3.4 Water Resources

3.4.1 Regulatory Background

The CWA, originally the Federal Water Pollution Control Act of 1948 (with major amendments in 1972 and 1977), is the framework that regulates water quality standards and pollutant discharges into waters of the U.S. Sections 303d and 305b of the CWA require that water quality of streams, rivers, and lakes are assessed on a regular basis; that waters found to be in violation of water quality standards are listed as impaired; and that priorities are set for actions to improve water quality. Section 402 of the CWA created the National Pollutant Discharge Elimination System, which is administered by most individual states and includes stormwater permits and requirements for construction areas. Section 404 of the CWA regulates dredging and filling of waters of the U.S., and permits for such activities are issued by the USACE.

The Colorado River Basin's water quality also is administered under the Colorado River Basin Salinity Control Act, which is enacted through a forum. The purposes of the forum are to coordinate salinity control efforts among the states, to coordinate with federal agencies on the implementation of the Colorado River Basin Salinity Control Program, to work with Congress on the authorization and funding of the program, to disseminate information on salinity control, and to otherwise promote efforts to reduce the salt loading to the Colorado River (Colorado River Basin Salinity Control Forum 2012).

Water use is administered by individual states in some form of the prior appropriation doctrine under the following state statutes:

- Wyoming – Title 41, Wyoming Statutes Annotated, 1977
- Colorado – State Constitution Article XVI Sections 5 and 6
- Utah – Utah Code, Title 73
- Nevada – Nevada Revised Statutes, Chapters 532 through 538

3.4.2 Data Sources

The Watershed Boundary Dataset (WBD) is a GIS-based dataset of drainage boundaries for the U.S. (NRCS et al. 2010). The drainages are described as a multi-level or ordered, hierarchal system consisting of hydrographic regions, subregions, basins, subbasins, watersheds, and subwatersheds. There are 21 regions across the U.S., including Hawaii, Alaska, and Puerto Rico/U.S. Virgin Islands. Each subsequent level is divided into smaller drainages that nest within the higher level (e.g., the Upper Colorado Region has eight subregions). At each level, beginning with the region, the drainages within that level are described with a two-digit HUC; thus, hydrographic regions are identified by a two-digit HUC (HUC2), subregions are four digits (HUC4), basins are six digits (HUC6), subbasins are eight digits (HUC8), watersheds are ten digits (HUC10), and subwatersheds are twelve digits (HUC12).

The National Hydrography Dataset (NHD) also is a GIS-based dataset that represents the drainage network of streams, rivers, canals, lakes, and reservoirs in the U.S. (USGS 2011). This dataset is based largely on USGS topographic maps; however, updates to certain areas have occurred and will continue. The NHD is available in high- and medium-resolution. Due to the areal extent of this Project, the medium resolution was chosen, which is based on 1:100,000-scale topographic maps.

Individual states inventory water quality every 2 years and prepare an Integrated Water Quality and Impaired Waters Assessment Report, or Integrated Report (IR) as required by the CWA, Sections 303(d) and 305(b). These reports contain the water quality standards and the status of all classified waters within each state, along with a listing of all waters that are impaired or threatened. The most recently available IRs referenced in this document are listed below.

- Colorado: 2012 IR, submitted to USEPA in April 2012
- Nevada: 2008-10 IR, final approval by USEPA on April 18, 2013
- Utah: 2010 IR, final approval by USEPA on February 10, 2012
- Wyoming: 2012 IR, final approval by USEPA on May 3, 2012

3.4.3 Analysis Area

The water resources analysis area consists of all WBD-defined Watersheds (5th order, HUC10) with Project components located within them. **Table 3.4-1** lists the hydrographic basins within which the analysis area lies, and a detailed tabulation of the watersheds is contained in Section 3.4.5, Regional Summary. This water resource section of the EIS will focus on water resources with the potential to be directly or indirectly impacted by the Project. These resources include perennial streams and rivers (continually flowing), intermittent streams (groundwater component with augmentation by seasonal precipitation), ephemeral streams (flowing in response to precipitation events), lakes, reservoirs, springs, and groundwater within the watersheds and downstream of Project components

Table 3.4-1 Hydrographic Regions and Basins Crossed by the TransWest Project

Hydrographic Region	Basin
North Platte	North Platte
Upper Colorado	Colorado Headwaters
	Upper Colorado-Dolores
	Upper Green
	Great Divide Closed Basin
	White-Yampa
	Lower Green
	Upper Colorado-Dirty Devil
Great Basin	Jordan
	Escalante Desert-Sevier Lake
	Central Nevada Desert Basins
Lower Colorado	Lower Colorado-Lake Mead
	Lower Colorado-Below Hoover Dam

Sources: NRCS et al. 2010.

3.4.4 Baseline Description

The water resources analysis area consists of 179 hydrographic watersheds within the North Platte, Great Salt Lake, Upper Colorado, and Lower Colorado River hydrographic regions as defined by the WBD (NRCS et al. 2010). The North Platte Region drains the east side of the Continental Divide and ultimately empties to the Gulf of Mexico. The Upper Colorado Region, Lower Colorado Region, and Great Basin Region all drain the western side of the Continental Divide. Both the Upper and Lower Colorado regions ultimately drain toward the Gulf of California (excepting the Great Divide Closed Basin in south-central Wyoming), while the Great Basin Region is a closed drainage that never reaches an ocean but instead generally drains toward the Great Salt Lake.

Groundwater resources in the analysis area have been characterized by Planert and Williams (1995), Robson and Banta (1995), and Whitehead (1996). These authors report that the major aquifer systems in the analysis area are the Upper Colorado or Colorado Plateau aquifers, and the Basin and Range aquifers. Surficial aquifers are present in the floodplains of major surface water features and in the low-lying areas of the Basin and Range area (Planert and Williams 1995; Robson and Banta 1995;

Whitehead 1996). There are no sole-source aquifers within the analysis area (USEPA 2012). However, springs and seeps are found throughout the analysis area.

3.4.5 Regional Summary

The 179 watersheds (HUC10) within the analysis area are listed in **Table 3.4-2** and depicted in **Figures 3.4-1** through **3.4-4** by region. The major rivers within each Project Region are listed in **Table 3.4-3**. **Appendix F** contains a detailed listing of waterbodies crossed by Project alternative alignments.

Table 3.4-2 Watersheds Crossed by the TWE Project

General Project Region	Basin	Watershed	HUC10[1]	Figure Code[2]
I	North Platte	Sage Creek	1018000209	07
		North Platte River-Iron Springs Draw	1018000210	01
		Sugar Creek	1018000213	04
	Great Divide Closed Basin	Frewen Lake	1404020004	01
		Upper Separation Creek	1404020013	04
		Mud Springs Lake	1404020003	05
		Lower Separation Creek	1404020014	06
I & II	White-Yampa	Elkhead Creek	1405000106	01
		Fortification Creek	1405000107	02
		Dry Creek-Yampa River	1405000111	03
		Morgan Gulch-Yampa River	1405000202	04
		Deception Creek-Yampa River	1405000204	05
		Spring Creek-Yampa River	1405000205	06
		Hells Canyon-Yampa River	1405000206	07
		Little Snake River-Willow Creek	1405000302	08
		Fourmile Creek	1405000305	09
		Upper Sand Creek	1405000306	10
		Lower Sand Creek	1405000307	11
		Little Snake River-Powder Wash	1405000308	12
		Greasewood Gulch-Little Snake River	1405000309	13
		Sand Wash	1405000310	14
		Upper Muddy Creek	1405000401	15
		Redwash	1405000402	16
		Lower Muddy Creek	1405000403	17
		Wolf Creek	1405000701	18
		Outlet Douglas Creek	1405000703	19
		Red Wash-White River	1405000704	20
		Dripping Rock Creek-White River	1405000705	21
		Evacuation Creek	1405000706	22
		Bitter Creek	1405000709	23
		Coyote Wash	1405000710	24
		Cottonwood Wash-White River	1405000711	25
		Lay Creek	1405000203	26
		Outlet Little Snake River	1405000311	27
		Crooked Wash-White River	1405000505	28

Table 3.4-2 Watersheds Crossed by the TWE Project

General Project Region	Basin	Watershed	HUC10[1]	Figure Code[2]
II	Colorado Headwaters	West Salt Creek	1401000517	01
		McDonald Creek-Colorado River	1401000519	02
II	Upper Colorado-Dolores	Bitter Creek	1403000101	01
		Westwater Creek	1403000102	02
		Cottonwood Canyon	1403000104	03
		Cisco Wash	1403000106	04
		Sagers Wash	1403000107	05
		Westwater Creek-Colorado River	1403000108	06
		Salt Wash	1403000501	07
II	Lower Green	Cliff Creek	1406000102	02
		Twelvemile Wash	1406000104	04
		Walker Hollow-Green River	1406000105	05
		Pelican Lake-Green River	1406000106	06
		Strawberry River-Duchesne River	1406000304	09
		Pigeon Water Creek-Lake Fork River	1406000308	10
		Dry Gulch Creek	1406000309	11
		Cottonwood Creek-Dry Gulch Creek	1406000310	12
		Uinta River	1406000314	13
		Duchesne River	1406000315	14
		Upper Strawberry River	1406000401	15
		Middle Strawberry River	1406000403	16
		Currant Creek	1406000404	17
		Red Creek	1406000405	18
		Rabbit Gulch	1406000406	19
		Lower Strawberry River	1406000408	20
		White River	1406000701	21
		Desert Seep Wash	1406000707	22
		Cottonwood Wash-Price River	1406000710	23
		Little Park Wash-Price River	1406000711	24
		Lost Spring Wash-Saleratus Wash	1406000801	25
		Tusher Wash-Green River	1406000802	35
		Little Grand Wash	1406000803	26
		Salt Wash-Green River	1406000804	27
		Tenmile Canyon	1406000805	28
		Huntington Creek	1406000901	29
		Cottonwood Creek	1406000902	30
		Ferron Creek	1406000903	31
		North Salt Wash	1406000904	32
		Upper San Rafael River	1406000905	33
		Antelope Creek	1406000305	36
		Upper Pariette Draw	1406000501	37
		Lower Pariette Draw	1406000502	38

Table 3.4-2 Watersheds Crossed by the TWE Project

General Project Region	Basin	Watershed	HUC10[1]	Figure Code[2]
II	Lower Green (Continued)	Upper Ninemile Creek	1406000503	39
		Lower Ninemile Creek	1406000504	40
		Sheep Wash-Green River	1406000505	41
		Agency Draw-Willow Creek	1406000604	42
		Scofield Reservoir	1406000702	43
		Willow Creek	1406000703	44
		Gordon Creek	1406000704	45
		Beaver Creek-Price River	1406000705	46
		Miller Creek	1406000706	47
		Coal Creek-Price River	1406000708	48
		Grassy Trail Creek	1406000709	49
		Indian Canyon	1406000407	50
		Avintaquin Creek	1406000402	51
II	Upper Colorado - Dirty Devil	Ivie Creek	1407000201	01
		Headwaters Muddy Creek	1407000202	02
II	Jordan	West Creek	1602020101	01
		Soldier Creek	1602020201	02
		Thistle Creek	1602020202	03
		Diamond Fork	1602020203	04
II	Great Salt Lake Basin	Dry Lake Creek-Fish Springs Wash	1602030603	01
II & III	Escalante Desert-Sevier Lake	Salina Creek	1603000304	01
		Lost Creek-Sevier River	1603000305	02
		Silver Creek	1603000401	03
		Upper San Pitch River	1603000402	04
		Ivie Creek	1603000501	05
		Dog Valley Wash	1603000503	06
		Upper Sevier River	1603000504	07
		Tanner Creek	1603000505	08
		Cherry Creek Wash	1603000507	09
		Sugarville-Broad Canyon	1603000508	10
		Picture Rock Wash	1603000509	11
		Hog Back Reservoir-Old River Bed	1603000510	12
		Swasey Wash	1603000511	13
		Middle Sevier River	1603000512	14
		Chalk Creek	1603000514	15
		Oak Creek	1603000515	16
		Soap Hollow	1603000516	17
		Lower Sevier River	1603000517	18
		Iron Springs Creek-Frontal Lund Flats	1603000605	19
		Mud Spring Wash	1603000606	20
		Fisher's Wash	1603000607	21

Table 3.4-2 Watersheds Crossed by the TWE Project

General Project Region	Basin	Watershed	HUC10[1]	Figure Code[2]
II & III	Escalante Desert-Sevier Lake (Continued)	Fourmile Wash	1603000608	22
		Mountain Spring Wash	1603000609	23
		Gold Springs Wash	1603000610	24
		McDonald Wash-Negro Liza Wash	1603000612	25
		Shoal Creek	1603000613	26
		Escalante Valley-Pinto Creek	1603000614	27
		Long Lick Canyon-Big Wash	1603000703	28
		The Big Wash-Beaver River	1603000706	29
		Morehouse Canyon-Beaver River	1603000707	30
		Upper Beaver River	1603000803	31
		Lower Beaver River	1603000805	32
		Fillmore Wash-Frontal Sevier Lake	1603000903	33
III & IV	Lower Colorado-Lake Mead	Government Wash-Colorado River	1501000512	01
		Gypsum Wash-Colorado River	1501000513	02
		Moody Wash	1501000806	03
		Upper Santa Clara River	1501000807	04
		Lower Santa Clara River	1501000808	05
		Upper Beaver Dam Wash	1501001001	06
		Lower Beaver Dam Wash	1501001002	07
		Garden Wash	1501001004	08
		Toquop Wash	1501001005	09
		Sand Hollow Wash-Virgin River	1501001006	10
		Halfway Wash-Virgin River	1501001007	11
		Pahranagat Creek	1501001116	12
		Kane Springs Wash	1501001201	13
		Upper Pahranagat Wash	1501001202	14
		Middle Pahranagat Wash	1501001203	15
		Elbow Canyon	1501001204	16
		Dry Lake Valley	1501001206	17
		California Wash	1501001207	18
		Upper Muddy River	1501001208	19
		Lower Muddy River	1501001209	20
		Clover Creek	1501001305	21
		Cathedral Gorge-Meadow Valley Wash	1501001306	22
		Kershaw Canyon-Meadow Valley Wash	1501001307	23
		Lower Meadow Valley Wash	1501001309	24
		Nellis Air Force Base	1501001504	25
		Duck Creek-Las Vegas Wash	1501001507	26
		Lower Pahranagat Wash	1501001205	27

Table 3.4-2 Watersheds Crossed by the TWE Project

General Project Region	Basin	Watershed	HUC10[1]	Figure Code[2]
III & IV	Central Nevada Desert Basins	Red Rock Wash	1606000908	01
		Dry Lake Valley	1606000909	02
		Delamar Valley	1606000910	03
		Eldorado Valley	1606001518	04
		McCullough Spring	1606001516	05
		Ora Hanna Spring	1606001517	06
IV	Lower Colorado-Below Hoover Dam	Jumbo Wash-Colorado River	1503010101	01

[1] Ten digit USGS HUC, unique to each watershed.

[2] Figure Code refers to the watershed display system utilized in **Figures 3.4-1** through **3.4-4**.

Sources: NRCS et al. 2010.

