HRS DOCUMENTATION RECORD--REVIEW COVER SHEET

Name of Site: Nelson Tunnel/Commodore Waste Rock
EPA ID No.: CON000802630

Contact Persons

Site Investigation: URS Operating Services For EPA (303) 296-3523
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Pathways, Components, or Threats Not Scored

Ground Water Migration Pathway

The Nelson Tunnel/Commodore Waste Rock (NT/CWR) site is remote and located in a sparsely populated valley; although there are several residences on East Willow Creek that may have ground water wells, these residences are separated from the NT/CWR site by Campbell Mountain. In addition, the City of Creede draws its potable water from wells outside the four mile radius. Based on lack of supporting data, the ground water pathway will not be scored as part of this Hazard Ranking System (HRS) package.

Soil Exposure Pathway

Several contaminants are present at elevated levels in surface soils associated with the NT/CWR site. However, it is extremely difficult to access the sources, and a paucity of nearby residents limit the impact of this pathway on the site score. Based on the lack of data and a limited number of targets, the soil exposure pathway will not be scored as part of this HRS package.

Air Migration Pathway

There are insufficient data to satisfy HRS requirements for establishing an observed release of contaminants to the air in the NT/CWR study area. Without an observed release, only the potential to release may be evaluated for this pathway, and because of the low population density, this minimally impacts the overall site score. As such, the air migration pathway will not be scored as part of this HRS package.

HRS DOCUMENTATION RECORD

Name of Site: Nelson Tunnel/Commodore Waste Rock

Date Prepared: March 2008

EPA Region: Region 8

Street Address of Site: National Forest Road 503.4, one mile north of Creede (Ref. 4)

City, County, State: Creede, Mineral County, Colorado, 81130 (Ref. 4)

General Location in the State: The Nelson Tunnel/Commodore Waste Rock site is located in the West Willow Creek Valley north of Creede, Colorado (Ref. 4). The site sources are identified as the Nelson Tunnel adit and the adjacent Commodore Waste Rock pile along West Willow Creek in Section 24, Township 42 N., Range 1 W. The latitude and longitude are calculated using the Commodore Tunnel adit found on the USGS map (Ref. 4).

Topographic Map: Creede, Colorado (Ref. 4)

Latitude: 37°52' 15" North Longitude: 106° 56' 24" West (Ref. 3)

Scores

Ground Water Pathway	0.00
Surface Water Pathway	96.06
Soil Exposure Pathway	0.00
Air Pathway	0.00
HRS SITE SCORE	48.03

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NS	NS
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	96.06	
2b.	Ground water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	96.06	9,227
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		9,227
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		48.03

NS = Not Scored

TABLE 4-1
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET
(continued)

Factor Categories and Factors	Maximum Value	Value Assigned
Drinking Water Threat		
Likelihood of Release:		
1. Observed Release	550	550
2. Potential to Release by Overland Flow:		
2a. Containment	10	NS
2b. Runoff	25	NS
2c. Distance to Surface Water	25	NS
2d. Potential to Release by Overland Flow (lines 2a[2b+2c])	500	NS
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	NS
3b. Flood Frequency	50	NS
3c. Potential to Release by Flood (lines 3a×b)	500	NS
4. Potential to Release (lines 2d+3c, subject to a maximum of 500)	500	NS
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:		
6. Toxicity/Persistence	(a)	10,000
7. Hazardous Waste Quantity	(a)	10,000
8. Waste Characteristics	100	100
Targets:		
9. Nearest Intake	50	NS
10. Population		
10a. Level I Concentrations	(b)	NS
10b. Level II Concentrations	(b)	NS
10c. Potential Contamination	(b)	NS
10d. Population (lines 10a+10b+10c)	(b)	NS
11. Resources	5	NS
12. Targets (lines 9+10d+11)	(b)	NS
Drinking Water Threat Score:		
13. Drinking Water Threat Score ([lines 5×8×12]/82,500, subject to a maximum of 100)	100	NS
Human Food Chain Threat		
Likelihood of Release:		
14. Likelihood of Release (same value as line 5)	550	550

TABLE 4-1
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET
(continued)

Factor Categories and Factors	Maximum Value	Value Assigned
Waste Characteristics:		
15. Toxicity/Persistence/Bioaccumulation	(a)	5×10^8
16. Hazardous Waste Quantity	(a)	100
17. Waste Characteristics	1,000	320
Targets:		
18. Food Chain Individual	50	45
19. Population		
19a. Level I Concentrations	(b)	0
19b. Level II Concentrations	(b)	0.03
19c. Potential Human Food Chain Contamination	(b)	0.00033
19d. Population (lines 19a+19b+19c)	(b)	0.03033
20. Targets (lines 18+19d)	(b)	45.03033
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14×17×20]/82,500, subject to a maximum of 100)	100	96.06
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics:		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	NS
24. Hazardous Waste Quantity	(a)	NS
25. Waste Characteristics	1,000	NS
Targets:		
26. Sensitive Environments		NS
26a. Level I Concentrations	(b)	NS
26b. Level II Concentrations	(b)	NS
26c. Potential Contamination	(b)	NS
26d. Sensitive Environments (lines 26a+26b+26c)	(b)	NS
27. Targets (value from line 26d)	(b)	NS
Environmental Threat Score:		
28. Environmental Threat Score ([lines 22×25×27]/82,500, subject to a maximum of 60)	60	NS

TABLE 4-1
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Surface Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score[c] (lines 13+21+28, subject to a maximum of 100)	100	96.06
Surface Water Overland/Flood Migration Component Score		
30. Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	96.06

NS = Not Scored.
(a) = Maximum value applies to waste characteristics category
(b) = Maximum value not applicable
(c) = Do not round to the nearest integer

