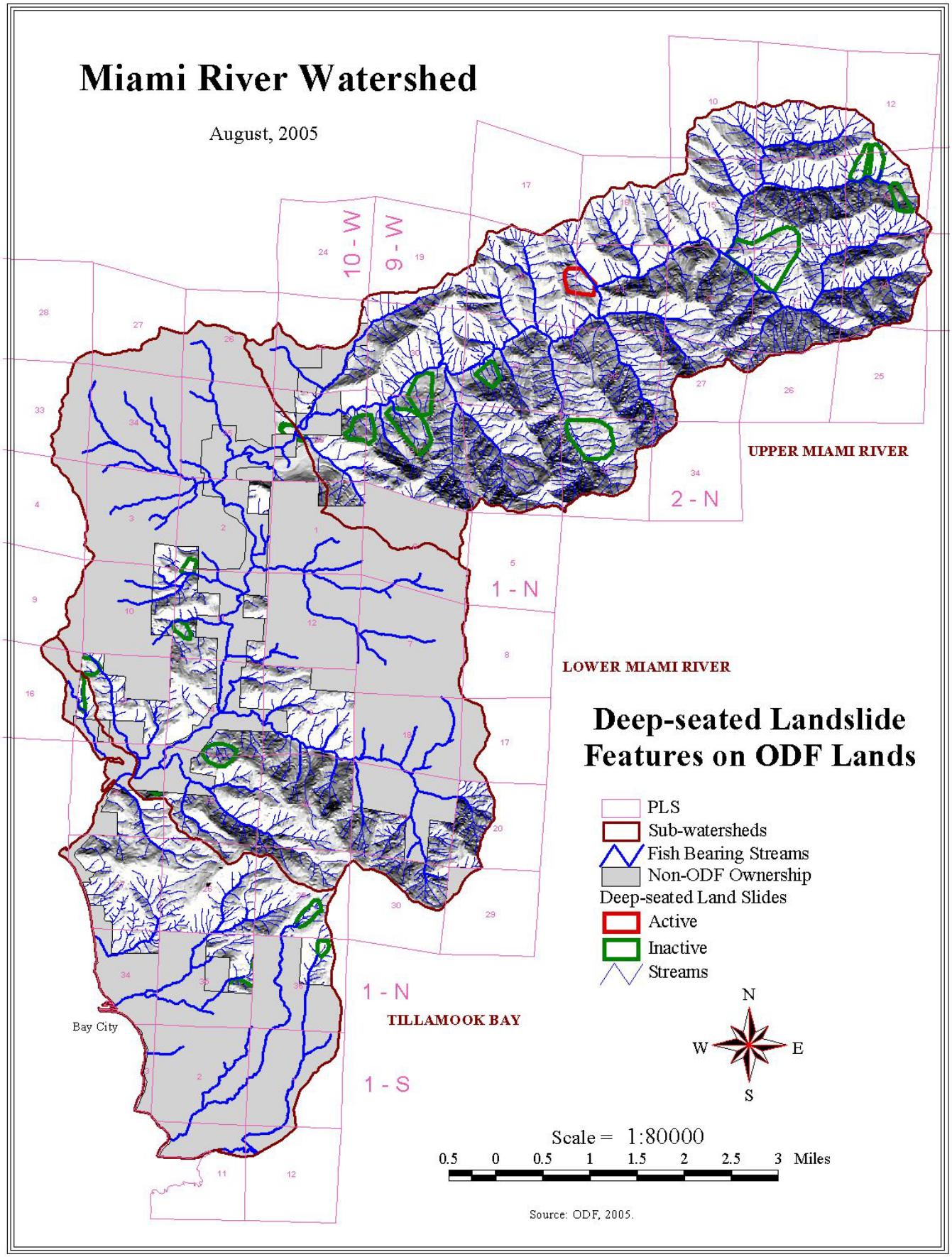

Figure 3. Active and inactive deep-seated landslides in the Miami River Watershed Project Area.

Other potentially unstable features mapped by ODF (2004a) in the project area include slow- imperceptibly-moving, deep-seated landslides. Eighteen features, or portions of features have been mapped on ODF lands (Figure 15). On geology maps of the region these and similar landforms are categorized as ancient landslide deposits, or earthflows (Walker and MacLeod 1991, Wells, et al., 1994). Ten of these features are located in the Upper Miami subwatershed, five in the Lower Miami, and three in the Tillamook Bay Streams subwatershed. Features such as these may be active or inactive. One of the eighteen mapped features is identified as being active. It is located in an unnamed drainage between Buehner and Carpenter Creeks in the Upper Miami subwatershed. The heads or crowns and the toes of earthflow features can be sites where unstable slope conditions are prevalent (Swanson and 1976).