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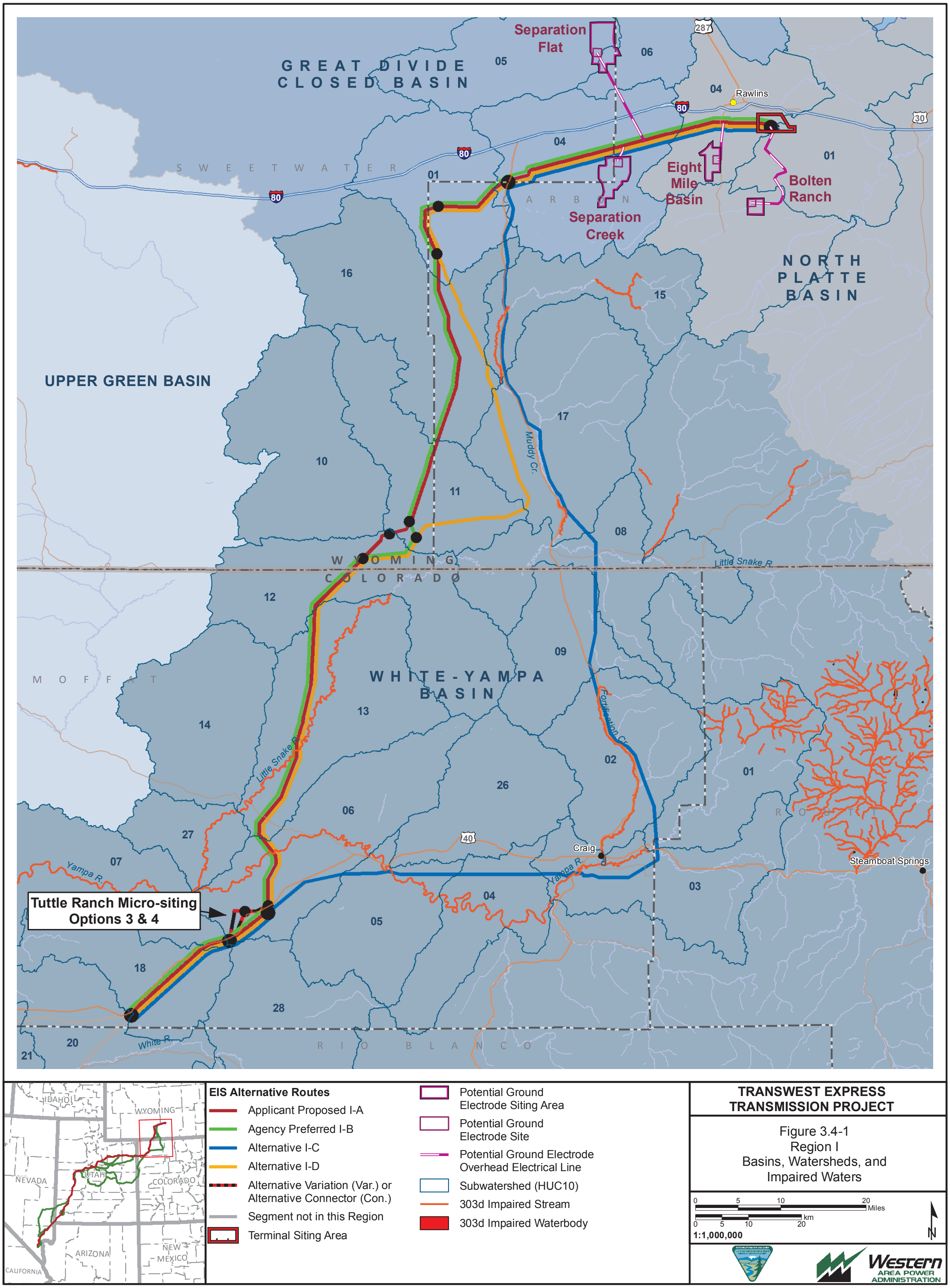

Figure 3.4-1
Region I
Basins, Watersheds, and Impaired Waters

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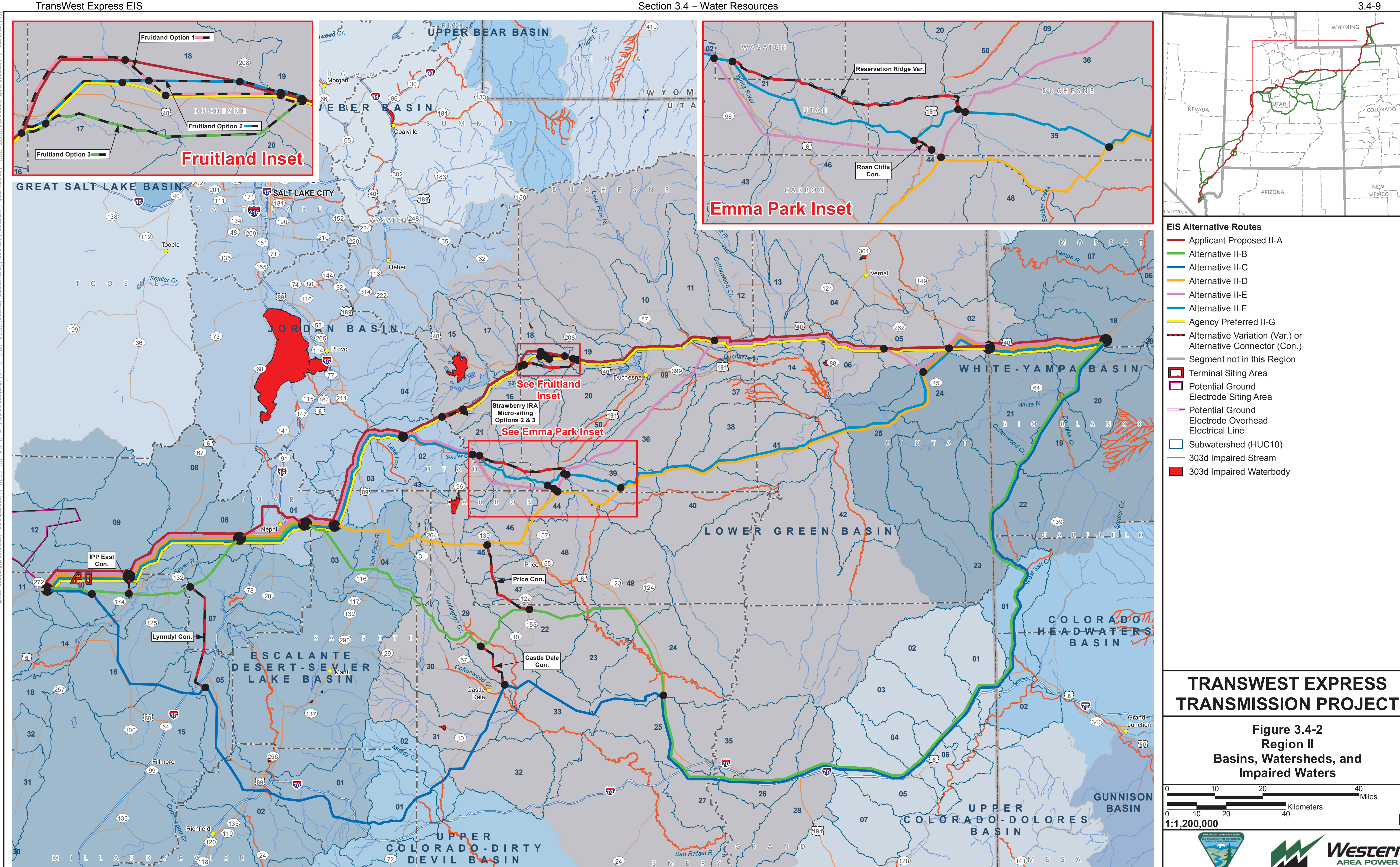

Figure 3.4-2 Region II Basins, Watersheds, and Impaired Waters

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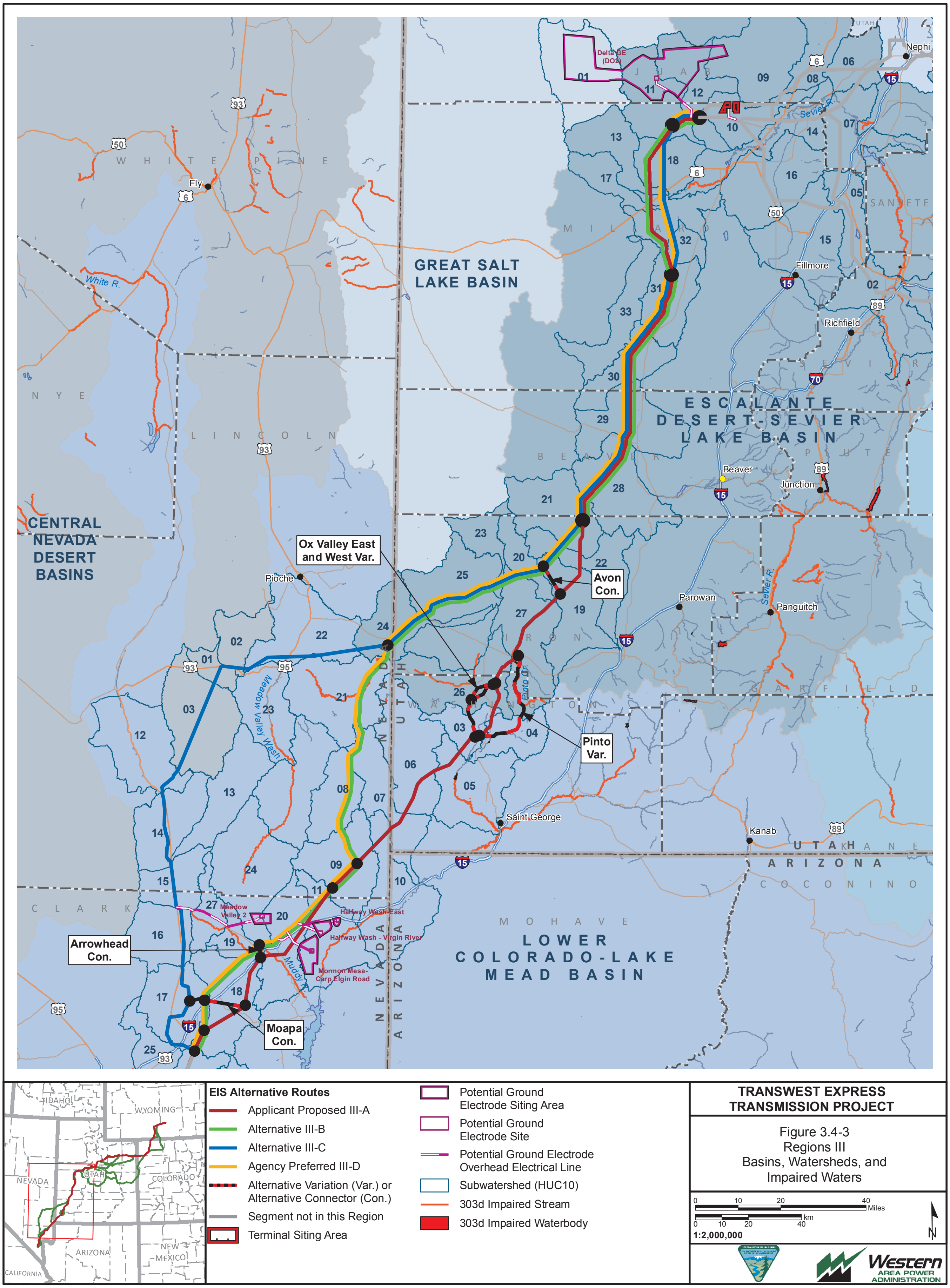

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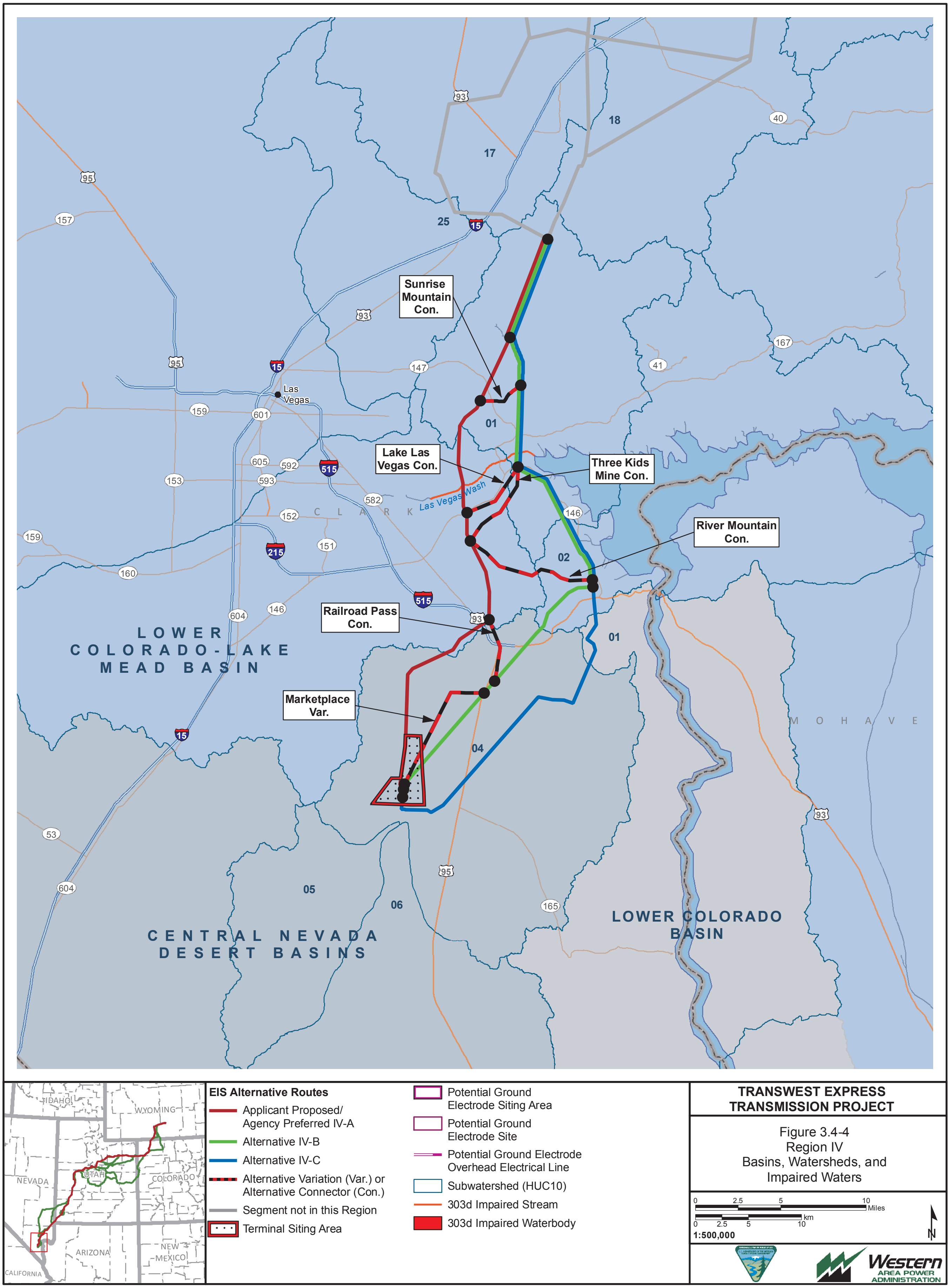

Figure 3.4-4
Region IV
Basins, Watersheds, and Impaired Waters

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Table 3.4-3 Major Rivers and Impaired Waters within Analysis Area and Project Regions

Project Region	River/Impaired Water	Water Quality Use Classification[3]	Reason for Impairment/TMDL[1,2]	Watershed	Hydrographic Basin
I	McKinney Creek	2AB (WY)	Removed 2012	Upper Muddy Creek	White-Yampa
	Muddy Creek	2C (WY)	Removed 2012		
	Muddy Creek	2C (WY)	Se, Cl, Phys Alt	Lower Muddy Creek	
	Little Snake River	2AB (WY)	NA	Little Snake River-Willow Creek	
		A (CO)		Little Snake River-Powder Wash	
	Little Snake River	A (CO)	Sed/Silt	Greasewood Gulch-Little Snake River	
				Outlet Little Snake River	
	Yampa River	B (CO)	Sed/Silt, Fe	Deception Creek-Yampa River	
				Spring Creek-Yampa River	
				Hells Canyon-Yampa River	
	Fortification Creek	C (CO)	Se	Fortification Creek	
	White River	B (CO)	NA	Red Wash-White River	
				Dripping Rock Creek-White River	
				Asphalt Wash-White River	
				Cottonwood Wash-White River	
	Green River	B (CO)	NA	Garden Creek-Green River	Lower Green
				Walker Hollow-Green River	
II	Douglas Creek	D (CO)	Sed/Silt	Outlet Douglas Creek	White-Yampa
	West Evacuation Creek	D (CO)	Sed/Silt	Evacuation Creek	
	Salt Creek	E (CO)	Sed/Silt, Se	West Salt Creek	Colorado Headwaters
	Colorado River	C (CO)	Se	McDonald Creek-Colorado River	
		1C, 2B, 3A, 4 (UT)		Westwater Creek-Colorado River	Upper Colorado-Dolores
	Green River	1C, 2A, 3B, 4 (UT)	NA	Pelican Lake-Green River	Lower Green
				Sheep Wash-Green River	
				Tusher Wash-Green River	
				Salt Wash-Green River	
				Lower Pariette Draw	
	Pariette Draw and tributaries	2B, 3B, 3D, 4 (UT)	Bo, Se, TDS		
				Upper Pariette Draw	
	Willow Creek	2B, 3A, 4 (UT)	Bioassay	Agency Draw-Willow Creek	
	Ninemile Creek	1C, 2A, 3B, 4 (UT)	Temp	Lower Ninemile Creek	
				Upper Ninemile Creek	
	Pelican Lake	2B, 3B, 4 (UT)	pH	Pelican Lake-Green River	
	Duchesne River	1C, 2B, 3A, 4 (UT)	TDS, Temp, Bioassay	Duchesne River	

Table 3.4-3 Major Rivers and Impaired Waters within Analysis Area and Project Regions