REFERENCES

Ref. No.	Description of the Reference
1	U.S. Environmental Protection Agency (EPA), [Office of the Federal Register National Archives and Records Administration (OFRNARA)], December 14, 1990, 40 CFR Part 300, Hazard Ranking System (HRS). 2 pages, excerpt. The complete HRS is available in the Regional Docket, upon request.
2	U.S. Environmental Protection Agency (EPA). 1996. Superfund Chemical Data Matrix, Hazardous Substance Reference Table. January 2004. 15 pages, excerpt.
3	Latitude and Longitude Calculation Worksheet #1 LI Using Custom Ruler or Coordinator™ for the Nelson Tunnel/Commodore Waste Rock Site. October 1, 2007. 1 page.
4	U.S. Geological Survey (USGS) 7.5' Series Topographic Maps. Creede, Colorado, 2001, Wagon Wheel Gap, Colorado. 2001, San Luis Peak, Colorado. 2001, and URS Operating Services, Inc. (UOS). 2007. Sample Location Maps. Nelson Tunnel. Mineral County, Colorado. 6 maps.
5	Ecosystems Protection Program, EPA, Region 8. 2005. Aquatic Resources Assessment of the Willow Creek Watershed. August, 2005. 26 pages, excerpt.
6	Duane A. Smith. 1982. Song of the Hammer and Drill: The Colorado San Juans 1860-1914. University Press of Colorado, Boulder, Colorado. 10 pages, excerpt.
7	URS Operating Services, Inc. (UOS). 2007. Logbook. Nelson Tunnel Package. TDD No. 0602-03. 18 pages, excerpt.
8	Colorado Department of Public Health and the Environment (CDPHE). 1997. Site Inspection Comprehensive Analytical Results Report, East Willow Creek and West Willow Creek, Mineral County, Colorado. April 1997. 12 pages, excerpt.
9	McCulley, Frick, & Gilman, Inc. 1999. Preliminary Characterization of the Willow Creek Watershed: Existing Conditions and Recommended Actions. April 5, 1999. 28 pages, excerpt.
10	URS Operating Services, Inc. (UOS). 2007. Data Validation Report Nelson Tunnel. Review Assigned September 27, 2007, completed October 5, 2007 with complete raw data package. 160 pages.
11	URS Operating Services, Inc. (UOS). 2007. Sampling and Analysis Plan for Nelson Tunnel sampling event, July 2007. 29 pages
12	Colorado Division of Minerals and Geology, Willow Creek Reclamation Committee (WCRC). 2002. Underground Investigations of the Amethyst Vein, Technical Report 2. December 20, 2002. 27 pages.
13	Willow Creek Reclamation Committee (WCRC). 2001. Underground Investigations of the Amethyst Vein, Interim Report. June 21, 2001. 15 pages.

14 Colorado Division of Wildlife (CDOW). 2007. Telephone memoranda between John Alves (CDOW) and Bryan Williams (UOS)/Gwen Christiansen (EPA) regarding fisheries of the Willow Creek watershed and the Rio Grande River. 4 pages.

15 Colorado Division of Water Rights (CDWR) database. 2007. Division 3: Rio Grande River Basin Provisional Data Subject to Revision. October 15, 2007. (http://www.dwr.state.co.us/Surface Water/data/division.aspx?div=3). 3 pages

16 Willow Creek Reclamation Committee (WCRC). 2004. Report on Characterization of Waste Rock and Tailings Piles Above Creede, Colorado, Final Report. February, 2004. 58 pages.

17 Animas Valley and South Fork Anglers. 2007. Fly Fishing Creede and South Fork Colorado on the Rio Grande River. (http://www.gottrout.com/RiverInfo/Rio/Index.htm and http://www.riograndeangler.com/guide_services.htm). Accessed February 12, 2008. 8 pages.

Site Description

Although mining in the Creede Mining District began with the exploration of the upper Animas River drainage for placer deposits in 1865, it progressed slowly until the Ute Indians agreed to permit mineral exploration in the area in 1873 (Ref. 5, p. 27). In 1876 prospectors explored the Willow Creek watershed and over the next few years staked several silver claims (the Alpha and the Bachelor most notably), but failed to find the backing to mine or process these ores (Ref. 5, p. 29). Little else occurred in the district until 1889 when Nicolas Creede and his partner George L. Smith staked a claim called the Holy Moses along West Willow Creek (Refs. 5, p. 29; 6, p. 128). With the discovery of the Holy Moses claim, prospecting in the district greatly increased over the next few years and other prospectors, tracing the source to the headwaters of West Willow Creek staked additional claims such as the Last Chance and Amethyst; some of the richest claims in the district (Ref. 5, pp. 29, 30). Following this period, mining activity fluctuated based on available transportation, silver futures, mining technology, and population variations (Ref. 5, p. 30). The Commodore Mine lies in the West Willow Creek drainage approximately 0.5 miles north of the East/West Willow Creek confluence along Forest Road (FR) 508-2 (Ref. 4, Creede 7.5 minute topo; Ref. 12, p. 1). East and West Willow Creek have steep gradients and carve spectacular canyons for several miles above Creede. Most of the historic mining in the area took place one to three miles north of Creede before the two forks merge forming Willow Creek. Willow Creek is then conveyed through a concrete flume through town. Below Creede, Willow Creek bifurcates and forms a braided stream before reaching the Rio Grande River two miles south of town (Ref. 8, p. 2). The Commodore mine workings consist primarily of the Commodore Tunnel, waste rock pile, cribbings, and several structures spanning the West Willow Creek valley (Ref. 7, pp. 10, 11). West Willow Creek bisects the site, separating the tunnel from the structures and tailings pile (Ref. 7, pp. 10, 11). The Nelson Tunnel was completed in 1899 to access ores and drain the Commodore tunnel, and other workings in the area (Refs. 5, pp. 64, 65; 7, p. 13). In the 1980's all mining ended in the Creede District (Ref. 5, p. 30). There is no active mining in the district at this time (Ref. 8, p. 2). The sources consist of the Nelson Tunnel adit drainage and the adjacent Commodore waste rock pile, both adjacent and downgradient to the Commodore Tunnel (Ref. 7, pp. 10, 11).