4.4.2 Fluvial Erosion

Streambank erosion is another important sediment generating process in the project area. Oftentimes these processes are inextricably linked with landslide events triggered by intense precipitation and heavy runoff.

Accelerated bank erosion has been observed along a number of reaches that have been heavily modified by human disturbance. Stream surveys indicate that banks along significant portions of the lower and middle reaches of the Miami River show evidence of accelerated erosion (ODF 2004b, ODFW 1995). Other reaches were observed on Moss and Peterson Creeks. These are important sources of sediment directly linked to sensitive, low gradient channel types where critical fish habitat is located. With the exception of Moss Creek, all of the reaches are located on private non-industrial lands, primarily along the channel of the Miami River.

4.4.3 Road Related Erosion

There is an estimated 238 miles of road in the entire project area. The majority (42%) of road mileage in the project area is located on ODF land, 30 percent is on private industrial land, and 28 percent is on private non industrial land. Table 17 shows that the Lower Miami subwatershed contains the greatest amount (47%) of total road miles, followed by the Tillamook Bay (29%) and Upper Miami (24%) subwatersheds respectively. The majority of road miles in all three subwatersheds are located on ODF lands. Most of these have been in place since before the 1960’s (TBNEP 1996). About twenty-four miles of road on ODF lands are old unmanaged abandoned roads or decommissioned road segments.

The density of roads is greatest in the Tillamook Bay subwatershed where the majority of developed land is located and the dominant owner class is private non industrial. The density is the least in the Upper Miami, which is predominantly ODF land.

Table 2. Total Road Miles and Density by Owner Class and Subwatershed

Owner	PI		PNI		State		Total	
Subwatershed	miles	mi./sq. mi	miles	mi./sq. mi	miles	mi./sq. mi	miles	mi./sq. mi
Lower Miami	66	3.5	15	0.8	31	1.6	111	5.9
Upper Miami	4	0.2	2	0.1	51	3.0	58	3.3
Tillamook Bay	1	0.2	49	6.3	19	2.4	69	8.9
Total	71	1.6	66	1.5	101	2.3	238	5.4

Source: ODF 2004a

Although the majority (59%) of total road miles on ODF lands in the project area are located in the Upper Miami subwatershed, it contains the least miles of road of the three subwatersheds. Of the roads that are in the subwatershed, about 97 percent are on ODF land.

In the Lower Miami, most (59%) of the road miles in the subwatershed are on private industrial lands, and 28 percent are located on ODF lands. The majority (94%) of all miles on private industrial lands in the project area are in the Lower Miami. Roads that are located on, or that cross through non industrial lands amount to 14 percent of the miles in the Lower Miami, most are rural county roads that provide ingress and egress for rural residents.

In the Tillamook Bay subwatershed, 71 percent of the road miles are located on, or cross through private non industrial land. The majority of these are rural county and municipal roads in and around Bay City and Idaville, including Highway 101. Roads on ODF land account for 28 percent of the miles in the subwatershed, and roads on private industrial land account for the remaining 1 percent.

The majority (83%) of roads in the project area, and nearly all of the roads on ODF and private industrial lands, are comprised of gravel or dirt surfacing. Paved roads account for an estimated 17 percent of the total road miles. Most paved roads are located in the low lying developed and rural areas of the Tillamook Bay subwatershed, and are associated with Bay City, Idaville, or U.S. Highway 101. The primary paved road in the Miami watershed is the Miami-Foley Road.

For this study, road related erosion in the project area is assessed primarily for ODF lands, conditions on other ownerships is not addressed in detail. Comprehensive and specific information pertaining to road related erosion in the project area has been compiled for ODF land. Road conditions were surveyed in the project area by ODF staff in 2004 and 2005. The information and data that was collected during the survey is stored in the Road Inventory Management System (RIMS), a relatively new program that is being assembled in support of District programs and the FMP.

The inventory was conducted on nearly every road segment open for public travel on ODF land in the project area. An assortment of features and conditions on ODF lands, and their location were assessed as a part of the RIMS inventory. The data is intended to be used for two general purposes: 1) maintenance programming and planning and 2) determining road related effects on watershed resources (pers. comm. K. Mills 2005).

Approximately 77 miles (76%) of the road segments on ODF lands in the project area have been inventoried; about 24 miles were not surveyed because access was blocked,