Project Region	River/Impaired Water	Water Quality Use Classification[3]	Reason for Impairment/TMDL[1,2]	Watershed	Hydrographic Basin
II (Cont)	Strawberry River	1C, 2A, 3B, 4 (UT)	Bo	Lower Strawberry River	Lower Green (Continued)
	Lake Fork River	1C, 2B, 3A, 4 (UT)	Phys Alts; TMDL: TDS	Pigeon Water Creek-Lake Fork River	
	Antelope Creek and tributaries	2B, 3B, 4 (UT)	Bo, TDS	Antelope Creek	
	Indian Canyon Creek	2B, 3B, 4 (UT)	As, Bo, TDS	Indian Canyon	
	Red Creek Reservoir	2B, 3A, 4 (UT)	DO	Red Creek	
	Soldier Creek (trib. Price River)	1C, 2B, 3A, 4 (UT)	TMDL: P, Sed/Silt	Coal Creek-Price River	
	Price River	2B, 3C, 4 (UT)	Bioassay		
		1C, 2B, 3A, 4 (UT)		Beaver Creek-Price River	
		2B, 3C, 4 (UT)		Cottonwood Wash-Price River	
		2B, 3C, 4 (UT)		Little Park Wash-Price River	
	San Rafael River	2B, 3C, 4 (UT)	Bioassay	Upper San Rafael River	
	Huntington Creek	1C, 2B, 3A, 4 (UT)	TMDL: TDS - Removed in 2010 listing	Huntington Creek	
			Se		
	Cottonwood Creek	1C, 2B, 3A, 4 (UT)	TMDL: TDS	Cottonwood Creek	
	Scofield Reservoir	1C, 2B, 3A, 4 (UT)	TMDL: DO, P, pH	Scofield Reservoir	
	Lower Gooseberry Reservoir	1C, 2B, 3A, 4 (UT)	DO, P, pH		
	Quitchupah Creek	2B, 3A, 4 (UT)	Bioassay	Ivie Creek	Upper Colorado-Dirty Devil
	Soldier Creek (trib. Spanish Fork River)	2B, 3A, 4 (UT)	P, Sed/Silt	Soldier Creek	Jordan
	Currant Creek (trib. Mona Res)	2B, 3A, 4 (UT)	Temp, pH	West Creek	
	Salina Creek	2B, 3B, 4 (UT)	TMDL: TDS	Salina Creek	Escalante Desert-Sevier Lake
	San Pitch River	2B, 3A, 4 (UT)	NA	Upper San Pitch River	
	Sevier River	2B, 3B, 4 (UT)	NA	Upper Sevier River	
				Middle Sevier River	
III	Sevier River	2B, 3C, 4 (UT)	NA	Lower Sevier River	Escalante Desert-Sevier Lake
	Beaver River	2B, 3C, 4 (UT)	NA	The Big Wash-Beaver River	
				Morehouse Canyon-Beaver River	
				Upper Beaver River	
				Lower Beaver River	
	Newcastle Reservoir	2B, 3A, 4 (UT)	TMDL: DO, P	Escalante Valley-Pinto Creek	

Table 3.4-3 Major Rivers and Impaired Waters within Analysis Area and Project Regions

Project Region	River/Impaired Water	Water Quality Use Classification[3]	Reason for Impairment/TMDL[1,2]	Watershed	Hydrographic Basin
	Pinto Creek	2B, 3A, 4 (UT)	Bioassay		
	Baker Dam Reservoir	2B, 3A, 4 (UT)	DO	Upper Santa Clara River	Lower Colorado-Lake Mead
	Santa Clara River	2B, 3A, 4 (UT)	NA		
		1C, 2B, 3B, 4 (UT)	Temp, B	Lower Santa Clara River	
	Gunlock Reservoir	1C, 2A, 3B, 4 (UT)	TMDL: DO		
	Meadow Valley Wash	A (NV)	P, Temp, B	Kershaw Canyon-Meadow Valley Wash	
				Lower Meadow Valley Wash	
	Muddy River	B (NV)	Temp, Fe, DO, P	Upper Muddy River	
	Muddy River	C (NV)	Temp, Fe, B, Mo, Mn	Lower Muddy River	
	Virgin River	A (NV)	Fe, Temp, P, Mn	Sand Hollow Wash-Virgin River	
				Halfway Wash-Virgin River	
IV	Duck Creek	NA	Se, TDS,	Duck Creek-Las Vegas Wash	Lower Colorado-Lake Mead
	Las Vegas Wash	D (NV)	Fe, Mo; TMDL: P, NH3, Chlor		
	Colorado River	B (NV)	DO, Temp	Jumbo Wash-Colorado River	Lower Colorado-Below Hoover Dam

1 TMDL – Total Maximum Daily Load.

2 Phys Alt – Physical Alterations; Sed – Sediment; Fe – Iron; Se – Selenium; Cl – Chloride; Bo – Boron; TDS – Total Dissolved Solids; As – Arsenic; DO – Dissolved Oxygen; P – Phosphorous; Temp – Temperature; NA – Not Applicable; Mo – Molybdenum; Mn – Manganese; NH_3 – Ammonia; Chlor – Chlorophyll-a.

3 Water quality use classification notations:

Wyoming (Wyoming Department of Environmental Quality 2001): 2AB- Drinking Water, Game and Non-game Fish, Fish Consumption, Other Aquatic Life, Recreation, Wildlife, Agriculture, Industry, Scenic Values; 2C- Drinking Water, Other Aquatic Life, Recreation, Wildlife, Agriculture, Industry, Scenic Values.

Colorado (Colorado Department of Public Health and Environment 2013a,b): A- Aquatic Life Cold 1, Recreation E, Water Supply, Agriculture; B- Aquatic Life Warm1, Recreation E, Water Supply, Agriculture; C- Aquatic Life Cold 1, Recreation E, Agriculture; D- Aquatic Life Warm 2, Recreation P, Agriculture; E- Aquatic Life Warm 2, Recreation E, Agriculture.

Utah (Utah Administrative Code 2014): 1C- Domestic purposes; 2A- Recreation, frequent primary contact; 2B- Recreation, infrequent primary contact ;3A- Cold water game fish; 3B- Warm water game fish; 3C- Nongame fish; 4- Agriculture.

Nevada (Nevada Administrative Code [NAC] 2012): A- Livestock, Irrigation, Aquatic, Noncontact, Industrial, Wildlife; B- Livestock, Irrigation, Aquatic, Contact, Noncontact, Municipal, Industrial, Wildlife; C- Livestock, Irrigation, Aquatic, Contact, Noncontact, Industrial, Wildlife; D- Livestock, Irrigation, Aquatic, Noncontact, Wildlife, Marsh.

Water use by Project Region is tabulated in **Table 3.4-4**. Regions I, II, and III reflect the majority of usage for agriculture. Other substantial uses (greater than 1 percent) include thermoelectric and public supply. Relatively small uses (less than 1 percent) of water include industrial, livestock, mining, aquaculture, and domestic purposes. The major use in Region IV is public supply, with substantial uses for thermoelectric, irrigation, and domestic uses. Small uses for industrial applications, mining, and livestock also are present in Region IV (Kenny et al. 2009).

Table 3.4-4 Water Uses (Surface Water and Groundwater) in 2005 by Project Region

Project Region[1]	Unit[2]	Irrigation	Public Supply	Thermo-electric	Domestic	Industrial	Livestock	Aqua-culture	Mining (incl. Oil and Gas)	Total Water Use
I	acre-feet/year	703,147	17,060	41,546	706	1,859	1,837	907	1,714	768,776
	Percent	91	2	5	0.1	0.2	0.2	0.1	0.2	
II	acre-feet/year	3,423,837	189,864	85,825	5,858	16,993	7,449	48,357	5,153	3,783,335
	Percent	90	5	2	0.2	0.4	0.2	1	0.1	
III	acre-feet/year	955,145	60,700	25,080	2,711	2,083	6,116	280	1,479	1,053,594
	Percent	91	6	2	0.3	0.2	1	<0.1	0.1	
IV	acre-feet/year	17,474	602,031	28,239	23,870	5,993	146	0	3,002	680,755
	Percent	3	88	4	4	1	<0.1	0	0.4	
Total	Percent	81	14	3	1	0.4	0.2	1	0.2	6,286,461

[1] Water use reported by county. The counties crossed within each Project Region were totaled and reported.

[2] Percent is of total water use in that Project Region.

Sources: Kenny et al. 2009.

3.4.6 Impacts to Water Resources

Potential impacts to water resources were identified through federal and state agency consultation and public scoping. These include potential impacts to surface water quality and quantity, such as increased erosion, sediment loads, turbidity, increased ion or salt concentrations, stream channel instability, and increased consumptive use of water. Also considered are potential impacts to springs and groundwater quality, such as degraded water quality or increased consumptive use.

Impacts to water resources would occur during the construction phase of the Project by ground disturbance for roadway, power line, terminal, temporary work areas, and electrode bed construction. Because of the disturbance and lack of vegetative cover, increased susceptibility to erosion would affect water quality through increases to turbidity, dissolved and suspended solids, sedimentation, and potentially increased salt/ion or metals concentrations. Additionally, the reduced vegetative cover and reduced infiltration rates from soil compaction would affect water quantity through an increased runoff rate, thus increasing streamflow. Impacts to water quantity would be reduced when water is used for concrete batching and dust abatement. Impacts from ground disturbance would continue into the operational phase at more localized areas where permanent disturbance occurs or where roads are constructed or widened at stream crossings, ephemeral drainage ways, or in close proximity to streams. Impacts of the decommissioning phase would be similar to those anticipated during construction. The POD would include several specific plans relevant to water resources, including a Wetlands and Waters of the U.S. Plan, an Erosion Control Plan, and a Storm Water Pollution Prevention Plan (SWPPP), which would each address specific environmental impacts or localized conditions (TWE-19 and TWE-20). Analysis considerations and assumptions for water resources are described in **Table 3.4-5**.

Table 3.4-5 Relevant Analysis Considerations for Water Resources

Resource Topic	Analysis Considerations and Assumptions
Water quality (sedimentation) effects at waterway crossings	Quantify the number of perennial and intermittent waterbodies and crossings. Evaluate adequacy of design features and BMPs for disturbance restoration, sediment control, and bank restoration. It is assumed that the number of stream crossings along alignments indicates the number of crossings by access roads. Quantify the acres of construction and operation disturbance within 300 feet and 100 feet of perennial streams. Quantify the change in road density from the construction and use of access roads within 300 feet and 100 feet of perennial streams.

Table 3.4-5 Relevant Analysis Considerations for Water Resources

Resource Topic	Analysis Considerations and Assumptions
Water quality (sedimentation) effects from upland disturbance	Quantify the size of construction disturbance areas. Estimate the relation to receiving perennial, intermittent, and ephemeral waterway crossings. Evaluate adequacy of design features and BMPs for disturbance restoration, sediment control, and bank restoration. Quantify the change in road density from the construction and use of access roads.
Floodplain obstruction and flooding damage	Identify locations of structures and/or ancillary facilities that would be constructed in river floodplain areas with the potential to obstruct overbank flows. A maximum span length of 1,500 feet is assumed; any floodplains requiring spans larger than this will require structures within the floodplain.
Water availability and use	Compare volume of water needed for Project construction to proposed water sources. Consider Project withdrawal rates and water demand at sources. Quantify water use from the Platte River and Colorado River basins.
Accidental releases of hazardous materials	Identify areas where accidental releases could impact both surface and groundwater quality. Evaluate adequacy of design features and BMPs to minimize and control releases.

Analyses Methodologies

GIS analyses were performed to quantify the number of stream crossings based on the alignment as well as the amount of potential disturbance based on the footprint of each alternative. Impacts to water quantity were analyzed by comparing the potential water use needed for construction of each alternative along with discussion regarding proposed sources. TransWest indicates that placement of structures in floodplains would be avoided with 1,500-foot spans between towers; however, floodplains crossed by alternatives for lengths greater than approximately 1,000 feet have been identified as areas that may necessitate potential tower sites. Due to the lack of consistent floodplain mapping in the analysis area, this was accomplished though desktop analysis of topographic maps and aerial photography.

Waterway Crossings

Although the exact locations of access roads have not been identified, the count of stream crossings by the alignments along each alternative route has been analyzed as a parameter to estimate the magnitude of impacts from stream crossings during construction, operation, and decommissioning. Additionally, streams with impaired water quality and the reasons for the impairment are identified. This approach provides an overestimate of crossings considering TransWest would avoid crossings where possible by utilizing existing roads. Sedimentation impacts from utilization of existing roads are anticipated to be significantly less than impacts from construction of new roads. Furthermore, TransWest has estimated the disturbance from construction of access roads in different terrain types as a function of the length of the alignment (see **Appendix D**). An Access Road Plan would be developed by TransWest for the agency preferred alternative during final engineering and design, which would define site-specific access to each structure and temporary work area, including identification of necessary water-crossings, and would be included as part of the COM Plan.

Construction and operation ground disturbance within 100 feet and 300 feet of perennial waterways was quantified using the general methodology described in Chapter 3.0, Affected Environment and Environmental Consequences. This was done to provide an indication of relative impact risk to water quality from increased erosion and sedimentation. Impacts to water quality from disturbance would decrease with increased distance from the streams. Because TransWest has committed to minimize the impacts to water resources and because there are multiple agency BMPs and stipulations that regulate disturbance near streams (see **Appendix C**), this methodology provides a conservative (overestimate) quantification of disturbance near streams.

Upland Disturbance

Ground disturbance was quantified using the general methodology described in Chapter 3.0, Affected Environment and Environmental Consequences. The analysis of indirect impacts to surface water quality is based on the assumption that surface disturbance within a given watershed serves as an indicator of the potential for increased sediment and salt runoff, and the acreage of disturbance is used as an impact parameter. Marston and Dolan (1988) conducted research to investigate the major criteria that control upland erosion in an environment similar to many locations within the analysis area. This research showed that slope and vegetative cover exert the most influence on upland erosion rates. Erosion was found to be inversely correlated with vegetation density (i.e., as vegetation density decreases, upland erosion increases).

The surface disturbance associated with the proposed Project would initially remove vegetative cover, which would increase surface runoff and exacerbate erosion. Areas needed for operation of the Project would remain disturbed, including the terminals and access roads; temporary work areas would be reclaimed. Once reclamation is complete in the temporary work areas, the vegetative cover would be reestablished, thereby decreasing erosion. As the vegetative cover approaches desired density levels, the erosion rate also would approach pre-construction levels. This is expected to occur within 3 to 5 years of initiating reclamation under general conditions (Monsen et al. 2004); however, areas of limited revegetation potential (see Section 3.3, Soil Resources) and periods of minimal precipitation or locally heavy high intensity storms might extend this timeframe.

Road Density

Increased road density was analyzed within each affected watershed (HUC10) as a parameter to address impacts from increased erosion from construction and use of new roads. Existing road density was calculated as miles of road per square mile of watershed utilizing the TIGER Roads dataset (U.S. Census Bureau 2010) and the WBD (NRCS et al. 2010). Lengths of Project access roads were determined based on the access road model (see **Appendix D**) and were added to the lengths of existing roads and density was recalculated by Project alternative. Existing and new road densities also were analyzed separately for the areas within 100 feet and 300 feet of perennial waters as parameters of the change in density near riparian areas where more change in density indicated a greater concentration of ground disturbance, which would constitute a greater impact to water quality in a given watershed. Because TransWest has committed to minimizing impacts to water resources and because there are multiple agency BMPs and stipulations that regulate disturbance near streams (see **Appendix C**), this methodology provides a conservative (overestimates) quantification of road density near streams.

Springs and Seeps

The NHD (NRCS et al. 2010) was used to define locations of springs and seeps across the analysis area. Springs and seeps located within the refined corridor were analyzed along each alternative to provide a metric for potential to affect water quality at each location.

3.4.6.1 Impacts from Terminal Construction and Operation

The Northern and Southern terminals would be constructed regardless of alternative route or design option.

<u>Northern Terminal</u>

The Northern Terminal would be sited in the Sugar Creek watershed near Sinclair, Wyoming, and would require disturbance of 519 acres for construction and 249 acres for operation. This location is in a largely undisturbed upland area with low slopes that drain to the North Platte River approximately 10 miles away. Areas of water-erosion prone soils (see Section 3.3, Soil Resources) as well as herbaceous wetland and woody riparian and wetland vegetative communities (see Section 3.5, Vegetation) are within this location. No streams, waterbodies, springs, or seeps are identified at the site.

During construction of the Northern Terminal, ground disturbance would remove vegetation and exacerbate upland erosion in susceptible areas. Erosion control design features such as water bars, cross drains, and vegetation restoration (TWE-13) would minimize upland erosion by directing runoff away from disturbed areas, decreasing velocities, and improving water infiltration. Agency BMPs including silt fencing (BMP WAT-9) also would mitigate impacts to receiving waterbodies by providing sediment settling locations and engineered water velocity controls.

Water use for substation/converter station construction primarily would be for dust control during site preparation work. During this period, water trucks patrolling the site to control dust would make as many as one pass per hour over the site. Once site preparation work is complete, concrete for the placement of foundations becomes the largest use of water and dust control becomes minimal. Dust control activities are not expected to occur after construction is complete. Water required for construction of the Northern Terminal is estimated to be approximately 1.8 acre-feet (600,000 gallons), including dust control. Because the terminal is located in the Platte River Basin, it is assumed the source(s) of water would be from that basin as well. The required water would be procured from municipal sources, from commercial sources, or through a temporary water use agreement with landowners holding existing water rights. No new water rights would be required.

Magnesium chloride ($MgCl_2$) may be used in dust abatement. Several studies performed along roadways in Colorado where $MgCl_2$ has been used as a dust inhibitor or a deicer indicate that its use might increase the levels of these constituents in waterways depending on application rates, road proximity to waterways, and weather patterns, among others. These studies show that the increases did not approach concentration limits implemented by USEPA in drinking water secondary standards and below levels that adversely affect fresh water aquatic organisms (Goodrich el al. 2009; Lewis 1999; Stevens 2001).