In 1995 Preliminary Assessments of the both East and West Willow Creeks were performed by the Colorado Department of Public Health and Environment (CDPHE); these were followed by a combined Site Inspection of East and West Willow Creeks that resulted in the completion of a Comprehensive Analytical Results Report in April, 1997 (Ref. 8). After collecting 111 samples, data collected during the investigation indicated that large volumes of source material containing high metals concentrations were available for release to the surface water pathway (Ref. 8, pp. 1, 5). In addition, a significant increase in cadmium, lead, and zinc occurs near the Commodore Mine and the adjacent Nelson Tunnel (Refs. 7, pp. 9, 10; 8, pp. 7-9). At that time, community, state, and federal stakeholders in the Willow Creek area formed the Willow Creek Reclamation Committee (WCRC) with the purpose of guiding reclamation of the watershed (Ref. 9, p. 1-1). In 1999, a Preliminary Characterization of the Willow Creek Watershed was completed for the WCRC by McCulley, Frick, & Gillman (Ref. 9, p. 1-1).

In August 2005 an Aquatic Resources Assessment (ARA) of the Willow Creek Watershed was prepared by the EPA for the WCRC (Ref. 5, cover page). In addition to other stated goals, the ARA evaluated some 25 technical reports the WCRC or its contractors had completed in the watershed to that date (Ref. 5, p. 5).

UOS conducted a sampling event for the EPA in the Willow Creek area during the month of July, 2007 (Ref. 11, pp. i, 7a). Objectives of the investigation were to determine and document the extent, if any, of metals contamination associated with the Commodore Waste Rock pile and the Nelson

Tunnel adit for the purpose of making further decisions and potentially proposing the NT/CWR site to the National Priorities List (Ref. 11, p. 7a). Because the Commodore pile is located immediately east of the Nelson adit (across West Willow Creek), these sources were evaluated concurrently (Ref. 7, pp. 9, 10). Field sampling was conducted during the last week in July; sampling involved the collection of 21 environmental samples, which were analyzed using various methods, including Contract Laboratory Program (CLP) target analyte list (TAL) total metals, cyanide, and dissolved metals (if aqueous) (Ref. 7, pp. 9, 10).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of the Source: Commodore Waste Rock Pile

Number of the source: 1

Source Type: Pile

Description and Location of the Source:

The Commodore Waste Rock pile lies in the West Willow Creek drainage approximately 0.5 miles north of the East/West Willow Creek confluence along Forest Road (FR) 508-2 (Ref. 4, Creede 7.5 minute topo; 12, p. 1). The waste rock pile, cribbings, and several structures span the West Willow Creek valley, and are separated only by the creek (Ref. 7, p. 11). Several of these structures are located directly on the waste rock pile; although the Commodore workings occupy approximately five acres, Source 1 covers approximately two acres, as determined by visual observation of the tailings by size, color, and texture (Refs. 7, pp. 10, 11; 16, p. 41).

UOS conducted a sampling event in the Willow Creek area for the EPA during the month of July, 2007 (Ref 11, p. i, 7a). Objectives of the investigation were to determine and document the extent, if any, of metals contamination associated with the Commodore Waste Rock pile and the Nelson Tunnel (Ref. 11, pp. 5, 7a). Field sampling was conducted during the last week in July; sampling involved the collection of 21 environmental samples, which were analyzed using various methods, for the Contract Laboratory Program (CLP) target analyte list (TAL) total metals and cyanide (Refs. 7; 10). Hazardous substances found in these samples are summarized in the following table:

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Hazardous Substance	Evidence		References
	Sample No.	Concentration (mg/kg)	
Arsenic	NT-SS-01/02	450/324	(Refs. 10, pp. 1-17, 89, 91, 92, 160; 11, p. 24; 7)
Cadmium	NT-SS-01/02	270/57.4	
Lead	NT-SS-01/02	23,400/18,800	
Manganese	NT-SS-01/02	15,000/4,310	
Zinc	NT-SS-01/02	55,400/8,810	

Source Sample Information

The source samples listed above were collected during the 2007 sampling effort conducted by UOS for EPA (Ref. 7, p. 7). All samples for inorganic analysis were delivered to CT Laboratories, in Baraboo, Wisconsin (Ref. 11, pp. 23, 24). Analytical results from the soil samples indicate the presence of arsenic (450 and 324 milligrams per kilogram (mg/kg)), cadmium (270 and 57.4 mg/kg), lead (23,400 and 18,800 mg/kg), manganese (15,000 and 4,310 mg/kg), and zinc (55,400 and

8,810 mg/kg), in NT-SS-01 and NT-SS-02, respectively, as well as several other contaminants (Refs. 10, pp. 1-17, 89, 91, 92, 160; 11, p. 24; Ref. 7, p. 7).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Value	References
Gas release to air:	NS	
Particulate release to air:	NS	
Release to ground water:	NS	
Release via overland migration and/or flood: The Commodore Waste Rock pile is not contained with a cover, liner, or run on/off system (Ref. 7, p. 11).	10	Ref. 7, p. 11

Notes: NS = Not Scored

2.2.4 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

Description

There are inadequate Hazardous Constituent Quantity data available for the Commodore Waste Rock pile to derive a Hazardous Constituent Quantity value.

Sum (pounds): Not available (NA)

Hazardous Constituent Quantity Assigned Value: NA

2.4.2.1.2 Hazardous Wastestream Quantity

Description

Data are not available; therefore, it is not possible to adequately determine the Hazardous Wastestream Quantity.

Sum (pounds): NA
Sum of Wastestream Quantity/5,000 (Table 2-5): NA

Hazardous Wastestream Quantity Assigned Value: NA

2.4.2.1.3 Volume

Description:

The volume of the waste rock pile has not been fully characterized; therefore, it is not possible to adequately determine the volume of this source.

Dimension of source (yd^3): 0
Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Source area 1 is evaluated as a waste pile (Ref. 1, Table 2-5 - p. 51591; Ref. 7, pp. 8, 10, 11). The Commodore workings area covers approximately five acres, and the pile covers at least two acres, as determined by visual observation of the tailings by size, color, and texture (Refs. 7, pp. 8-11; 16, p. 41).