The potential for accidental releases of hazardous materials at the terminal would be greatest during the construction phase; however, this risk also would be present during the operation phase to a lesser extent. Construction and operation equipment and vehicles are potential sources of hazardous materials. Design features that would be implemented include performing refueling and maintenance activities in designated construction zones located more than 100 feet from waterways (TWE-24), and other prevention and containment measures as needed. A Spill Prevention, Control, and Countermeasure (SPCC) Plan would be prepared as part of the COM Plan (TWE-57), as required by federal law.

Conclusion: Through the implementation of the design features and BMPs, and considering the upland location of the terminal that is distant from waterways, little to no impacts to water quality are anticipated from construction disturbance. Terminal construction and operation would not be expected to alter the existing off-site drainage patterns, or degrade the water quality of streams and rivers. Because the need for water during construction is minimal and existing water rights would be utilized, no impacts to other water users would be anticipated. While the risk of accidental releases of hazardous materials would not be completely mitigated, the above described design features would minimize the risk of occurrence. In the event that an accidental release of hazardous materials did occur, it would have to travel more than 2 miles over upland areas and along ephemeral channels to reach a perennial stream (Sugar Creek) at a point greater than 9 miles upstream of the North Platte River.

Southern Terminal

The Southern Terminal or Alternate Southern Terminal would be sited in the Eldorado Valley watershed near Boulder City, Nevada, in an upland area that is already highly developed and drains to playa lakes at the bottom of a closed watershed. No streams, waterbodies, springs, or seeps are identified at either of the sites. Ground disturbance impacts would be similar to those discussed for the Northern Terminal, and the same design features and BMPs would be implemented to minimize impacts. Through the implementation of the design features and BMPs, and considering the upland locations of the terminals that are distant from waterways, little to no impacts to water quality are anticipated from construction disturbance.

These terminals would require disturbance of 557 acres for construction and 226 acres for operation. Water required for construction of the Southern Terminal or the Alternate Southern Terminal is estimated to be approximately 1.2 acre-feet (400,000 gallons), including dust control. The potential for accidental releases of hazardous materials is the same as discussed under the Northern Terminal.

Design Options 2 and 3

If either of the design options were implemented, the Southern Terminal or a substation would be constructed near IPP in Millard County, Utah (see Section 2.4.3.1, Northern and Southern Terminals). The proposed terminal or substation site near IPP is within the Sugarville-Broad Canyon Watershed and drains to the northwest via intermittent channels to a depression lake approximately 3 miles downstream.

The terminal near IPP under Design Option 2 would require 156 acres of construction disturbance and 93 acres of operation disturbance. The substation near IPP under Design Option 3 would require 138 acres of construction disturbance and 75 acres of operation disturbance in the same location. Because similar facilities and structures to the proposed action would be constructed for Design Option 2, it is assumed that the volume of water needed for construction of the terminal would be similar to that of the proposed action's Southern Terminal in the Eldorado Valley (1.2 acre-feet). Design Option 3 would require both the Substation near IPP and the Southern Terminal in the Eldorado Valley, effectively doubling the required water for construction (2.4 acre-feet). The potential for accidental releases of hazardous materials is the same as discussed under the Northern Terminal.

Conclusion: While the risk of accidental releases of hazardous materials would not be completely mitigated, the above described design features would minimize the risk of occurrence. In the event that an accidental release of hazardous materials did occur, the location of this terminal or substation is within and near the bottom of a closed watershed, limiting the geographic extent to this area. Due to the minimal volume of water required for terminal construction, and because existing and active water rights would be utilized, no impacts to other water users would be anticipated. Terminal construction and operation would not be expected to alter the existing off-site drainage patterns.

3.4.6.2 Impacts Common to all Alternative Routes and Associated Components

<u>Construction Impacts</u>

Water quality would be impacted both directly and indirectly from transmission line construction due to the ground disturbance necessary to complete the transmission line and related facilities. Ground disturbance includes areas cleared for construction, such as Project access roads, transmission line tower work areas, conductor stringing and tensioning sites, communication and regeneration sites, material storage yards, batch plants, fly yards, staging areas, and ground electrode systems.

New access roads, facilities, and other disturbed areas would be located away from waterbodies, wherever practicable. Access roads would be designed and constructed to minimize disruption of natural drainage patterns and waterbodies including rivers, streams, ephemeral streams, ponds, lakes, reservoirs, and playas. The BLM requires roads and necessary stream crossings on BLM lands to be designed and constructed according to BLM manuals 9112, 9113, and the relevant RMPs. USFS standards and guidelines contained in the relevant LRMPs would dictate the road designs and construction practices on NFS lands. Practices described in these documents include avoiding development within riparian areas or employing mitigation if avoidance is not practical, siting stream crossings to minimize bank and channel disturbance and at 90-degree offsets (perpendicular) to channels, not siting new roads that parallel streams except where absolutely necessary, stabilization of stream banks which are damaged by development activities with methods that emphasize revegetation, and maintaining the natural complexity of riparian areas and their ability to act as effective sediment buffer zones.

Direct impacts would occur from the construction of access road waterway crossings, including crossings of perennial, intermittent, and ephemeral streams. Any such crossings would require CWA Section 404 permits issued by the USACE. **Appendix F** contains a detailed listing of waterbodies crossed by the proposed Project alignments. Alignment crossings do not equate directly to access road crossings, but are a parameter used to compare impacts across alternatives. These impacts could come in the form of channel instability due to streambank disturbance and increased sediment supply from disturbed areas directly adjacent to the crossings. This may in turn cause increased sediment from mass wasting of channel banks, and down-cutting of the streambed, with resultant changes in channel geomorphology.

Although engineered access road locations have not been determined they will be provided prior to final approval to begin construction. Three types of waterbody crossings are proposed:

1. Drive Through (Arizona Crossing): Crossing of a channel with minimal vegetation removal where no cut or fill is needed. This is typical for low-precipitation sagebrush country characterized by rolling topography and ephemeral streams that rarely flow with water.
2. Ford: Crossing of a channel that includes grading and stabilization. Stream banks and approaches would be graded and stabilized with rock or other erosion control devices to allow vehicle passage. Coarse rock would be installed in the streambed in a manner such that it would not raise the level of the streambed, allowing continued movement of water, fish and debris. This typically would be used on intermittent, larger ephemeral streams, or smaller perennial streams that would be expected to remain passable during a typical runoff season (e.g., estimated average peak streamflow in the magnitude of 100 cubic-feet per second [cfs] or less, and considering water velocity and depth).
3. Culvert: Crossing of a waterbody that includes installation of a culvert and construction of a stable road surface for vehicle passage over the culvert. Construction would occur during periods of low water. Culverts would be a minimum 18-inch-diameter and able to pass a 25-year flow event (BLM and USFS 2007). They typically would be partially buried in the streambed to maintain streambed material in the culvert. Non-erosive material would be placed around culverts to prevent scour or water flow outside the culvert. Stream banks and approaches also might be stabilized with rock or other erosion control devices. Culvert crossings could be used to limit impacts from in-stream erosion due to traffic within intermittent and smaller perennial streams.

During the final design phase, consultation would be conducted with the managing land agency regarding relevant standards and guidelines for waterbody road-crossing methods. Wherever needed, culverts, low-water crossings, and other devices of agency-approved design would be used to accommodate estimated peak flows of waterways (e.g., 25-year flow event) according to the relevant land-managing agency requirements (see **Appendix C**). Each waterbody crossing would be designed and reviewed as advanced engineering is completed. Construction disturbances of banks and beds of waterbodies would be minimized during this design process. Performance of low water stream crossings (i.e., drive through and ford) and culvert installations would be monitored for the life of the access road, and maintained as necessary to preserve water quality. Waterbody crossings would be built as near as possible at right angles (perpendicular) to the streams and washes (TWE-8).

Through the implementation of the Project design features and the engineered design of crossings, the direct impacts would be greatest for short periods of time during construction and through the reclamation process until successful revegetation occurred. Erosion and sedimentation impacts would decrease, but would continue during operation due to the remaining access road disturbance. There are certain waterbodies that the state agencies have identified as having impaired uses due to elevated sediment concentrations or other constituents that might be present in stormwater runoff, among other causes (see **Table 3.4-3**). Access roads crossing these waterbodies would contribute to the sediment being mobilized to these streams. Design Feature TWE-20 states that the applicant will develop a management plan to avoid, reduce, and/or minimize adverse impacts to these streams. Additional BMPs contained in agencies' land-management guidance (BLM FO-specific and forest-specific) would apply to further minimize impacts, such as avoidance zones from waterways and specific requirements for access road crossing designs. These can be found in **Appendix C** and the federal agency documents listed in **Tables 1-3** and **1-4**.

Conclusion: Through the implementation of BMPs and applicant-committed design features, direct impacts to water quality from stream crossings would be limited to times when streamflow was present and/or vehicles were using the crossings or from unstable streambanks contributing sediment.

The following mitigation measures have been prescribed to minimize the impacts to water resources from the direct disturbance of stream channels.

WR-1*: Existing stream crossings would be utilized wherever requested by agencies. This would be developed on a site-specific basis during POD development. Stream crossings would be maintained as appropriate.*

Effectiveness: By avoiding the construction of new crossings, additional long-term direct disturbance to streams would not occur, thus minimizing erosion and streambank stability impacts.

WR-2*: When existing crossings were not used, drive through (Arizona) crossings would not be utilized when unprotected (bare soil) streambeds are wet or when the stream is flowing water.*

Effectiveness: This mitigation would reduce erosion and increase stream stability by limiting the use of crossings from being used during times when the soil is highly susceptible to erosion thus minimizing erosion and streambank stability impacts.

Indirect impacts to water quality could occur from ground disturbance required for construction of proposed Project facilities in upland areas when precipitation events would cause overland runoff to erode bare soils and transport sediment and ions (e.g., salt) to waterways. This would result in sedimentation, increased suspended sediment and ion concentrations, and changes in channel geomorphology and stability. To minimize these impacts, structures would be sited a minimum distance of 200 feet from streams, whenever possible (TWE-8). Surface restoration would occur as required by the landowner or managing agency, returning the disturbed areas back to their natural contour, reseeding, and installing erosion control when necessary (TWE-13). Runoff from excavated (disturbed) areas would be controlled (TWE-22). Areas that would not require cut-and-fill for creation of a level workspace would have vegetation left in place wherever possible to maintain vegetation roots and increase soil stability (TWE-27). BMPs such as silt fences and check dams would further minimize this type of impact by trapping sediments or slowing the flow and allowing them to settle out of runoff before reaching the streams (BMP WAT-9). The CWA Section 402 requires that construction stormwater permits be obtained. These permits are administered by the states and would include these and other required BMPs to minimize water quality impacts. Additional agency BMPs and stipulations found in **Appendix C**, BLM RMPs, and USFS standards and guidelines also would be required as applicable. In some cases, these include setbacks from waterways as large as one quarter-mile. As successful reclamation and revegetation of the ground disturbance areas progress over multiple years, the erosion potential would decrease, nearing the pre-construction levels for all areas except those remaining disturbed during operation such as access roads.

The design features and BMPs discussed above and included in the Erosion Control Plan and SWPPP would minimize runoff and erosion from disturbed areas; however, impacts from proposed Project construction would result in increased erosion rates and sediment being delivered to streams. Although increased erosion would be expected, the disturbance would be dispersed along the linear path of the proposed Project. No significant alterations to the existing drainage patterns or increases of off-site erosion would be expected from the disturbance of upland areas by the proposed Project.

The following mitigation measures have been prescribed to minimize the impacts to water resources from erosion caused by the disturbance of upland areas.

WR-3: *As part of the ROW grant and prior to the final agency authorization for construction, TransWest would consult with federal agencies having land jurisdiction regarding location and design of access roads and temporary work areas near impaired streams to avoid erosion and sedimentation effects. The proposed design and location of new and upgraded access roads and temporary work areas within watersheds (HUC10) containing sediment- or ion-impaired waters (according to 303(d) lists) would be provided by TransWest to the agencies upon completion of conceptual design of these facilities. The agencies would coordinate and provide input (as deemed applicable by the agencies) to TransWest for modification of locations and designs within TransWest's final engineering schedule to prevent the Project from contributing additional sediment to impaired waters.*

Effectiveness: Consultation with agencies would encourage the consideration of best-science tools and local information, thus maximizing the final design process.

WR-4*: As part of the Erosion Control Plan, TransWest would include monitoring of erosion and sedimentation effects that would be recorded as part of the construction stormwater permits. In the event that the agencies deem erosion control measures ineffective, the agencies and TransWest would coordinate to develop additional measures for TransWest to implement for erosion control.*

Effectiveness: The ability to adjust, improve, and include additional control measures when existing measures are shown less effective than desired would ensure their applicability through potential condition changes.

Transmission line structures located in floodplains have the potential to obstruct overbank flood flows, and to increase the risk of damage to the structures from debris in the water colliding with structures or by flows scouring around structure foundations. Agency land use plans often contain stipulations that limit or mitigate the placement of permanent structures or project development in floodplains (**Appendix C**). Proposed Project design features address facilities located in wetlands and waters of the U.S. and state that the applicant would avoid locating structures in wetlands and waters of the U.S. (TWE-20 and TWE-8), but do not specifically address structures in floodplains (see Section 3.5, Vegetation, for information on wetlands). The majority of floodplains could be spanned by the proposed transmission line, which has potential spans of up to 1,500 feet or more. Where a floodplain is wider than 1,500 feet, transmission line tower structures may require placement within the floodplain. Access roads are not anticipated to impact floodplains because they would be at grade and have minimal disturbance within floodplains. Floodplain development requirements are administered by the states and/or counties that would be crossed in accordance with Federal Emergency Management Agency regulations (44 CFR 60) and permit conditions would stipulate that structures must be engineered to withstand flood events and that no flood flow patterns would be altered.

Although transmission line tower structures may be necessary in floodplains, due to their "skeletal" design and minimal footprint (1 to 5 foundations per tower depending on type, approximately 10-foot-diameter each, see **Appendix D**), and through adherence to the permit requirements, they would not be expected to impede or redirect flood flows, adversely affect the capacity of the floodplains, or affect the pattern and magnitude of flood flows. Furthermore, because the span lengths could allow for placement of towers at distances of hundreds of feet from active river channels, no scour would be expected that would result in structural or property damage or that would impact the stability of the bed and banks of a waterway.

Water use for transmission line construction would be for two primary purposes: foundation construction and ROW dust control. The required water would be procured from municipal sources, from commercial sources, or from temporary water use agreements with landowners holding existing water rights currently being used. No new water rights would be required. The estimated water required per mile of transmission line construction is approximately 3,400 gallons for foundation concrete and 240,000 gallons for dust control, totaling approximately 243,400 gallons (or approximately 0.75 acre-feet) per mile. Water requirements from each Hydrographic Region crossed (**Table 3.4-1**) are estimated based on the length of alignment crossing each region.

Because existing water rights and uses (current depletion) would be utilized, no new impacts to other water users or the water source would be anticipated. The effect of water depletions to special status aquatic species are discussed in Section 3.10.6, Impacts to Special Status Aquatic Species, including potential impacts specific to water depletions affecting species from the North Platte or Colorado River systems.

Spills or leaks of petroleum products and other hazardous materials from construction vehicles and equipment could impact water resources if they were to occur near, or be transported to, a waterway. TransWest has committed to refuel and service vehicles in designated construction zones that are located more than 100 feet from waterways. Spill prevention and containment practices would be incorporated as needed (TWE-24), which would lessen the likelihood for a release and provide containment if a release occurred. A Hazardous Materials Management Plan would be prepared and all waste, including petroleum products and other potentially hazardous materials, would be removed to an authorized disposal facility (TWE-61). A SPCC Plan would be prepared as part of the COM Plan (TWE-57). If a reportable release occurs, the applicable agencies would be notified. TransWest's contractor responsible for a release would be responsible for the clean-up (TWE-62).

While the risk of accidental releases of hazardous materials would not be completely mitigated, the above described design features would make it highly unlikely that water quality would be impacted due to proposed Project construction.

Tower foundations would generally be less than 15 to 25 feet deep, with potential for foundations up to 60 feet deep for tubular steel towers. These towers are currently only proposed for use in highly constrained urban areas. Because of the linear nature and relatively shallow depth of excavations required for the proposed Project, no impacts to groundwater resources are anticipated.

<u>Operation Impacts</u>

Water quality would be impacted both directly and indirectly during the operation of the proposed Project due to ground disturbance of permanent access roads and areas of unsuccessful reclamation due to poor reclamation potential.

Direct impacts at waterway crossings similar to those discussed for the construction phase would be anticipated. As stated in the construction phase discussion, the performance of low water stream crossings (i.e., drive through and ford) would be monitored as required by the agency for the life of the access road, and maintained as necessary to preserve water quality. Additionally, culverts installed in appropriate waterway crossings would be kept in good repair for the life of the access road.