By following the stated procedure outlined in Section 2.4.2 and Table 2-5, p. 51591 of the HRS (Ref. 1), the area value is assigned as follows: 87,120 (ft^2)/13 = 6,701

Area Assigned Value: 6,701

2.4.2.1.5 Source Hazardous Waste Quantity Value

Highest assigned value calculated from Table 2-5: 6,701

2.2.1 SOURCE IDENTIFICATION

Name of the Source: Nelson Tunnel Adit

Number of the source: 2
Source Type: other

Description and Location of the source:

The Nelson Tunnel adit is located on the western bank of West Willow Creek approximately 250 feet south and 40 feet lower in elevation from the Commodore Tunnel and immediately across the creek from the Commodore pile (Refs. 7, pp. 8-11; 12, p. 1; 16, p. 41). The adit drains the Amethyst Vein Complex, and comprises several drifts and shafts (Ref. 13, p. 4). The tunnel was originally constructed as a drain for water and a haulage way for ores from the shaft itself and upper workings in the late 1890's (Ref. 13, p. 4). The adit has collapsed, but water continues to flow from the portal directly into Willow Creek (Refs. 7, pp. 8, 9; 8, p. 6). The adit accesses over 15,000 feet of drifts (Ref. 13, p. 9). During a sampling event conducted under the direction of EPA, UOS observed a discharge of an estimated 303 gpm from the adit in July 2007, as derived from readings on a Cuttthroat 4" flume (Ref. 7, pp. 7, 14).

UOS conducted a sampling event for the EPA in the Willow Creek area during the month of July, 2007 (Ref. 7). Objectives of the investigation were to determine and document the extent, if any, of metals contamination associated with the Commodore Waste Rock pile and the Nelson Tunnel (Ref. 8, pp. 1, 5). Field sampling was conducted during the last week in July; sampling involved the collection of 27 environmental and QA samples, which were analyzed using various methods for several substances, including the Contract Laboratory Program (CLP) target analyte list (TAL) total metals, cyanide, and dissolved metals (Refs. 7; 10; 11, pp. 23, 24). Hazardous substances found in sample NT-SW-02 (adit discharge) are summarized in the following table for both total and dissolved metals. Sample NT-SW-02 was collected as close as possible to the collapsed adit, at a point approximately eight feet from the discharge point from the adit (Ref. 7, p. 7).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Hazardous Substance	Evidence (total metals)		References
	Sample No.	Concentration (µg/l)	
Arsenic	NT-SW-02	6.3/ 2.5 dis.	Ref. 10, pp. 1-17, 144, 145; 11, p. 24; 7.
Cadmium	NT-SW-02	183/ 150 dis.	Ref. 10, pp. 1-17, 83, 158; 11, p. 24; 7.
Copper	NT-SW-02	43.7/ 36 dis.	Ref. 10, pp. 1-17, 83, 158; 11, p. 24; 7.
Lead	NT-SW-02	1,020/ 815 dis.	Ref. 10, pp. 1-17, 83, 158; 11, p. 24; 7.
Manganese	NT-SW-02	18,300/ 13,700 dis.	Ref. 10, pp. 1-17, 81; 11, p. 24; 7.

Hazardous Substance	Evidence (total metals)		References
	Sample No.	Concentration (µg/l)	
Zinc	NT-SW-02	69,600/ 53,900 dis.	Ref. 10, pp. 1-17, 81; 11, p. 24; 7.

Note: dis. dissolved

Source Sample Information

The source sample listed above was collected during the 2007 sampling effort conducted by UOS for EPA (Ref. 11, p. 5). All aqueous samples scheduled for inorganic analysis were delivered to CT Laboratories, in Baraboo, Wisconsin (Ref. 11, pp. 23, 24). Analytical results from the aqueous sample indicate the presence of arsenic (6.3 micrograms per liter (µg/l)), cadmium (183 µg/l), copper (43.7 µg/l), lead (1,020 µg/l), manganese (18,300 µg/l), and zinc (69,600 µg/l), as well as several other contaminants (Refs. 10, pp. 1-17, 81, 144, 158; 11, p. 24; 7).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Value	References
Gas release to air:	NS	
Particulate release to air:	NS	
Release to ground water:	NS	
Release via overland migration and/or flood: The Nelson Tunnel discharge flows untreated directly into West Willow Creek (Ref. 7).	10	Ref. 7, pp. 7, 9

Notes: NS = Not Scored

2.2.4 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

Description

There are no Hazardous Constituent Quantity data available for the Nelson Tunnel adit to derive a Hazardous Constituent Quantity value.

Sum (pounds): Not available (NA)

Hazardous Constituent Quantity Assigned Value: NA

2.4.2.1.2 Hazardous Wastestream Quantity

Description

Data are not available; therefore, it is not possible to adequately determine the Hazardous Wastestream Quantity.

Sum (pounds): NA
Sum of Wastestream Quantity/5,000 (Table 2-5): NA
Hazardous Wastestream Quantity Assigned Value: NA

2.4.2.1.3 Volume

Description:

Source area 2 is evaluated as other (Ref. 1, Table 2-5 - p. 51591; Ref. 7, p. 9). During its site assessment activities for EPA, UOS determined that the Nelson Tunnel adit discharge at the time of sampling was 0.676 cfs, as derived from Cutthroat 4 inch flume readings (Ref 7, pp. 7, 14). However, the source waste quantity will be evaluated as greater than zero, but exact amount unknown to reflect any seasonal variations in flow rate.

Reference(s): Ref. 1; Ref. 7, p. 7
Volume Assigned Value: >0

2.4.2.1.4 Area

Description

Because a value was assigned based on Tier C data, the area was not evaluated for this source.

Area Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

Highest assigned value calculated from Table 2-5: >0

SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Available to Pathway (X)				
			Ground Water (GW)	Surface Water (SW)		Air	
				Overland/ flood	GW to SW	Gas	Particulate
1	6,701	N	NS	X	NS	NS	NS
2	> 0	N	NS	X	NS	NS	NS
Total	**>6,701**						

2.4.2.2 Hazardous Waste Quantity Factor Value

According to Table 2-6 in the HRS, based on a total Hazardous Waste Quantity value of 6,701, the Hazardous Waste Quantity factor value is 100 (Ref. 1, Table 2-6, p. 51591)

Hazardous Waste Quantity Factor Value: 100

Description of Other Sources not Evaluated

Other potential sources in the study area that were not evaluated consist of numerous other mines and mining related sites in the Creede Mining District (Ref. 4). There are at least 29 named mining sources within six square miles north of Creede (Ref. 8, p. 2). Numerous shafts and adits appear on the USGS topographic quadrangles for the area (Ref. 4, maps 1-3).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Two sources have been evaluated at the NT/CWR site; the Nelson tunnel adit and the Commodore waste pile. The Probable Point of Entry (PPE) is the same for both sources; the adit discharge enters West Willow Creek from the west directly across the creek from the waste pile (Ref. 7). According to USGS topographic maps, West Willow Creek is a perennial stream at the PPE as well as upstream of the sources (Ref. 4). From the Nelson Tunnel adit, a discharge (measured as approximately 0.676 cfs or 303 gpm during the EPA site investigation) flows roughly 25 feet to West Willow Creek (the Probable Point of Entry (PPE) of the adit flow to the Creek) (Ref. 7, pp. 7, 9, 10, 14). The WCRC has stated that the Nelson Tunnel adit discharges year round, typically never less than 0.5 cfs in volume (Ref. 7, p. 13). Topography directs runoff and other surface water flow from the waste pile directly into West Willow Creek across from the adit PPE (Refs. 4; 7, pp. 8-11). West Willow Creek flows in a southerly direction, visibly eroding the western edge of the Commodore Waste Rock pile over approximately 250 to 300 feet (Ref. 7, pp. 9-11). The surface water pathway Target Distance Limit (TDL) begins at the upstream most point where overland flow enters the creek, and flows southerly approximately 2,400 feet from the most downstream point to the confluence of West and East Willow Creeks, forming Willow Creek (Ref. 4). This occurs approximately 55 feet downstream of the bridge for Forest Road 502.2 (Ref. 4, map 2). Willow Creek flows in a southerly direction 4.15 miles through the town of Creede before entering the Rio Grande River (Ref. 4, maps 1-3). The Willow Creek drainage is reported to be devoid of fish life downstream of the mining facilities from the East and West branches to its confluence with the Rio Grande (Ref. 8, p. 6). The surface water pathway TDL continues in a generally east-southeasterly direction for an additional 10.85 miles along the Rio Grande where the TDL ends roughly four miles downstream of Wagon Wheel Gap (Ref. 4, map 3).

The City of Creede provides potable water to its residents from a ground water source located to the southwest (Refs. 4; 7, p. 13). Fish species present in the Willow Creek drainage are found only upstream of the former mining facilities on both branches of Willow Creek, or in the Rio Grande River (Refs. 14; 8, p. 6). These species include brown, rainbow, and cutthroat trout (Ref. 14). On the Rio Grande, brown trout are present at a density of 1,284 fish per mile, with a total production of 54.2 pounds/acre in the vicinity (Ref. 14). Palustrine scrub-shrub, and emergent wetlands were observed along the banks of the Rio Grande River during the 2007 EPA sampling event conducted by UOS (Ref. 7, p. 9).

The U.S. Geological Survey (USGS) does not maintain gauging stations on East or West Willow Creeks, and no data were available for the Rio Grande immediately below the confluence of Willow Creek; however, flow rate information was collected using a Marsh McBirney, during the 2007 EPA field event (Ref. 7, pp. 6, 15a). Flow measurements were collected from several surface water sample locations within the watershed (Ref. 7, p. 6). Flow in West Willow Creek above the site was recorded as 11.03 cubic feet per second (cfs); in Willow Creek below the confluence of East and West Willow Creeks, the flow was measured as 33.266 cfs (Ref. 7, pp. 6, 15a). Average annual flow rate for the Rio Grande River at the 30 Mile Bridge gauging station near Creede is 134 cfs (Ref. 15, p. 3).

The Rio Grande River does not have any recorded surface water intakes on the remainder of the 15-mile TDL downstream segment. There are extensive wetlands along the Rio Grande River (Ref. 4, maps 1, 2). Fish production data indicate that rainbow, brown, and cutthroat trout, are all present

in the Rio Grande River (Ref. 14). Population densities for the combined species may exceed 1,300 fish per mile, as estimated by the Colorado Division of Wildlife (Ref. 14).

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Direct Observation

- Basis for Direct Observation:

An observed release by direct observation has been documented for this pathway. This observed release is based on the fact that a portion of the Commodore Waste Rock pile is currently in West Willow Creek, and a portion of the pile was eroded by the washout of 2005 (Ref. 7, p. 9).

Chemical Analysis

The following tables provide analytical data to document the observed release by chemical analysis.

West Willow Creek

- Background and Release Concentrations - West Willow Creek Surface Water Samples:

Analysis of surface water samples NT-SW-01 and NT-SW-03, collected during the 2007 EPA field investigation conducted by UOS to document conditions in the Willow Creek drainage, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective background levels in sample NT-SW-01 (Refs. 10, pp. 61, 74, 138, 142; 11, p. 24). Sample NT-SW-01 was collected in West Willow Creek upstream of the confluence with East Willow Creek (Ref. 7, p. 6).

Hazardous Substance	**Background Sample (µg/l)**	**Downgradient Sample (µg/l)**
	(Refs. 10, pp. 1-17, 61, 63, 74, 76, 138, 139, 142, 143; 11, p. 24; 7)	
	NT-SW-01	**NT-SW-03**
Arsenic (0.80)	0.80 U/0.80 U dis.	1.5/0.80 U dis.
Cadmium (0.40)	3.6/2.8 dis.	20.3/18 dis.
Lead (1.3)	8.6/4.7 dis.	124/110 dis.
Manganese (0.50)	14.3/8.4 dis.	422/420 dis.
Zinc (2.2)	179/150 dis.	4,150/4,200 dis.