This monitoring and maintenance, along with the design features discussed under construction impacts would decrease impacts to water quality; however, the proposed Project would continue to contribute sediment from access road crossings. Existing drainage patterns would likely begin to stabilize as vehicle use at crossings was minimized during operations, but any changes in channel geomorphology that were created by construction would continue to alter stream channels and drainage for years until a new, stable channel is created either by reclamation efforts or the cycles of nature (10 to 100+ years).

Indirect impacts from bare soils on permanent access roads could occur by creating sedimentation issues and increased suspended sediment concentrations in streams. Design features such as water bars across the roads (TWE-13) would decrease this impact by diverting water to undisturbed areas, thus, limiting the distance that water would run down disturbed areas and slowing the runoff once it reached the undisturbed, vegetated areas.

The design features and BMPs discussed under construction impacts and included in the Erosion Control Plan and SWPPP would apply during Project operation and would minimize erosion from disturbed areas. However, increased erosion and sediment delivery would occur to streams from the access roads during periods of precipitation or snowmelt, especially in areas where roads are located in close proximity to streams.

Spills or leaks of petroleum products and other hazardous materials from operation and maintenance vehicles and equipment could impact water resources in the same manner as discussed under construction impacts; however, the risk for impacts is less due to a reduced number of vehicles and equipment in use.

While the risk of accidental releases of hazardous materials would not be completely mitigated, the design features discussed under construction impacts would apply during operations and would make it highly unlikely that water quality would be impacted due to Project operation.

Decommissioning Impacts

Impacts to water resources during the decommissioning phase of the proposed Project would be similar to construction impacts. However, upon completion of the decommissioning phase and successful reclamation, impacts to water resources would be expected to decrease below the operations phase through cessation of Project traffic for operations and maintenance, and removal of facilities.

3.4.6.3 Region I

Table 3.4-6 provides a tabulation of impacts associated with the alternative routes in Region I. Key impact parameters relate to the impact discussion in Section 3.4.6.3, Impacts Common to All Alternative Routes and Associated Components. Changes to road density within the affected watersheds (HUC10) are tabulated in **Table 3.4-7**. Specific differences by alternative are discussed below.

Table 3.4-6 Summary of Region I Alternative Route Impact Parameters

Parameter	Alternative I-A	Alternative I-B	Alternative I-C	Alternative I-D
Waterbody Crossings (count)				
Total	252	261	321	297
Perennial	9	9	11	10
Intermittent	235	244	296	279
Canals	0	0	7	0
Reservoirs/Lakes	8	8	7	8
Impaired	2	2	5	2
Known Springs/Seeps in refined corridor	0	1	1	2
Floodplains over 1,000-feet wide (count)	2	2	3	3
Water Use (acre-feet)[1]	116	117	139	126
Construction Disturbance (acres)	2,072	2,101	2,484	2,212
Operation Disturbance (acres)	462	471	554	480
Construction Disturbance in Watersheds with Sediment, Ion, or Alteration Impaired Steams (acres/percent of watershed)				
Deception Creek-Yampa River	--	--	183/0.1%	--
Fortification Creek	--	--	258/0.2%	--
Greasewood Gulch-Little Snake River	393/0.2%	393/0.2%	--	393/0.2%
Hells Canyon-Yampa River	37/<0.1%	37/<0.1%	37/<0.1%	37/<0.1%
Lower Muddy Creek	--	--	294/0.1%	189/0.1%
Spring Creek-Yampa River	226/0.1%	226/0.1%	226/0.1%	226/0.1%
Upper Muddy Creek	--	--	168/0.1%	5/<0.1%

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Table 3.4-7 Summary of Road Density Changes by Watershed (HUC10) in Region I

Watershed Name	HUC10[2]	Existing Density (mi/mi²)			Alternative I-A Added Density (mi/mi²)			Alternative I-B Added Density (mi/mi²)			Alternative I-C Added Density (mi/mi²)			Alternative I-D Added Density (mi/mi²)		
		100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC
Deception Creek-Yampa River	1405000204	0.65	1.55	1.33	–	–	–	–	–	–	0.06	0.06	0.08	–	–	–
Dry Creek-Yampa River	1405000111	1.64	2.20	1.94	–	–	–	–	–	–	0.03	0.04	0.08	–	–	–
Elkhead Creek	1405000106	0.82	1.36	1.00	–	–	–	–	–	–	0.01	0.01	0.02	–	–	–
Fortification Creek	1405000107	1.19	2.00	1.36	–	–	–	–	–	–	0.11	0.12	0.10	–	–	–
Fourmile Creek	1405000305	0.59	1.03	1.02	–	–	–	–	–	–	0.08	0.36	0.08	–	–	–
Frewen Lake	1404020004	0.50	1.59	2.08	0.50	0.43	0.09	0.50	0.43	0.09	–	–	0.01	–	–	0.09
Greasewood Gulch-Little Snake River	1405000309	0.38	0.66	0.86	0.04	0.04	0.12	0.04	0.04	0.12	–	–	–	0.04	0.04	0.12
Hells Canyon-Yampa River	1405000206	0.17	0.51	0.68	–	–	0.01	–	–	0.01	–	–	0.01	–	–	0.01
Little Snake River-Powder Wash	1405000308	0.31	0.58	1.25	–	–	0.05	–	–	0.05	–	–	–	–	–	0.05
Little Snake River-Willow Creek	1405000302	0.54	1.12	1.38	–	–	–	–	–	–	0.05	0.04	0.03	–	–	–
Lower Muddy Creek	1405000403	1.08	2.12	1.36	–	–	–	–	–	–	0.07	0.05	0.07	0.01	0.01	0.05
Lower Sand Creek	1405000307	0.99	1.79	0.88	–	–	0.06	–	–	0.07	–	–	–	–	0.35	0.07
Morgan Gulch-Yampa River	1405000202	3.43	3.17	1.53	–	–	–	–	–	–	–	0.02	0.07	–	–	–
Red Wash	1405000402	1.25	2.37	1.32	–	–	0.07	–	–	0.07	–	0.06	0.01	–	–	0.04
Spring Creek-Yampa River	1405000205	0.46	1.01	1.03	0.03	0.03	0.07	0.03	0.03	0.07	–	–	0.07	0.03	0.03	0.07
Sugar Creek	1018000213	1.44	2.39	2.58	0.08	0.05	0.06	0.08	0.05	0.06	0.08	0.05	0.06	0.08	0.05	0.06
Upper Muddy Creek	1405000401	1.02	1.90	1.50	–	–	–	–	–	–	0.06	0.05	0.08	–	–	–
Upper Separation Creek	1404020013	3.45	4.50	2.07	–	–	0.07	–	–	0.07	–	–	0.08	–	–	0.07
Wolf Creek	1405000701	4.49	5.16	1.28	–	–	0.06	–	–	0.06	–	–	0.06	–	–	0.06

[1] Watershed contains stream(s) that currently are on the states' 303(d) Impaired Streams lists for sedimentation and/or physical alterations.

[2] Ten digit USGS HUC, unique to each watershed.

Notes: Road density is reported as miles of road divided by square miles of area. Blanks indicate watershed is not affected by the alternative.

100 feet: area of watershed within 100 feet of a perennial waterway; 300 feet: area of watershed within 300 feet of a perennial waterway; HUC10: entire HUC10 Watershed area.

Sources: NRCS et al. 2010; U.S. Census Bureau 2010.

Alternative I-A (Applicant Proposed)

Key Parameters Summary

Alternative I-A would entail the crossing of nine perennial streams, two of which are impaired. The Little Snake River (in Colorado) is impaired due to elevated sediment concentrations. The Yampa River has elevated sediment and iron concentrations. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to only include the potential for unstable streambanks to contribute sediment to the stream. The nearest existing crossing of the Little Snake River is nearly 4 straight line miles away on SH-318 near Two Bar Ranch and the nearest crossing of the Yampa River is nearly 5 straight line miles away on SH-318 near Sunbeam, Colorado.

Although many factors affect erosion in upland areas and sedimentation to streams (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative I-A generally increases by no more than 0.1 mi/mi^2, with one watershed (Frewen Lake) increasing by 0.50 mi/mi^2 within 100 feet of perennial waterways. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 116 acre-feet of water. Approximately 8 acre-feet of this need would come from the North Platte River drainage, with the remainder coming from the Upper Colorado drainage. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effect on other water users would be anticipated.

Alternative I-B (Agency Preferred)

Key Parameters Summary

Alternative I-B would entail the crossing of nine perennial streams, two of which are impaired. The Little Snake River (in Colorado) is impaired due to elevated sediment concentrations. The Yampa River has elevated sediment and iron concentrations. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would include the potential for unstable streambanks to contribute sediment to the stream. The nearest existing crossing of the Little Snake River is nearly 4 straight line miles away on SH-318 near Two Bar Ranch and the nearest crossing of the Yampa River is approximately 5 straight line miles away on SH-318 near Sunbeam, Colorado.

Although many factors affect erosion in upland areas and sedimentation to streams (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative I-B generally increases by no more than 0.1 mi/mi^2, with one watershed (Frewen Lake) increasing by 0.50 mi/mi^2 within 100 feet of perennial waterways. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 117 acre-feet of water. Approximately 8 acre-feet of this need would come from the North Platte River drainage, with the remainder coming from the Upper Colorado drainage. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effect on other water users would be anticipated.

Tuttle Ranch Micro-siting Options 3 and 4

The Tuttle Ranch Micro-siting Options 3 and 4 would not cross any perennial streams. However, crossings of intermittent streams would increase under either option when compared to the main alternative. As such, neither option would provide a decrease to impacts of water resources, and instead impacts would be slightly greater than those disclosed for the main alternatives above.

Alternative I-C

Key Parameters Summary

Alternative I-C would entail 11 perennial stream crossings, 5 of which are impaired waters. Fortification Creek is impaired due to elevated selenium concentrations and the Yampa River (crossed 3 times) is impaired for elevated sediment and iron concentrations. One crossing of Muddy Creek (out of three crossings) and downstream from this alternative are impaired due to elevated selenium and chloride concentrations, and physical alterations. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measure **WR-1**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to the stream. As part of mitigation measure **WR-1**, the existing crossings of Muddy Creek and Fortification Creek along SH-789 would be utilized by the Project and no new crossings would be constructed. Likewise, existing crossings of the Yampa River around Craig, Colorado, and along US-40 would be utilized.

Although many factors affect erosion in upland areas and sedimentation to streams (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density, especially near perennial waterways. Road density due to Alternative I-C generally increases no more than 0.1 mi/mi^2, with the exception of two watersheds where the highest increase is 0.36 mi/mi^2 in Fourmile Creek Watershed. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 139 acre-feet of water. Approximately 8 acre-feet of this need would come from the North Platte River drainage, with the remainder coming from the Upper Colorado drainage. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effect on other water users would be anticipated.

Alternative I-D

Key Parameters Summary

Alternative I-D would entail the crossing of 10 perennial streams, 2 of which are impaired. The Little Snake River (in Colorado) is impaired due to elevated sediment concentrations. The Yampa River has elevated sediment and iron concentrations. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to only include the potential for unstable streambanks to contribute sediment to the stream. The nearest existing crossing of the Little Snake River is nearly 4 straight line miles away on SH-318 near Two Bar Ranch and the nearest crossing of the Yampa River is approximately 5 straight line miles away on SH-318 near Sunbeam, Colorado.

Although many factors affect erosion in upland areas and sedimentation to streams (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative I-D increases no more than 0.12 mi/mi^2, with the exception of one watershed where the highest increase is 0.35 mi/mi^2 in Lower Sand Creek Watershed. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 126 acre-feet of water. Approximately 8 acre-feet of this need would come from the North Platte River drainage, with the remainder coming from the Upper Colorado drainage. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effect on other water users would be anticipated.

Alternative Ground Electrode Systems in Region I

It would be necessary to locate the northern ground electrode system within 100 miles of the Northern Terminal as discussed in Chapter 2.0. Conceptual locations and connections to the alternative routes have been provided by TransWest. The impacts associated with constructing and operating this system are the same as those discussed in Section 3.4.6.3, Impacts Common to All Alternative Routes and Associated Components. **Table 3.4-8** summarizes impacts associated with the alternative location possibilities for the northern ground electrode system.

Table 3.4-8 Summary of Region I Alternative Ground Electrode System Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use[1] (acre-feet)	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canal	Reservoirs/Lakes	Impaired				
Bolten Ranch (All Alternatives)	23	1	22	0	0	0	0	11	151	52
Separation Flat (All Alternatives)	23	0	23	0	0	0	0	9	121	36
Separation Creek (All Alternatives)	0	0	0	0	0	0	0	1	76	11
Eight Mile Basin (All Alternatives)	7	0	7	0	0	0	0	4	89	18

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Region I Conclusion

Within Region I, Alternative I-C exhibits the highest impacts of all alternatives, with the most streams crossed, impaired streams crossed, floodplains crossed, water use, and construction and operation disturbance. Alternative I-D also has a higher number of crossings, floodplains, and disturbance within watersheds with impaired streams when compared to Alternatives I-A and I-B. There is no distinct difference in potential impacts to water resources between Alternatives I-A and I-B. Regardless of the alternative the overall disturbance from the Project is relatively low in the watersheds crossed, and through effective implementation of design features, BMPs, and proposed mitigation, the adverse impacts to water quality would be prevented. Water quantity impacts would be minimized as well because the need is minimal compared to the overall current water use and availability.

3.4.6.4 Region II

Table 3.4-9 provides a tabulation of impacts associated with the alternative routes in Region II. Key impact parameters relate to the impact discussion in Section 3.4.6.3, Impacts Common to All Alternative Routes and Associated Components. Changes to road density within the affected watersheds (HUC10) are tabulated in **Table 3.4-10**. Specific differences by alternative are discussed below.

Table 3.4-9 Summary of Region II Alternative Route Impact Parameters

Parameter	Alternative						
	II-A	**II-B**	**II-C**	**II-D**	**II-E**	**II-F**	**II-G**
Waterbody Crossings (count)							
Total	383	585	550	358	431	371	389
Perennial	32	34	40	24	55	31	29
Intermittent	334	537	489	331	366	337	345
Canals	7	10	16	1	8	1	6
Reservoirs/Lakes	10	4	5	2	2	2	9
Impaired	4	40	42	1	26	9	4
Known Springs/Seeps in refined corridor	6	7	5	2	7	4	6
Floodplains over 1,000 feet wide (count)	2	4	4	1	2	1	2
Water Use (acre-feet)	193	259	273	193	201	202	188
Construction Disturbance (acres)	3,759	4,874	4,981	3,970	3,977	4,226	3,703
Operation Disturbance (acres)	1,011	1,210	1,163	1,089	1,058	1,196	1,014
Construction Disturbance in Watersheds with Sediment, Ion, or Alteration Impaired Streams (acres/percent of watershed)							
Antelope Creek	--	--	--	1/<0.1%	320/0.3%	1/<0.1%	--
Coal Creek-Price River	--	45/<0.1%	--	8/<0.1%	--	--	--
Cottonwood Creek	--	199/0.1%	90/<0.1%	--	--	--	--
Duchesne River	40/<0.1%	--	--	--	55/0.1%	--	40/<0.1%
Evacuation Creek	--	285/0.2%	285/0.2%	--	--	--	--
Huntington Creek	--	303/0.1%	106/<0.1%	83/<0.1%	--	--	--
Lower Pariette Draw	--	--	--	57/<0.1%	--	57/<0.1%	--
Lower Strawberry River	45/<0.1%	--	--	--	--	--	45/<0.1%
McDonald Creek-Colorado River	--	34/<0.1%	34/<0.1%	--	--	--	--
Outlet Douglas Creek	--	237/0.2%	237/0.2%	--	--	--	--
Pigeon Water Creek-Lake Fork River	92/0.1%	--	--	--	79/0.1%	--	92/0.1%
Salina Creek	--	--	303/0.2%	--	--	--	--
Soldier Creek	296/0.2%	--	--	--	415/0.3%	415/0.3%	296/0.2%
Upper Pariette Draw	--	--	--	49/<0.1%	--	49/<0.1%	--
West Salt Creek	--	340/0.3%	340/0.3%	--	--	--	--
Westwater Creek-Colorado River	--	78/0.1%	78/0.1%	--	--	--	--

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

<u>Alternative II-A (Applicant Proposed)</u>

Key Parameters Summary

Alternative II-A would entail the crossing of 32 perennial streams, four of which are impaired. The State of Utah Department of Environmental Quality (UDEQ) has developed a TMDL for total dissolved solids

(TDS) on the Lake Fork River and has requested that the Lake Fork River be delisted (UDEQ 2010). The Duchesne River is impaired because of elevated TDS concentrations and elevated water temperature, and observed bio-toxicity. Soldier Creek is impaired due to elevated nutrients, phosphorus, and sedimentation; Lake Fork (tributary of Soldier Creek) is listed as an impaired stream due to elevated TDS concentrations and sedimentation. Each of these streams has existing crossing locations nearby that could be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to the stream.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-A generally increases no more than 0.1 mi/mi^2, with exceptions in 10 watersheds where the highest increase in road density of 0.20 mi/mi^2 was calculated within the 300-foot perennial buffer of the Soldier Creek Watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 193 acre-feet of water; of which an estimated 111 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Fruitland and Strawberry IRA Micro-siting Options

The three Fruitland micro-siting options would cross the same two perennial streams as Alternative II-A (Red Creek and Currant Creek). There would be minor differences in the number of intermittent streams crossed ranging from 16 intermittent crossings along the comparable portion of Alternative II-A, to 11 intermittent crossings along Fruitland Micro-siting Option 3. The Strawberry IRA micro-siting options would not cross any perennial streams, and the number of intermittent streams crossed would remain the same. As such, none of these options would change the impacts to water resources from those disclosed for the main alternative above.

<u>Alternative II-B</u>

Key Parameters Summary

Alternative II-B would entail 34 perennial stream crossings. Three of those streams are impaired streams that would be crossed a total of 40 times. Douglas Creek is impaired due to sedimentation. West Salt Creek (crossed 38 times, 5 of which are in perennial reaches) is impaired due to elevated sediment and iron concentrations. Huntington Creek has an established TMDL for TDS. UDEQ (2010) has requested that Huntington Creek be delisted. There are no obvious existing crossings of West Salt Creek along approximately 2 miles of perennial stream and 11 miles of intermittent stream that could be utilized, and construction of new crossings or use of Arizona or ford crossings would increase erosion and sedimentation in this stream. The locations of both Douglas Creek and Huntington Creek proposed new crossings have existing crossings within 2 miles or less that could be utilized. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only those discussed along West Salt Creek, as well as the potential for unstable streambanks to contribute sediment to the stream.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-B generally increases no more than 0.1 mi/mi^2, with exceptions in 9 watersheds where the highest increase in road density of 1.19 mi/mi^2 was calculated within the 100-foot perennial buffer of West Salt Creek Watershed.

Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 259 acre-feet of water; of which an estimated 192 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

<u>Alternative II-C</u>

Key Parameters Summary

Alternative II-C would entail 40 perennial stream crossings. Five of those streams are impaired and would be crossed a total of 42 times. Cottonwood Creek is impaired due to elevated TDS with an established TMDL. Douglas Creek is impaired due to sedimentation. West Salt Creek (crossed 38 times, 5 of which are in perennial reaches) is impaired due to elevated sediment and iron concentrations. Huntington Creek is impaired for elevated selenium concentrations. Quitchupah Creek is listed due to observed bio-toxicity. As discussed for Alternative II-B, impacts from crossings of West Salt Creek would increase erosion and sedimentation due to the need for construction of multiple crossings. The locations of Douglas Creek, Huntington Creek, and Quitchupah Creek proposed new crossings have existing crossings within 2 miles or less that could be utilized. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only those discussed along West Salt Creek as well as the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-C generally increases no more than 0.1 mi/mi^2, with exceptions in 8 watersheds where the highest increase in road density of 1.19 mi/mi^2 was calculated within the 100-foot perennial buffer of West Salt Creek Watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 273 acre-feet of water; of which an estimated 197 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Table 3.4-10 Summary of Road Density Changes by Watershed (HUC10) in Region II

Watershed Name	HUC10[2]	Existing Density (mi/mi^2)			Alternative II-A Added Density (mi/mi^2)			Alternative II-B Added Density (mi/mi^2)			Alternative II-C Added Density (mi/mi^2)			Alternative II-D Added Density (mi/mi^2)			Alternative II-E Added Density (mi/mi^2)			Alternative II-F Added Density (mi/mi^2)			Alternative II-G Added Density (mi/mi^2)		
		100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC	100 feet	300 feet	HUC
Agency Draw-Willow Creek	1406000604	3.29	4.17	1.60	–	–	–	–	–	–	–	–	–	0.07	0.05	0.06	–	–	–	--	--	--	--	--	--
Antelope Creek	1406000305	3.10	4.94	1.07	–	–	–	–	–	–	–	–	–	–	–	–	4.87	3.54	0.13	--	--	--	--	--	--
Beaver Creek-Price River	1406000705	7.00	6.61	2.45	–	–	–	–	–	–	–	–	–	0.03	0.05	0.10	0.10	0.17	0.07	--	--	--	--	--	--
Bitter Creek	1403000101	–	0.12	1.53	–	–	–	–	–	0.06	–	–	0.06	–	–	–	–	–	–	--	--	--	--	--	--
Bitter Creek	1405000709	4.28	4.82	1.33	–	–	–	–	0.04	0.02	–	0.04	0.02	–	–	–	–	–	–	--	--	--	--	--	--
Chalk Creek	1603000514	11.31	5.41	2.08	–	–	–	–	–	–	–	–	0.03	–	–	–	–	–	–	--	--	--	--	--	--
Cherry Creek Wash	1603000507	9.42	7.07	1.46	–	–	0.01	–	–	–	–	–	–	–	–	0.01	–	–	0.01	--	--	0.01	--	--	0.01
Cisco Wash	1403000106	–	1.87	0.82	–	–	–	–	–	0.05	–	–	0.05	–	–	–	–	–	–	--	--		--	--	--
Cliff Creek	1406000102	0.40	5.63	1.60	–	–	0.07	–	–	–	–	–	–	–	–	0.09	–	–	0.09	--	--	0.09	--	--	0.07
Coal Creek-Price River	1406000708	2.00	2.81	2.62	–	–	–	0.09	0.06	0.02	–	–	–	–	–	–	–	–	–	--	--	--	--	--	--
Cottonwood Canyon	1403000104	4.45	3.69	0.56	–	–	–	–	–	0.03	–	–	0.03	–	–	–	–	–	–	--	--	--	--	--	--
Cottonwood Creek	1406000902	1.60	2.92	1.64	–	–	–	0.01	0.01	0.07	0.01	0.01	0.03	–	–	–	–	–	–	--	--	--	--	--	--
Cottonwood Creek-Dry Gulch Creek	1406000310	1.93	2.72	2.22	0.15	0.09	0.05	–	–	–	–	–	–	–	–	–	0.15	0.09	0.05	--	--	--	0.15	0.09	0.05
Cottonwood Wash-White River	1405000711	0.36	0.78	1.70	–	–	–	–	–	–	–	–	–	0.04	0.05	0.07	–	–	0.01	--	--	--	--	--	--
Coyote Wash	1405000710	1.94	2.37	1.96	–	–	–	–	–	–	–	–	–	0.37	0.30	0.12	–	–	0.05	--	--	0.03	--	--	--
Current Creek	1406000404	3.24	3.02	1.99	0.01	0.02	0.06	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	0.01	0.01	0.05
Desert Seep Wash	1406000707	1.13	1.50	1.81	–	–	–	0.02	0.03	0.11	–	–	–	–	–	–	–	–	–	--	--	--	--	--	--
Dog Valley Wash	1603000503	8.44	4.69	2.01	–	–	0.13	–	–	0.07	–	–	–	–	–	0.13	–	–	0.13	--	--	0.13	--	--	0.13
Dripping Rock Creek-White River	1405000705	1.54	2.75	1.96	0.01	0.02	0.03	–	–	–	–	–	–	0.01	0.02	0.03	0.01	0.02	0.03	0.01	0.02	0.03	0.01	0.02	0.03
Dry Gulch Creek	1406000309	1.61	2.37	2.13	0.05	0.06	0.04	–	–	–	–	–	–	–	–	–	0.05	0.06	0.03	--	--	--	0.05	0.06	0.04
Duchesne River	1406000315	0.97	1.30	2.29	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	0.03	--	--	--	--	--	0.02
Evacuation Creek	1405000706	3.89	4.68	1.03	–	–	–	–	–	0.10	–	–	0.10	–	–	–	–	–	–	--	--	--	--	--	--
Ferron Creek	1406000903	1.54	2.02	1.51	–	–	–	–	–	–	0.01	0.04	0.05	–	–	–	–	–	–	--	--	--	--	--	--
Gordon Creek	1406000704	4.18	4.39	2.08	–	–	–	–	–	–	–	–	–	0.07	0.08	0.18	–	–	–	--	--	--	--	--	--
Grassy Trail Creek	1406000709	11.39	7.18	1.70	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	--	--	--	--	--	--
Headwaters Muddy Creek	1407000202	1.99	2.05	1.80	–	–	–	–	–	–	0.04	0.04	0.04	–	–	–	–	–	–	--	--	--	--	--	--
Hog Back Reservoir-Old River Bed	1603000510	–	0.69	0.56	–	–	0.01	–	–	–	–	–	–	–	–	0.01	–	–	0.01	--	--	0.01	--	--	0.01
Huntington Creek	1406000901	3.87	4.10	1.65	–	–	–	0.02	0.03	0.10	0.01	0.01	0.03	0.01	0.01	0.03	–	–	–	--	--	--	--	--	--
Ivie Creek	1407000201	3.86	6.20	2.90	–	–	–	–	–	–	0.06	0.07	0.09	–	–	–	–	–	–	--	--	--	--	--	--
Ivie Creek	1603000501	3.46	3.50	1.87	–	–	–	–	–	–	0.18	0.25	0.16	–	–	–	–	–	–	--	--	--	--	--	--
Little Grand Wash	1406000803	1.08	1.55	0.78	–	–	–	0.06	0.07	0.15	0.06	0.07	0.15	–	–	–	–	–	–	--	--	--	--	--	--
Little Park Wash-Price River	1406000711	3.15	3.10	0.99	–	–	–	0.05	0.03	0.05	–	–	0.03	–	–	–	–	–	–	--	--	--	--	--	--
Lost Creek-Sevier River	1603000305	9.44	9.35	4.88	–	–	–	–	–	–	0.05	0.06	0.08	–	–	–	–	–	–	--	--	--	--	--	--
Lost Spring Wash-Saleratus Wash	1406000801	0.43	1.81	1.10	–	–	–	–	–	0.11	–	–	0.17	–	–	–	–	–	–	--	--	--	--	--	--
Lower Ninemile Creek	1406000504	4.80	3.81	1.02	–	–	–	–	–	–	–	–	–	–	–	0.04	–	–	–	--	--	--	--	--	--
Lower Pariette Draw	1406000502	0.56	1.04	1.55	–	–	–	–	–	–	–	–	–	–	–	0.03	–	–	–	--	--	--	--	--	--
Lower Strawberry River	1406000408	0.99	2.10	1.74	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	--	--	0.02
McDonald Creek-Colorado River	1401000519	0.16	0.43	1.04	–	–	–	–	–	0.03	–	–	0.03	–	–	–	–	–	–	--	--	--	--	--	--
Middle Sevier River	1603000512	1.43	2.13	2.28	–	–	–	0.01	0.02	0.04	0.03	0.04	0.02	–	–	–	–	–	–	--	--	--	--	--	--
Middle Strawberry River	1406000403	7.91	5.43	1.30	–	–	0.19	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	--	--	0.19

Table 3.4-10 Summary of Road Density Changes by Watershed (HUC10) in Region II

		Existing Density (mi/mi^2)			Alternative II-A Added Density (mi/mi^2)			Alternative II-B Added Density (mi/mi^2)			Alternative II-C Added Density (mi/mi^2)			Alternative II-D Added Density (mi/mi^2)			Alternative II-E Added Density (mi/mi^2)			Alternative II-F Added Density (mi/mi^2)			Alternative II-G Added Density (mi/mi^2)		
Watershed Name	**HUC10[2]**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**
North Salt Wash	1406000904	4.04	4.13	1.15	–	–	–	–	–	–	–	–	0.04	–	–	–	–	–	–	--	--	--	--	--	--
Oak Creek	1603000515	8.53	6.08	1.93	–	–	–	–	–	–	–	–	0.06	–	–	–	–	–	–	--	--	--	--	--	--
Outlet Douglas Creek	1405000703	1.14	3.27	1.51	–	–	–	0.14	0.35	0.16	0.14	0.35	0.16	–	–	–	–	–	–	--	--	--	--	--	--
Pelican Lake-Green River	1406000106	0.55	1.43	1.94	0.01	0.02	0.10	–	–	–	–	–	–	–	–	–	0.01	0.02	0.10	--	--	--	0.01	0.02	0.10
Pigeon Water Creek-Lake Fork River	1406000308	0.83	1.44	2.23	0.02	0.02	0.04	–	–	–	–	–	–	–	–	–	0.09	0.10	0.03	--	--	--	0.02	0.02	0.04
Rabbit Gulch	1406000406	0.37	1.68	2.12	–	0.10	0.12	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	--	0.10	0.11
Red Creek	1406000405	3.45	4.61	2.46	0.05	0.07	0.11	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	0.03	0.04	0.06
Red Wash-White River	1405000704	1.13	2.50	0.70	0.02	0.02	0.02	0.06	0.09	0.03	0.06	0.09	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sagers Wash	1403000107	1.39	1.58	1.03	–	–	–	0.20	0.22	0.08	0.20	0.22	0.08	–	–	–	–	–	–	--	--	--	--	--	--
Salina Creek	1603000304	8.75	11.89	3.83	–	–	–	–	–	–	0.11	0.11	0.10	–	–	–	–	–	–	--	--	--	--	--	--
Salt Wash	1403000501	0.14	0.32	0.91	–	–	–	–	–	0.02	–	–	0.02	–	–	–	–	–	–	--	--	--	--	--	--
Salt Wash-Green River	1406000804	0.13	0.64	1.54	–	–	–	0.03	0.04	0.05	0.03	0.04	0.05	–	–	–	–	–	–	--	--	--	--	--	--
Scofield Reservoir	1406000702	3.81	4.46	2.67	–	–	–	–	–	–	–	–	–	0.08	0.15	0.09	0.01	0.01	–	--	--	--	--	--	--
Sheep Wash-Green River	1406000505	0.09	0.33	1.21	–	–	–	–	–	–	–	–	–	0.04	0.05	0.14	–	–	–	--	--	--	--	--	--
Silver Creek	1603000401	2.05	2.94	2.55	–	–	–	–	–	0.18	–	–	–	–	–	0.08	–	–	–	--	--	--	--	--	--
Soldier Creek	1602020201	8.40	6.93	2.45	0.17	0.20	0.17	–	–	–	–	–	–	–	–	–	0.21	0.21	0.22	0.02	0.02	0.08	0.17	0.20	0.17
Strawberry River-Duchesne River	1406000304	1.54	1.81	2.39	0.09	0.06	0.04	–	–	–	–	–	–	–	–	–	0.13	0.10	0.08	--	--	--	0.09	0.06	0.04
Sugarville-Broad Canyon	1603000508	3.95	3.00	1.18	–	–	0.12	–	–	0.08	–	–	0.08	–	–	0.12	–	–	0.12	--	--	0.12	--	--	0.12
Tanner Creek	1603000505	5.83	4.80	2.20	–	–	0.07	–	–	–	–	–	–	–	–	0.07	–	–	0.07	--	--	0.07	--	--	0.07
Tenmile Canyon	1406000805	3.98	4.83	1.31	–	–	–	0.15	0.14	0.04	0.15	0.14	0.04	–	–	–	–	–	–	--	--	--	--	--	--
Thistle Creek	1602020202	10.88	7.18	2.76	0.08	0.09	0.18	–	–	–	–	–	–	–	–	–	0.08	0.09	0.18	0.08	0.09	0.18	0.08	0.09	0.18
Uinta River	1406000314	1.39	2.15	2.16	0.01	0.01	0.03	–	–	–	–	–	–	–	–	–	0.01	0.01	0.03	--	--	--	0.01	0.01	0.03
Upper Ninemile Creek	1406000503	4.02	4.56	0.99	–	–	–	–	–	–	–	–	–	0.08	0.09	0.20	0.19	0.25	0.04	--	--	--	--	--	--
Upper Pariette Draw	1406000501	1.36	1.62	1.87	–	–	–	–	–	–	–	–	–	–	–	0.03	–	–	–	--	--	--	--	--	--
Upper San Pitch River	1603000402	4.25	4.52	2.94	–	–	–	0.06	0.07	0.14	–	–	–	0.07	0.16	0.12	–	–	–	--	--	--	--	--	--
Upper San Rafael River	1406000905	0.69	0.94	1.30	–	–	–	–	–	–	–	–	0.07	–	–	–	–	–	–	--	--	--	--	--	--
Upper Sevier River	1603000504	0.98	1.87	1.71	–	–	–	0.03	0.04	0.06	–	–	–	–	–	–	–	–	–	--	--	--	--	--	--
Upper Strawberry River	1406000401	1.01	1.52	1.72	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	--	--	--	--	--	0.03
Walker Hollow-Green River	1406000105	0.78	1.94	2.46	–	–	0.17	–	–	–	–	–	–	–	–	–	–	–	0.07	--	--	--	--	--	0.17
West Creek	1602020101	3.59	4.13	2.08	0.18	0.15	0.16	0.03	0.04	0.12	–	–	–	0.05	0.05	0.16	0.14	0.12	0.18	0.14	0.12	0.18	0.14	0.12	0.18
West Salt Creek	1401000517	5.46	4.47	1.04	–	–	–	1.19	0.73	0.17	1.19	0.73	0.17	–	–	–	–	–	–	--	--	--	--	--	--
Westwater Creek	1403000102	4.24	3.67	0.96	–	–	–	–	–	0.04	–	–	0.04	–	–	–	–	–	–	--	--	--	--	--	--
Westwater Creek-Colorado River	1403000108	0.37	0.64	1.20	–	–	–	–	–	0.05	–	–	0.05	–	–	–	–	–	–	--	--	--	--	--	--
White River	1406000701	6.17	5.95	2.44	–	–	–	–	–	–	–	–	–	–	–	–	0.04	0.05	0.10	--	--	--	--	--	--
Willow Creek	1406000703	4.10	4.19	1.37	–	–	–	–	–	–	–	–	–	0.18	0.43	0.27	0.39	0.42	0.22	--	--	--	--	--	--

[1] Watershed contains stream(s) that are currently on the states' 303(d) Impaired Streams lists for sedimentation and/or physical alterations.