Notes: µg/l Micrograms per liter
(#) Reporting limit
dis. dissolved

Analyses of surface water samples collected during the 2007 sampling event indicate that concentrations of arsenic, cadmium, lead, manganese, and zinc are significantly above background

concentrations in West Willow Creek (Refs. 10, pp. 1-17, 61, 74, 138, 142; 11, p. 24; 7). According to the HRS, if an observed release can be established for the watershed, an observed release factor value of 550 is assigned (Ref. 1, Section 4.1.2.1.1, p. 51609).

- Background and Release Concentrations - West Willow Creek Sediment Samples:

Analysis of sediment samples NT-SD-01 and NT-SD-03, collected from West Willow Creek during the 2007 sampling event conducted for EPA by UOS, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective background levels in sample NT-SD-01 (Refs. 10, pp. 66, 154, 157; 11, p. 24). Sample NT-SD-01 was collected in West Willow Creek upstream of the confluence with East Willow Creek (Ref. 7, p. 6).

Hazardous Substance	**Background Sample (mg/kg)**	**Downgradient Sample (mg/kg)**
	Sample IDs (Refs. 10, pp. 1-17, 66, 154, 157: 11, p. 24; 7)	
	NT-SD-01	**NT-SD-03**
Cadmium	4.6 (0.071)	16.1 (0.081)
Copper	22.6 (0.95)	126 (1.1)
Lead	1,100 (0.36)	3,860 (4.0)
Zinc	594 (0.19)	3,510 (2.2)

Notes: mg/kg Milligrams per kilogram
(#) Reporting Limit

Analyses of sediment samples collected during the 2007 sampling event indicate that concentrations of cadmium, copper, lead, and zinc are significantly above background concentrations in West Willow Creek. According to the HRS, if an observed release can be established for the watershed, an observed release factor value of 550 is assigned (Ref. 1, Section 4.1.2.1.1, p. 51609).

Willow Creek

- Background and Release Concentrations - Willow Creek Surface Water Samples:

Analysis of surface water samples NT-SW-01, NT-SW-04, NT-SW-05, NT-SW-06, and NT-SW-08, collected during the 2007 investigation of Willow Creek conducted by UOS for EPA, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective background levels in sample NT-SW-01 for both total and dissolved metals (Refs. 10, pp. 1-17, 33, 35, 47, 49, 54, 68, 74, 76, 152, 155; 11, pp. 23, 24; 7). Control sample NT-SW-04 was collected in East Willow Creek upstream of the confluence with West Willow Creek (Ref. 7, p. 6). Samples NT-SW-05, NT-SW-06, and NT-SW-08 were collected in Willow Creek as much as 1.05 miles downstream of the confluence (Refs. 4; 7, pp. 3, 5).

Hazardous Substance (µg/l)	Background Sample	Control Sample	Downgradient Samples		
	(Refs. 10, pp. 1-17, 33, 35, 47, 49, 54, 68, 74, 76, 152, 155; 11, pp. 23, 24; 7)				
	NT-SW-01	NT-SW-04	NT-SW-05	NT-SW-06	NT-SW-08
Lead (1.3)	8.6/4.7 dis.	4.7/-	101/78.0 dis.	35.8/32.0 dis.	39.8/34.0 dis.
Manganese (0.50)	14.3/8.4 dis.	7.3/-	349/340 dis.	100/110 dis.	110/110 dis.
Zinc (2.2)	179/150 dis.	131/-	3,630/3,600 dis.	1,730/1,800 dis.	1,500/1,500 dis.

Notes: µg/l Micrograms per liter
- Results not significantly above background
(#) Reporting limit
dis. dissolved

Analyses of sediment and surface water samples collected during the 2007 sampling event for the ESI indicate that concentrations of lead, manganese, and zinc are significantly above background concentrations in Willow Creek. According to the HRS, an observed release can be established for Willow Creek (Ref. 1, Section 4.1.2.1.1, p. 51609).

- Background and Release Concentrations - Willow Creek Sediment Samples:

Analysis of sediment samples NT-SD-01, NT-SD-04, NT-SD-05, NT-SD-06, and NT-SD-08, collected during the 2007 EPA investigation of Willow Creek, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective background levels in sample NT-SD-01 (Refs. 10, pp. 1-17, 41, 42, 52, 151, 153, 156, 157; 11, pp. 23, 24; 7). Sample NT-SD-04 was collected in East Willow Creek upstream of the confluence with West Willow Creek (Ref. 7, p. 6). Samples NT-SD-05, NT-SD-06, and NT-SD-08 were collected in Willow Creek up to 1.05 miles downstream of the confluence (Refs. 4; 7, pp. 3, 5; 11).

Hazardous Substance (mg/kg)	Background	Control Sample	Downgradient Samples		
	(Refs. 10, pp. 1-17, 41, 42, 52, 59, 151, 153, 156, 157; 11, pp. 23, 24; 7)				
	NT-SD-01	NT-SD-04	NT-SD-05	NT-SD-06	NT-SD-08
Arsenic	71.2 (0.71)	36.7 (0.71)	249 (0.88)	-	-
Cadmium	4.6 (0.071)	6.3 (0.071)	51.2 (0.088)	32.3 (0.088)	15.5 (0.072)
Copper	22.6 (0.95)	14.2 (0.95)	220 (1.2)	220 (1.2)	70.4 (0.95)
		427 (0.36)	7,390 (4.4)	7,980 (4.4)	4,060 (3.6)

Hazardous Substance (mg/kg)	Background	Control Sample	Downgradient Samples		
	(Refs. 10, pp. 1-17, 41, 42, 52, 59, 151, 153, 156, 157; 11, pp. 23, 24; 7)				
	NT-SD-01	NT-SD-04	NT-SD-05	NT-SD-06	NT-SD-08
Lead	1,100 (0.36)				
Manganese	1,040 (0.059)	379 (0.059)	4,360 (0.73)	5,410 (0.73)	4,240 (0.60)
Zinc	594 (0.19)	1,020 (0.19)	11,500 (2.3)	8,100 (2.4)	4,060 (1.9)

Notes: - Results not significantly above background
(#) Reporting limit

Analyses of sediment and surface water samples collected during the 2007 sampling event for the ESI indicate that concentrations of cadmium, copper, lead, manganese, arsenic, and zinc are significantly above background concentrations in West Willow Creek.