[2] Ten digit USGS HUC, unique to each watershed.

Note: Road density is reported as miles of road divided by square miles of area. Blanks indicate watershed is not affected by the alternative.
100 feet: area of watershed within 100 feet of a perennial waterway; 300 feet: area of watershed within 300 feet of a perennial waterway; HUC10: entire HUC10 Watershed area.

Sources: NRCS et al. 2010; U.S. Census Bureau 2010.

Alternative II-D

Key Parameters Summary

Alternative II-D would entail the crossing of 24 perennial streams, one of which is impaired. Willow Creek (tributary to Green River) is listed due to observed bio-toxicity. The nearest mapped existing crossing on Willow Creek is approximately 3 straight-line miles away. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only those discussed along Cottonwood Creek as well as the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-D generally increases no more than 0.1 mi/mi^2, with exceptions in 10 watersheds where the highest increase in road density of 0.43 mi/mi^2 was calculated within the 300-foot perennial buffer of Willow Creek Watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 193 acre-feet of water; of which an estimated 129 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Alternative II-E

Key Parameters Summary

Alternative II-E would entail 55 perennial stream crossings. Five of those streams are impaired and would be crossed a total of 26 times. The State of Utah has developed a TMDL for TDS on the Lake Fork River. UDEQ (2010) has requested that the Lake Fork River be delisted. The Duchesne River is listed due to elevated TDS concentrations and elevated water temperature, and observed bio-toxicity. Sowers Creek (crossed 21 times) is impaired due to elevated TDS and boron concentrations. Soldier Creek (crossed 2 times) is impaired due to elevated nutrients, phosphorus, and sedimentation. Lake Fork (tributary to Soldier Creek) is listed as an impaired stream due to elevated TDS concentrations and sedimentation. Existing crossings of the Duchesne River, Lake Fork River, Soldier Creek, and Lake Fork River (Soldier Creek) exist within several miles or less from proposed new crossings. The alignment follows Sowers Creek through a narrow canyon for approximately 15 miles, crossing the stream numerous times. The road along this stretch of the creek is a small “cherrystem” into USFS inventoried roadless area. No apparent existing crossings exist along portions of this canyon, and the construction of crossings would increase erosion and sedimentation in this stream, which also would further increase the TDS concentrations. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only those discussed along Sowers Creek, as well as the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-E generally increases around 0.1 mi/mi^2, with exceptions in 10 watersheds where the highest increase in road density of 4.87 mi/mi^2 was calculated within the 100-foot perennial buffer of Antelope Creek Watershed (Sowers Creek). Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 201 acre-feet of water; of which an estimated 118 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

<u>Alternative II-F</u>

Key Parameters Summary

Alternative II-F would require 32 perennial stream crossings. Of those crossings, three streams are impaired and would be crossed a total of nine times: Lake Fork (tributary to Soldier Creek) is impaired for sedimentation/siltation and TDS, Soldier Creek (crossed three times) is impaired for sedimentation/siltation and phosphorus, and Willow Creek (tributary of Green River, crossed five times) is listed due to observed bio-toxicity. Each of these streams has existing crossing locations nearby that could be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized.

An increased contribution of sediment would be expected from upland areas relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density increases by more than 0.1 mi/mi^2 in 4 watersheds affected by this alternative. The highest increase would be expected in the Thistle Creek and West Creek watersheds where the road density might increase by 0.19 mi/mi^2 in the watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 202 acre-feet of water; of which an estimated 115 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

<u>Alternative II-G (Agency Preferred)</u>

Key Parameters Summary

Alternative II-G would entail the crossing of 29 perennial streams, four of which are impaired. The State of UDEQ has developed a TMDL for TDS on the Lake Fork River and has requested that the Lake Fork River be delisted (UDEQ 2010). The Duchesne River is impaired because of elevated TDS concentrations and elevated water temperature, and observed bio-toxicity. Soldier Creek is impaired due to elevated nutrients, phosphorus, and sedimentation; Lake Fork (tributary of Soldier Creek) is listed as an impaired stream due to elevated TDS concentrations and sedimentation. Each of these streams has existing crossing locations nearby that could be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to the stream.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative II-G generally increases no more than 0.1 mi/mi^2, with exceptions in 8 watersheds where the highest increase in road density of 0.20 mi/mi^2 was calculated within the 300-foot perennial buffer of the Soldier Creek Watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 188 acre-feet of water; of which an estimated 110 acre-feet would come from the Upper Colorado Basin. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Fruitland and Strawberry IRA Micro-siting Options

The three Fruitland micro-siting options would cross the same two perennial streams as Alternative II-G (Red Creek and Currant Creek). There would be minor differences in the number of intermittent streams crossed ranging from 16 intermittent crossings along the comparable portion of Alternative II-A, to 11 intermittent crossings along Fruitland Micro-siting Option 3. The Strawberry IRA micro-siting options would not cross any perennial streams, and the number of intermittent streams crossed would remain the same. As such, none of these options would change the impacts to water resources from those disclosed for the main alternative above.

<u>Alternative Variation in Region II</u>

Reservation Ridge Alternative Variation

This alternative variation would minimize the number of necessary stream crossings by locating the proposed Project along a ridgeline instead of through the bottom of drainages as shown in **Table 3.4-11**. However, none of the stream crossings that would be avoided are impaired streams, which reduces the benefit of avoiding them. Additionally, the upland erosion that would likely occur along the steep slopes of this variation would be greater than what would occur along the comparable portion of Alternative II-F.

Table 3.4-11 Summary of Region II Alternative Variation Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Reservation Ridge Alternative Variation	11	2	9	0	0	0	0	15	422	142
Comparable Portion of II-F	22	10	12	0	0	0	0	16	444	143

Alternative Connectors in Region II

Table 3.4-12 summarizes impacts associated with the alternative connectors in Region II. The Lynndyl Alternative Connector would include an increase in total waterbodies crossed, disturbed areas, and water use. The IPP East Alternative Connector would include minor increases to water use and disturbance primarily due to its short length.

Table 3.4-12 Summary of Region II Alternative Connector Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Roan Cliffs Alternative Connector	2	1	1	0	0	0	0	1	34	13
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Castle Dale Alternative Connector	19	0	16	3	0	0	0	8	150	29
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Price Alternative Connector	32	4	28	0	0	0	0	14	263	66
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Lynndyl Alternative Connector	34	0	34	0	0	0	0	18	306	67
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
IPP East Alternative Connector	0	0	0	0	0	0	0	3	53	8
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Region II Series Compensation Stations (Design Option 3)

If Design Option 3 were implemented, a series compensation station would be necessary along the alternative routes of Region II during the first-phase (AC operation). There are three potential sites, each corresponding to specific alternative routes. Upon completion of Phase 2 of Design Option 3, when there was no utility for the station, it would be deconstructed and reclaimed to the original condition. These series compensation station alternatives are depicted in **Figure 2-3**.

Series Compensation Station 1 – Design Option 3 corresponds to Alternatives II-A and II-E. There are two intermittent channels within the siting area; neither are impaired waters. There are existing roads that could be used to access the site, negating the need for additional stream crossings.

Series Compensation Station 2 – Design Option 3 corresponds to Alternatives II-B and II-C. There is one intermittent channel within the siting area; it is not an impaired water. There is a mapped existing road that could be used to access the site, negating the need for additional stream crossings.

Series Compensation Station 3 – Design Option 3 corresponds to Alternatives II-D and II-F. There are several intermittent channels within the siting area; none are impaired waters. There are existing oil and gas roads that could be used to access the site, negating the need for additional stream crossings.

Region II Conclusion

Alternatives II-A, II-D, II-F, and II-G all have similar impacts to water resources, which are less than the remaining alternatives. Alternatives II-B, II-C, and II-E would have a greater number of stream crossings listed for impaired water quality (without existing crossings nearby) and the largest increases to road densities in certain watersheds, which indicate that increased impacts to these streams would be likely. These alternatives also are longer in length, which equates to more ground disturbance and stream crossings. Alternatives II-B and II-C are 30 to 40 percent longer than Alternatives II-A, II-D, II-E, II-F, and II-G, which equates to increased crossings, ground disturbance, and water use. Water quantity impacts would be minimized as well because the need is minimal compared to the overall current water use.

3.4.6.5 Region III

Table 3.4-13 provides a tabulation of impacts associated with the alternative routes in Region III. Key impact parameters relate to the impact discussion in Section 3.4.6.3, Impacts Common to all Alternative Routes and Associated Components. Changes to road density within the affected watersheds (HUC10) are tabulated in **Table 3.4-14**. Specific differences by alternative are discussed below. No streams with impairments for sediment or physical alterations would be crossed by alternatives in Region III.

Table 3.4-13 Summary of Region III Alternative Route Impact Parameters

Parameter	Alternative III-A	Alternative III-B	Alternative III-C	Alternative III-D
Waterbody Crossings (count)				
Total	510	425	474	438
Perennial	5	5	4	5
Intermittent	502	418	462	426
Canals	2	1	7	6
Reservoirs/Lakes	1	1	1	1
Impaired	2	1	0	1
Known Springs/Seeps in refined corridor	16	9	10	9
Floodplains over 1,000 feet wide (count)	2	2	2	2
Water Use (acre-feet)[1]	206	212	230	210
Construction Disturbance (acres)	3,588	3,558	3,797	3,500
Operation Disturbance (acres)	791	697	749	665
Construction Disturbance in Watersheds with Sediment, Ion, or Alteration Impaired Streams (acres/percent of watershed)				
Halfway Wash-Virgin River	108/0.1%	74/<0.1%	--	74/<0.1%
Kershaw Canyon-Meadow Valley Wash	--	--	9/<0.1%	--
Lower Meadow Valley Wash	--	41/<0.1%	--	41/<0.1%
Lower Muddy River	219/0.1%	139/0.1%	--	139/0.1%
Lower Santa Clara River	97/0.1%	--	--	--
Sand Hollow Wash-Virgin River	87/<0.1%	--	--	--

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Alternative III-A (Applicant Proposed)

Key Parameters Summary

Alternative III-A would entail the crossing of five perennial streams, and two impaired streams. Pinto Creek is listed because of observed bio-toxicity and would be crossed in an intermittent reach. The Muddy River is impaired due to elevated iron, temperature, and boron. Existing crossings of these waterways are located within several miles of the proposed new crossings and would be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative III-A generally increases no more than 0.1 mi/mi^2, with exceptions in 5 watersheds where the highest increase in road density of 0.23 mi/mi^2 was calculated within the 300-foot perennial buffer of Lower Muddy River Watershed. Agency stipulations for the affected BLM FOs and USFS-administered lands require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 206 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Alternative III-B

Key Parameters Summary

Alternative III-B would entail the crossing of five perennial streams, one of which is impaired. The Muddy River is impaired due to elevated iron, phosphate, temperature, and decreased dissolved oxygen. Existing crossings of the Muddy River are within 1 mile and would be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative III-B generally increases no more than 0.1 mi/mi^2, with exceptions in 3 watersheds where the highest increase in road density of 0.31 mi/mi^2 was calculated within the 100-foot and 300-foot perennial buffer of Lower Beaver Dam Watershed. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 212 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Table 3.4-14 Summary of Road Density Changes by Watershed (HUC10) in Region III

		Existing Density (mi/mi^2)			Alternative III-A Added Density (mi/mi^2)			Alternative III-B Added Density (mi/mi^2)			Alternative III-C Added Density (mi/mi^2)			Alternative III-D Added Density (mi/mi^2)		
Watershed Name	**HUC10**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**100 feet**	**300 feet**	**HUC**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**
California Wash	1501001207	–	–	0.73	–	–	0.12	–	–	0.06	--	--	--	--	--	0.06
Cathedral Gorge-Meadow Valley Wash	1501001306	4.77	4.15	1.40	–	–	–	–	–	–	--	--	0.08	--	--	--
Clover Creek	1501001305	7.61	5.50	0.82	–	–	–	–	–	0.07	--	--	0.01	--	--	0.07
Delamar Valley	1606000910	–	4.01	0.93	–	–	–	–	–	–	--	--	0.07	--	--	--
Dry Lake Valley	1501001206	–	–	0.73	–	–	–	–	–	0.03	--	--	0.13	--	--	0.03
Dry Lake Valley	1606000909	–	–	0.97	–	–	–	–	–	–	--	--	0.03	--	--	--
Elbow Canyon	1501001204	–	–	0.19	–	–	–	–	–	–	--	--	0.08	--	--	--
Escalante Valley-Pinto Creek	1603000614	5.07	5.05	1.59	–	–	0.05	–	–	0.02	--	--	0.02	--	--	0.02
Fisher's Wash	1603000607	2.93	5.82	1.60	–	–	0.04	–	–	0.05	--	--	0.05	--	--	0.05
Fourmile Wash-Frontal Lund Flats	1603000606	19.68	9.17	1.54	–	–	0.01	–	–	0.05	--	--	0.05	--	--	0.05
Garden Wash	1501001004	–	–	0.91	–	–	–	–	–	0.15	--	--	--	--	--	0.15
Gold Springs Wash	1603000610	0.67	2.45	1.17	–	–	–	–	–	0.07	--	--	0.09	--	--	0.07
Government Wash-Colorado River	1501000512	0.04	0.12	0.55	–	–	0.01	–	–	0.01	--	--	0.02	--	--	0.02
Halfway Wash-Virgin River	1501001007	0.04	0.32	0.83	–	–	0.05	–	–	0.02	--	--	--	--	--	0.02
Iron Springs Creek-Frontal Lund Flats	1603000605	4.15	5.47	2.14	–	–	0.03	–	–	0.03	--	--	0.03	--	--	0.03
Long Lick Canyon-Big Wash	1603000703	1.04	2.54	2.13	–	–	0.05	–	–	0.05	--	--	0.05	--	--	0.05
Lower Beaver Dam Wash	1501001002	0.94	1.38	0.80	0.14	0.20	0.03	0.31	0.31	0.05	--	--	--	0.31	0.31	0.05
Lower Beaver River	1603000805	–	–	1.30	–	–	–	–	–	–	--	--	0.08	--	--	0.08
Lower Meadow Valley Wash	1501001309	0.37	0.97	0.31	–	–	–	0.08	0.09	0.01	--	--	--	0.08	0.09	0.01
Lower Muddy River	1501001209	1.67	2.75	1.03	0.11	0.23	0.10	–	–	0.04	--	--	--	--	--	0.04
Lower Santa Clara River	1501000808	2.85	4.29	2.00	–	–	0.03	–	–	–	--	--	--	--	--	--
Lower Sevier River	1603000517	1.56	2.44	1.56	–	–	0.10	–	–	0.10	--	--	0.06	--	--	0.06
McDonald Wash-Negro Liza Wash	1603000612	2.22	2.54	1.27	–	–	–	–	–	0.08	--	--	0.08	--	--	0.08
Middle Pahranagat Wash	1501001203	–	–	0.36	–	–	–	–	–	–	--	--	0.08	--	--	--
Moody Wash	1501000806	2.04	2.93	1.46	–	–	0.16	–	–	–	--	--	--	--	--	--
Morehouse Canyon-Beaver River	1603000707	–	–	1.44	–	–	0.07	–	–	0.07	--	--	0.07	--	--	0.07
Mountain Spring Wash	1603000609	2.84	6.09	1.30	–	–	–	–	–	0.02	--	--	0.02	--	--	0.02
Mud Spring Wash	1603000608	4.26	5.01	1.87	–	–	0.01	–	–	0.01	--	--	0.01	--	--	0.01
Nellis Air Force Base	1501001504	19.15	16.82	3.39	–	–	–	–	–	–	--	--	0.01	--	--	--
Pahranagat Creek	1501001116	1.60	2.17	0.80	–	–	–	–	–	–	--	--	0.02	--	--	--
Picture Rock Wash	1603000509	1.00	1.30	1.30	–	–	0.03	–	–	0.03	--	--	0.03	--	--	0.03
Red Rock Wash	1606000908	2.79	11.93	0.83	–	–	–	–	–	–	--	--	0.13	--	--	--
Sand Hollow Wash-Virgin River	1501001006	0.66	0.90	1.56	–	–	0.03	–	–	–	--	--	--	--	--	--
Shoal Creek	1603000613	6.88	7.29	1.80	0.06	0.08	0.07	–	–	–	--	--	--	--	--	--

Table 3.4-14 Summary of Road Density Changes by Watershed (HUC10) in Region III

		Existing Density (mi/mi^2)			Alternative III-A Added Density (mi/mi^2)			Alternative III-B Added Density (mi/mi^2)			Alternative III-C Added Density (mi/mi^2)			Alternative III-D Added Density (mi/mi^2)		
Watershed Name	**HUC10**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**100 feet**	**300 feet**	**HUC**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**
Soap Hollow	1603000516	2.84	8.22	1.22	–	–	0.01	–	–	0.01	--	--	--	--	--	--
Swasey Wash	1603000511	8.20	7.53	0.89	–	–	0.01	–	–	0.01	--	--	0.01	--	--	0.01
The Big Wash-Beaver River	1603000706	1.81	2.56	2.39	–	0.14	0.04	–	0.14	0.04	--	0.14	0.04	--	0.14	0.04
Toquop Wash	1501001005	5.01	3.70	0.57	–	–	0.07	–	–	0.08	--	--	--	--	--	0.08
Upper Beaver Dam Wash	1501001001	5.54	3.34	0.95	–	–	0.05	–	–	–	--	--	--	--	--	--
Upper Beaver River	1603000803	5.36	5.60	1.41	–	–	0.10	–	–	0.10	--	--	0.08	--	--	0.08
Upper Muddy River	1501001208	2.82	2.88	1.01	–	–	0.03	0.05	0.05	0.03	--	--	--	0.05	0.05	0.03
Upper Pahranagat Wash	1501001202	–	3.60	0.27	–	–	–	–	–	–	--	--	0.09	--	--	--
Upper Santa Clara River	1501000807	1.78	2.57	1.56	–	–	0.05	–	–	–	--	--	--	--	--	--

Notes: Road density is reported as miles of road divided by square miles of area. Blanks indicate watershed is not affected by the alternative.
100 feet: area of watershed within 100 feet of a perennial waterway; 300 feet:: area of watershed within 300 feet of a perennial waterway; HUC10: entire HUC10 Watershed area.