Rio Grande River

- Background and Release Concentrations - Rio Grande River Surface Water Samples:

Analysis of surface water samples NT-SW-09 and NT-SW-10, collected from the Willow Creek watershed during the 2007 EPA sampling event conducted by UOS, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective background levels in sample NT-SW-01 (Refs. 10, pp. 1-17, 17, 24, 126, 128; 11, p. 23; 7). Sample NT-SW-09 was collected in the Rio Grande River upstream of the confluence with Willow Creek (Ref. 4). Sample NT-SW-10 was collected in the Rio Grande 0.05 miles downgradient of the confluence with Willow Creek. (Refs. 4; 11).

Hazardous Substance	Control Sample (µg/l)	Downgradient Sample (µg/l)
	(Refs. 10, pp. 1-17, 17, 24, 126, 127, 128, 129, 146, 149; 11, p. 23; 7)	
	NT-SW-09	NT-SW-10
Arsenic (0.80)	0.80 U/-	1.4/-
Cadmium (0.40)	0.40 U/0.40 U dis.	3.9/4.1 dis.
Copper (3.0)	3.0 U/1.3 U dis.	7.0/3.0 dis.
Lead (1.3)	1.8/1.4 dis.	36.2/29.0 dis.
Zinc (2.2)	8.0/4.1 dis.	548/460 dis.

Notes: µg/l Micrograms per liter
(#) Reporting limit
dis. dissolved

Analyses of surface water samples collected during the 2007 sampling event for the Willow Creek area indicate that concentrations of arsenic, cadmium, copper, lead, and zinc are significantly above background concentrations in the Rio Grande. According to the HRS, an observed release can be established for the Rio Grande River (Ref. 1, Section 4.1.2.1.1, p. 51609).

- Background and Release Concentrations - Rio Grande River Sediment Samples:

Analysis of sediment samples NT-SD-09 and NT-SD-10, collected during the 2007 EPA sampling event for Willow Creek, indicated the presence of inorganic hazardous substances attributable to the site at concentrations greater than three times the respective control levels in sample NT-SD-09 (Refs. 10, pp. 1-17, 21, 28; 11, p. 23; 7). Sample NT-SD-09 was collected in the Rio Grande River upstream of the confluence with Willow Creek (Ref. 4). Sample NT-SD-10 was collected in the Rio Grande 0.05 miles downstream of the confluence (Refs. 4; 11).

Hazardous Substance	**Control Sample (mg/l)**	**Background Sample**
	Sample IDs (Refs. 10, pp. 1-17, 21, 22, 28; 11, p. 23; 7)	
	NT-SD-09	**NT-SD-10**
Arsenic	1.8 (0.85)	182 (0.84)
Cadmium	0.20 (0.085)	29.1 (0.84)
Copper	5.5 (1.1)	136 (11)
Lead	4.4 (0.43)	4,450 (4.2)
Manganese	496 (0.071)	3,010 (0.70)
Zinc	25.5 (0.23)	4,770 (2.2)

Notes: mg/l Milligrams per liter
(#) Sample quantitation limit

Analyses of sediment samples collected during the 2007 sampling event for the Willow Creek watershed indicate that concentrations of arsenic, cadmium, copper, lead, manganese, and zinc are significantly above background concentrations in the Rio Grande River. According to the HRS, an observed release can be established for the Rio Grande River (Ref. 1, Section 4.1.2.1.1, p. 51609).

4.1.2.1.2 Potential to Release

Potential to Release by overland flow was not evaluated because an observed release was established (Ref. 1 Section 4.1.2.1.2, p. 51609).

Attribution

Although other historical mine sites are located upstream on West Willow Creek from the NT/CWR site, the selection of a background/control sample immediately upgradient of the sources yet below

these other mines supports the attribution of the releases to the site (Ref. 7, pp. 8, 10). In addition, the direct observation of the waste pile as being in contact with West Willow Creek, and the observation of flow from the Nelson Tunnel adit into the creek also establish that at least part of the significant increase in contaminant levels is due to releases from the site. Furthermore, the continuing decrease in metals concentrations (as shown in the previous tables) indicates that there are no other significant sources releasing contaminants in large quantities downstream of the site sources along the TDL. Also, in 2005 a reported blow out from the Nelson Tunnel eroded waste material directly into the Commodore waste rock pile, cojoining any sediments from the two sources and reaching into the Rio Grande River (Ref. 7, pp. 9, 10, 13).

4.1.3.2 Human Food Chain Threat Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value*	Bioaccu-mulation Value**	Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-16)	References
Arsenic	1	10,000	1.0	5.0	5×10^4	Ref. 2, p. BI-1
Cadmium	1, 2	10,000	1.0	5,000	5×10^7	Ref. 2, p. BI-2
Copper	1, 2	0	1.0	500	0	Ref. 2, p. BI-3
Lead	1, 2	10,000	1.0	5.0	5×10^4	Ref. 2, p. BI-8
Manganese	1, 2	10,000	1.0	50,000	5×10^8	Ref. 2, p. BI-8
Zinc	1, 2	10	1.0	5.0	50	Ref. 2, p. BI-12

Notes:

* Persistence value for Rivers

** Bioaccumulation factor value for Freshwater

The hazardous substance with the highest Toxicity/Persistence/Bioaccumulation Factor Value is manganese with a value of 5×10^8 (Ref. 1, Section 4.1.3.2.1.4, Table 4-16; Ref. 2, p. BI-8).

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	pile	6,701
2	other	> 0
Total		> 6,701

The sum of the source hazardous waste quantity values is assigned as the Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.2). A Hazardous Waste Quantity Factor Value of 100 is assigned to a site whose sum of Source Hazardous Waste Quantity Values is greater than 100 to 10,000 (Ref. 1, Table 2-6, p. 51591).

Sum of Values: > 6,701

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Table 2-6)

4.1.3.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 1×10^2

Waste Characteristics Factor Category Value: 320
(Ref. 1, Table 2-7)

4.1.3.3 Human Food Chain Threat Targets

Actual Human Food Chain Contamination

The following samples support that at least part of the human food chain fishery in the Rio Grande can be considered as actually contaminated because an observed release of a hazardous substance with a bioaccumulation factor value of 500 or greater into the Rio Grande has been documented.

Sample ID	Sample Medium	Distance from PPE	Hazardous Substance	Bio-accumulation Factor Value	References
NT-SW-10	Surface water	4.2 miles	Arsenic	5.0	2, pp. BI-1, BI-2, BI-3, BI-8, BI-12; 4, Creede 7.5 minute topo; 11
NT-SD-10	Sediment				
NT-SW-10	Surface water		Cadmium	5,000	
NT-SD-10	Sediment				
NT-SW-10	Surface water		Copper	500	
NT-SD-10	Sediment				
NT-SW-10	Surface water		Lead	5.0	
NT-SD-10	Sediment				
NT-SW-10	Surface		Manganese	50,000	

Sample ID	Sample Medium	Distance from PPE	Hazardous Substance	Bio-accumulation Factor Value	References
	water				
NT-SD-10	Sediment				
NT-SW-10	Surface water		Zinc	5.0	
NT-SD-10	Sediment				

- Closed Fisheries:

The state of Colorado has not declared any portion of the surface water pathway a closed fishery.

- Fish Tissue:

There is no record of fish tissue having been collected from the Willow Creek drainage for purposes of metals analysis. As such, Level I contamination can not be documented.

Level I Fisheries

Neither West Willow Creek, Willow Creek, nor the Rio Grande River have been documented as having fisheries subject to Level I actual contamination (Ref. 1, p. 51620).

Most Distant Level II Sample

The most distant Level II observed release surface water and sediment samples, NT-SD/SW-10, were collected from the Rio Grande River below the confluence with Willow Creek, approximately 4.2 miles downstream of the NT/CWR PPE (Refs. 4, Maps 1, 4; 11).

Level II Fisheries

Identity of Fishery	Extent of Level II Fishery (Relative to PPE)	Refs.
Rio Grande River	0.05 miles	Refs. 4, maps 1, 4; 11

4.1.3.3.1 Food Chain Individual

Actual contamination of the Rio Grande River Human Food Chain fishery was documented by Level II concentrations in surface water and sediment samples NT-SE/SW-10 (Refs. 4, maps 1, 4; 11). This fishery is subject to Level II concentrations; therefore, a value of 45 is assigned to the Human Food Chain Individual Factor Value (Ref. 1, Sec. 4.1.3.3.1). The presence of a human food chain fishery in this stream reach is supported in the State of Colorado's documentation of the presence of human food chain species and by documentation of recreational fishing in that portion of the Rio Grande (Refs. 14; 17)

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Not applicable

Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

The extent of the Level II contamination of the Rio Grande River fishery is 0.05 miles (distance from the confluence of Willow Creek and the Rio Grande River to sample location NT-SW/SE-10) (Refs. 4, map 2; 11). Values for the amount of potential human food chain organisms produced annually from the Rio Grande have been estimated to be 54.2 pounds per acre, in brown and rainbow trout (Ref. 14). However, only the brown trout are permitted by the State to be taken for consumption, and existing information is insufficient to determine the poundage of fish actually caught for human consumption in the actually contaminated portion of the fishery (Ref. 14). For an annual production of greater than 0 to 100 pounds per year, a Human Food Chain Population Value of 0.03 is assigned for the fishery (Ref. 1, Section 4.1.3.3.2.2, Table 4-18).

Identity of Fishery	Annual Production (pounds)	References	Human Food Chain Population Value (Table 4-18)
Actually Contaminated portion of Rio Grande River	between 0 and 100	Refs. 1, p. 51621; 14	0.03

Sum of Level II Human Food Chain Population Values: 0.03

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The Rio Grande fishery downstream of sample location NT-SW/SE-10 to the TDL may be considered subject to potential contamination (see Section 4.1.3.3.2.3). Values for the amount of human food chain organisms produced annually from these fisheries have been estimated at 54.2 pounds/acre for the Rio Grande (Ref. 14).

Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Refs.	Population Value (P_i) (Table 4-18)	Dilution Weight (D_i) (Table 4-13)	$P_i \times D_i$
Rio Grande River	54.2 lb./acre	moderate to large stream	134 cfs	14; 15, p. 3	0.03	0.01	0.0003

Sum of $P_i \times D_i$: 0.0033

(Sum of P_i x D_i)/10: 0.00033

Potential Human Food Chain Contamination Factor Value: 0.00033

4.1.3.3.2.4 Calculation of Population Factor Value

The population factor value is calculated by summing the value of Level I concentration (0), Level II concentration (0.03) and potential human food chain contamination factors for the watershed (0.00033). The resulting value is assigned the population factor value for the watershed (Ref. 1, Section 4.1.3.3.2.4).

Calculations:

0 + 0.03 + 0.00033 = 0.03033

4.1.3.3.3 Calculation of a Human Food Chain Threat - Target Factor Category Value

The Human Food Chain Threat-Target Factor Category Value is calculated by summing the Food Chain Individual (45) and Population Factor Value of the watershed (0.03033). The resulting value, 45.03033, is assigned as the Human Food Chain Threat-Target Score (Ref. 1, Sec. 4.1.3.3.3).

Food Chain Target Factor Category Value: 45.03033

4.1.3.4 Calculation of a Human Food Chain Threat Score for a Watershed

The Human Food Chain Threat is calculated by multiplying the Human Food Chain Threat Factor Category Value for likelihood of release (550), Waste Characteristics (320) and Targets for a Watershed (45.03033). The product is rounded to the nearest integer and divided by 82,500. The resulting value, subject to a maximum of 100, is assigned as the Human Food Chain Threat Score for the watershed (Ref. 1, Sec. 4.1.3.4).

Calculations:

(550 x 320 x 45.03033) ÷ 82,500 = 96.06