Sources: NRCS et al. 2010; U.S. Census Bureau 2010.

Alternative III-C

Key Parameters Summary

Alternative III-C would entail crossing four perennial streams, and no impaired streams would be crossed. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative III-C generally increases no more than 0.1 mi/mi^2, with exceptions in 3 watersheds where the highest increase in road density of 0.13 mi/mi^2 was calculated within the Red Rock Wash Watershed. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 230 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Alternative III-D (Agency Preferred)

Key Parameters Summary

Alternative III-D would entail the crossing of five perennial streams, one of which is impaired. The Muddy River is impaired due to elevated iron, phosphate, temperature, and decreased dissolved oxygen. Existing crossings of the Muddy River are within 1 mile and would be utilized according to mitigation measure **WR-1**. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative III-D generally increases no more than 0.1 mi/mi^2, with exceptions in 3 watersheds where the highest increase in road density of 0.31 mi/mi^2 was calculated within the 100-foot and 300-foot perennial buffer of Lower Beaver Dam Watershed. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 210 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Alternative Variations in Region III

Table 3.4-15 provides a comparison of impacts associated with the alternative variations in Region III. Each of the alternative variations in Region III would require increased water use and disturbance areas when compared with the corresponding portion of the alternative route they would replace. Ox Valley East Alternative Variation would slightly reduce total waterbody crossings; Ox Valley West Alternative Variation and Pinto Alternative Variations would slightly increase total waterbody crossings. Both Ox

Valley variations would reduce perennial stream crossings when compared with the corresponding portion of the alternative route they would replace.

Alternative Connectors in Region III

Table 3.4-16 summarizes impacts associated with the alternative connectors in Region III. The Moapa Alternative Connector would include an increase in total waterbodies crossed, disturbed areas, and water use.

Table 3.4-15 Summary of Region III Alternative Variation Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Ox Valley East Alternative Variation	29	1	28	0	0	0	0	12	319	108
Comparable portion of III-A	36	2	34	0	0	0	1	11	282	79
Ox Valley West Alternative Variation	33	1	32	0	0	0	0	13	313	110
Comparable portion of III-A	36	2	34	0	0	0	1	11	282	79
Pinto Alternative Variation	58	11	45	0	2	1	1	21	462	114
Comparable portion of III-A	62	1	60	0	1	0	0	17	415	115

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Table 3.4-16 Summary of Region III Alternative Connector Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Avon Alternative Connector	0	0	0	0	0	0	0	6	99	19
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Arrowhead Alternative Connector	1	1	0	0	0	1	0	2	54	9
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Moapa Alternative Connector	26	0	26	0	0	0	0	10	176	33
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Alternative Ground Electrode Systems in Region III

It would be necessary to locate the southern ground electrode system within 100 miles of the Southern Terminal as discussed in Chapter 2.0. Although the location for this system has not been determined, conceptual locations and connections to the alternative routes have been provided by TransWest. The impacts associated with constructing and operating this system would be the same as those discussed in Section 3.4.6.3, Impacts Common to all Alternative Routes and Associated Components. **Table 3.4-17** summarizes impacts associated with the seven combinations of alternative routing and locations possible for a southern ground electrode system.

Table 3.4-17 Summary of Region III Alternative Ground Electrode System Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use[1] (acre-feet)	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Mormon Mesa-Carp Elgin Rd (Alternative III-A)	7	0	7	0	8	0	0	4	90	18
Halfway Wash-Virgin River (Alternative III-A)	6	0	5	1	0	0	0	3	83	15
Halfway Wash East (Alternative III-A)	12	0	12	0	0	0	0	6	101	24
Mormon Mesa-Carp Elgin Rd (Alternative III-B)	9	0	8	0	1	0	0	6	102	24
Halfway Wash-Virgin River (Alternative III-B)	3	0	3	0	0	0	0	4	92	19
Halfway Wash East (Alternative III-B)	16	0	15	1	0	0	0	7	111	29
Meadow Valley 2 (Alternative III-C)	27	0	27	0	0	0	0	16	170	61
Delta (Design Option 2)	11	0	11	0	0	0	0	10	127	37

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Region III Series Compensation Stations (Design Option 2)

If Design Option 2 were implemented, a series compensation station would be necessary along the AC-configured alternative routes of Region III. There are three potential sites, each corresponding to a specific alternative route. These series compensation station alternatives are depicted in **Figure 2-2**.

Series Compensation Station 1 – Design Option 2 corresponds to Alternative III-A. There is one intermittent channel within the siting area; it is not an impaired water. There is an existing road that could be used to access the site, negating the need for additional stream crossings.

Series Compensation Station 2 – Design Option 2 corresponds to Alternative III-C. There are multiple intermittent channels within the siting area, all flowing through an alluvial fan from the Delmar Mountains; none are impaired waters. There is an existing road that could be used to access the site, negating the need for additional stream crossings.

Series Compensation Station 3 – Design Option 2 corresponds to Alternative II-B. There are several intermittent channels within the siting area; none are impaired waters. There are existing roads that could be used to access the site, negating the need for additional stream crossings.

Region III Conclusion

Impacts to water resources from the alternatives in Region III are all relatively similar. Alternative III-B would require the least number of stream crossings, and Alternative III-D is nearly the same. Regardless of the alternative the overall disturbance from the Project is relatively low in the watersheds crossed, and through effective implementation of design features, BMPs, and proposed mitigation, the adverse impacts to water quality would be prevented. Water quantity impacts would be minimized as well because the need is minimal compared to the overall current water use and availability.

3.4.6.6 Region IV

Table 3.4-18 provides a tabulation of impacts associated with the alternative routes in Region IV. Key impact parameters relate to the impact discussion in Section 3.4.6.3, Impacts Common to all Alternative Routes and Associated Components. Changes to road density within the affected watersheds (HUC10) are tabulated in **Table 3.4-19**. Specific differences by alternative are discussed below. Although there are streams with impairments crossed by Region IV alternatives, none have been listed as impaired for sediment or physical alterations.

Alternative IV-A (Applicant Proposed and Agency Preferred)

Key Parameters Summary

Alternative IV-A would entail the crossing of two perennial streams, one of which is impaired. Las Vegas Wash is impaired due to elevated iron and molybdenum. A TMDL has been established to limit phosphorus, ammonia, and chlorophyll-a. Construction of crossings in this wash would be avoided by utilization of existing crossings in the area. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Table 3.4-18 Summary of Region IV Alternative Route Impact Parameters

Parameter	Alternative IV-A	Alternative IV-B	Alternative IV-C
Waterbody Crossings (count)			
Total	68	50	49
Perennial	2	3	2
Intermittent	65	47	47
Canals	1	0	0
Reservoirs/Lakes	0	0	0
Impaired	1	1	1
Known Springs/Seeps in refined corridor	0	0	0
Floodplains over 1,000 feet wide (count)	0	0	0
Water Use (acre-feet)	28	30	33
Construction Disturbance (acres)	547	565	623
Operation Disturbance (acres)	124	123	128
Construction Disturbance in Watersheds with Sediment, Ion, or Alteration Impaired Streams (acres/percent of watershed)			
Duck Creek-Las Vegas Wash	247/0.1%	--	--

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Table 3.4-19 Summary of Road Density Changes by Watershed (HUC10) in Region IV

		Existing Density (mi/mi²)			Alternative IV-A Added Density (mi/mi²)			Alternative IV-B Added Density (mi/mi²)			Alternative IV-C Added Density (mi/mi²)		
Watershed Name	**HUC10**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**	**100 feet**	**300 feet**	**HUC**
Duck Creek-Las Vegas Wash	1501001507	2.78	3.98	6.54	0.05	0.05	0.06	–	–	–	–	–	–
Eldorado Valley	1606001518	0.59	1.81	1.28	–	–	0.04	–	–	0.05	–	–	0.06
Government Wash-Colorado River	1501000512	0.04	0.12	0.55	–	–	0.04	–	–	0.07	–	–	0.07
Gypsum Wash-Colorado River	1501000513	0.03	0.05	0.38	–	–	–	–	0.01	0.04	–	–	0.03
Jumbo Wash-Colorado River	1503010101	0.06	0.14	0.56	–	–	–	–	–	–	–	–	0.01

Note: Road density is reported as miles of road divided by square miles of area. Blanks indicate watershed is not affected by the alternative.
100 feet: area of watershed within 100 feet of a perennial waterway; 300 feet: area of watershed within 300 feet of a perennial waterway; HUC10: entire HUC10 Watershed area.
Sources: NRCS et al. 2010; U.S. Census Bureau 2010.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative IV-A increases less than 0.1 mi/mi^2. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 28 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

<u>Alternative IV-B</u>

Key Parameters Summary

Alternative IV-B would entail the crossing of three perennial streams, one of which is impaired. Las Vegas Wash is impaired due to elevated iron and molybdenum. A TMDL has been established to limit phosphorous, ammonia, and chlorophyll-a. Construction of crossings in this wash would be avoided by utilization of existing crossings in the area. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative IV-B increases less than 0.1 mi/mi^2. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 30 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

<u>Alternative IV-C</u>

Key Parameters Summary

Alternative IV-C would entail the crossing of two perennial streams, one of which is impaired. Las Vegas Wash is impaired due to elevated iron and molybdenum. A TMDL has been established to limit phosphorous, ammonia, and chlorophyll-a. Construction of crossings in this wash would be avoided by utilization of existing crossings in the area. Through the implementation of applicant-committed design features, agency BMPs, and mitigation measures **WR-1** and **WR-2**, impacts to water quality from stream crossings would be minimized to include only the potential for unstable streambanks to contribute sediment to streams.

Although other factors contribute to erosion and sediment yield in upland areas (e.g., soil type, vegetative cover, slope), an increased contribution of sediment would be expected relative to the amount of construction and operation disturbance, and relative to the increase in road density especially near perennial waterways. Road density due to Alternative IV-C increases less than 0.1 mi/mi^2. Agency stipulations in the affected BLM FOs require the avoidance of areas near perennial waterways (see **Appendix C**). Additionally, mitigation measure **WR-3** would require the location and design of disturbance areas be consulted upon with federal agencies to avoid impacts to impaired streams. Mitigation measure **WR-4** would require monitoring and adjustments (if necessary) of erosion control measures.

Water use would require 33 acre-feet of water. Water would be supplied through arrangements with existing water rights holders and temporary use permits, subject to review and approval by the appropriate state. No new withdrawals would be required, and no effects on other water users would be anticipated.

Alternative Variations in Region IV

Table 3.4-20 provides a comparison of impacts associated with the alternative variation in Region IV. The Marketplace Alternative Variation would not cross any waterbodies, nor would the corresponding portion of the alternative route (Alternative IV-B) it would replace. The same comparison shows a slight increase in disturbance area and water use if the variation were constructed.

Table 3.4-20 Summary of Region IV Alternative Variation Impact Parameters

	Waterbody Crossings (count)						Floodplains over 1,000 feet wide (count)	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired				
Marketplace Alt. Variation	6	0	6	0	0	0	0	6	108	20
Comparable portion of IV-B	3	0	3	0	0	0	0	5	81	12

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

Alternative Connectors in Region IV

Table 3.4-21 tabulates impacts associated with the alternative connectors in Region IV. Each alternative connector would increase the total number of waterbodies crossed, disturbed areas, and amount of water used.

Region IV Conclusion

Impacts to water resources in Region IV are relatively similar. Alternative IV-A has more stream crossings; however, the development in the area would provide opportunities for use of existing crossings. Water use and construction disturbance show no appreciable differences among the alternatives. Regardless of the alternative the overall disturbance from the Project is relatively low in the watersheds crossed, and through effective implementation of design features, BMPs, and proposed mitigation, the adverse impacts to water quality would be prevented. Water quantity impacts would be minimized as well because the need is minimal compared to the overall current water use and availability.

Table 3.4-21 Summary of Region IV Alternative Connector Impact Parameters

	Waterbody Crossings (count)									
	Total	Perennial	Intermittent	Canals	Reservoirs/Lakes	Impaired	Floodplains over 1,000 feet wide (count)	Water Use (acre-feet)[1]	Construction Disturbance (acres)	Operation Disturbance (acres)
Sunrise Mountain Alt. Connector	6	1	5	0	0	0	1	2	52	8
Conclusion	This connector could be utilized through numerous combinations to avoid crossing the impaired reach of Las Vegas Wash. There are no apparent unique constraints for water resources by utilizing this connector.									
Lake Las Vegas Alt. Connector	9	0	9	0	0	0	0	3	76	20
Conclusion	This connector could be utilized through numerous combinations to avoid crossing the impaired reach of Las Vegas Wash. There are no apparent unique constraints for water resources by utilizing this connector.									
Three Kids Mine Alt. Connector	8	0	8	0	0	0	0	4	98	27
Conclusion	This connector could be utilized through numerous combinations to avoid crossing the impaired reach of Las Vegas Wash. There are no apparent unique constraints for water resources by utilizing this connector.									
River Mountains Alt. Connector	11	1	10	0	0	0	0	6	165	58
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									
Railroad Pass Alt. Connector	5	0	5	0	0	0	0	3	68	16
Conclusion	There are no apparent unique opportunities or constraints for water resources by utilizing this connector.									

[1] Estimation of water use based on assumptions provided for construction of a 600-kV DC transmission line.

3.4.6.7 Residual Impacts

Mitigation measures are designed to identify and reduce impacts to water resources but would not fully eliminate those impacts. The proposed Project would result in the potential for site-specific increases of upland erosion during construction, thereby increasing sedimentation to streams. This impact would decrease with successful reclamation; however, some continued increases in sedimentation would be expected in areas with poor or low reclamation potential during operation due to the continued use of constructed roads.

For disturbance in watersheds with impaired waters, site-specific coordination with appropriate federal agencies on the location and design of construction disturbance and avoidance of new stream crossings would prevent sedimentation to these waters, precluding further contributions to their impairment. The exceptions to this are Alternatives II-B, II-C, and II-E. The alignments of Alternatives II-B and II-C would cross West Salt Creek multiple times, and the alignment of Alternative II-E would cross Sowers Creek multiple times; prevention of additional degradation would be unlikely along these stream reaches.

Although water needed for Project construction would come from existing water rights, the actual use of the water will continue an existing depletion. The relative amount of water needed for construction is minimal compared with overall existing water use and availability, and the impact would from the Project would be temporary, occurring only during construction.

3.4.6.8 Irreversible and Irretrievable Commitment of Resources

Irreversible impacts to surface water are not anticipated since environmental measures, including reclamation, would mitigate long-term effects on water quantity and quality over time. Temporary reductions in water quality from erosion and sedimentation would be irretrievable.

Water consumptively used during the project would be irretrievable. However, consumptive use would not be irreversible because the water uses would end after construction of the Project.

3.4.6.9 Relationship between Local Short-term Uses and Long-term Productivity

Increases in erosion and decreases in streamside bank vegetation during construction could potentially impact channel stability beyond the construction phase of the Project. If reclamation is effectively implemented, this would not impact the long-term productivity of the streams.

3.4.6.10 Impacts to Water Resources from the No Action Alternative

Current management across the analysis area would be maintained under the No Action alternative. Under this alternative, there would be no Project construction, operation, or maintenance disturbance to impact water quality or water use. There would be no Project construction, operation, or maintenance equipment or infrastructure in the area to cause hazardous material spills.