3.13 SOIL AND WATER RESOURCES

3.13.1 Regional Overview

The VPA lies within portions of nine catalogued USGS 8-Digit Hydrologic Unit Code (HUC) watersheds located within the Upper Colorado hydrologic region (Region 14). The majority of the VPA is contained within seven watersheds in the Lower Green River drainage, although portions also are associated with the Upper Green River and the Lower White River drainage. Watershed acreages are described in Table 3.13.1.

TABLE 3.13.1. WATERSHEDS ASSOCIATED WITH THE VPA

8-Digit HUC	Watershed Name	Acres within VPA
14040106	Upper Green-Flaming Gorge Reservoir	543,564
14060001	Lower Green-Diamond	566,835
14060002	Lower Green-Ashley-Brush	420,697
14060003	Lower Green-Duchesne	1,649,897
14060004	Lower Green-Strawberry	394,405
14060005	Lower Green-Desolation Canyon	645,365
14060007	Lower Green-Price	22,542
14060006	Lower Green-Willow	461,197
14050007	Lower White	797,137

Two municipal watersheds, Ashley Creek and Red Fleet, are also located within the VPA. The Ashley Creek municipal watershed occurs almost entirely upon lands administered by the USFS - Ashley National Forest; however, the BLM administers 670 acres, including Ashley Spring, the access point for the municipal supply. The Red Fleet municipal watershed contains 18,660 acres administered by the BLM, including lands surrounding Red Fleet Reservoir, which is the access point for the municipal supply.

3.13.2 Topography

The topography of the VPA is primarily defined along its northern portion by the Uinta Mountains. The Uinta Mountains are broad and massive and extend approximately 150 miles east to west. The Uinta Mountains consist of extensively glaciated, sedimentary and metamorphic rocks. Glacial deposition features have created numerous natural dams and small lakes on the slopes of the range. A portion of the VPA lies north of the Uinta Mountains and drains to the Green River below Flaming Gorge Reservoir. The Green River exits the VPA approximately 30 miles downstream of Flaming Gorge at the Utah/Colorado state boundary and reenters the VPA near Diamond Mountain, again along the Utah/Colorado state boundary. Portions of the south side of the Uinta Mountains drain to the Green River below Diamond Mountain through major tributaries such as Ashley Creek, Big Brush Creek, and the Whiterocks River.

The western side of the VPA is drained by the Duchesne River and its major tributary, the Strawberry River. The Duchesne River drains a topographic basin composed of Mesozoic and Tertiary sedimentary rocks characterized by a gently rolling, dissected plateau with deeply cut ravines and alluvial valleys. The Duchesne River enters the Green River near Ouray, in the central part of the VPA.

The eastern and southern part of the VPA, primarily consisting of the Book Cliffs portion of the VPA, is drained by Hill Creek, Bitter Creek, Evacuation Creek, Willow Creek, and the White River; these drainages also enter the Green River near Ouray. This area is part of the Tavaputs Plateau, composed of Tertiary sedimentary rocks and characterized by rugged terrain and deeply incised canyons (UDWaR 1999).

3.13.3 Soil Resources

Soils in the VPA have developed from bedrock, from rocks/minerals deposited by rivers and glacial activity, and from windblown silt and sand. They were derived primarily from the sedimentary, metamorphic quartzite and volcanic rocks of the Uinta Mountains, Diamond Mountain Plateau, Avintaquin Mountains, East Tavaputs Plateau, West Tavaputs Plateau, Roan Cliffs, and Book Cliffs, which form the boundaries of the Uinta Basin and Browns Park.

Soils in the VPA are composed of a wide variety of soil types and characteristics. Certain soil types have chemical features that limit restoration and make reclamation difficult, these include sodium, soluble salts, carbonates, and gypsum. Physical soil characteristics that may limit reclamation include sandy soils, clayey soils, large coarse fragments (e.g., stones and boulders), shallow depth to parent material, and low organic matter content. A shallow depth to groundwater limits reclamation in hydric soils. Soils with these features are referred to as limiting soils.

3.13.3.1 Natural Resource Conservation Service (NRCS) Soil Surveys

The Natural Resource Conservation Service (NRCS) has conducted three soil surveys throughout the VPA, with second and third order delineation. The Uintah Area, Utah soil survey includes parts of Daggett, Grand, and Uintah Counties. Portions of Daggett County are also included in the Henrys Fork Area, Utah-Wyoming soil survey. The Duchesne County part of the VPA is covered by the Duchesne Area, Utah soil survey.

3.13.3.1.1 Henrys Fork Area, Utah-Wyoming Soil Survey (USDA 1990)

This soil survey covers the northern parts of Daggett County, as well as parts of Summit County, Utah and parts of Uinta and Sweetwater Counties in Wyoming. The survey, correlated in October 1990, is complete and available in digital format. Information on soil features and use ratings can be obtained by using either the NRCS Soil Data Viewer or Microsoft Access software. Soil polygons can be accessed with ArcView software.

3.13.3.1.2 Uintah Area, Utah Soil Survey (USDA 1999)

This soil survey covers Uintah County, part of northern Grand County, and the southern part of Daggett County. The survey, correlated in June 1999, is complete and available in digital format. Information on soil features and use ratings can be obtained by using either the NRCS Soil Data Viewer or Microsoft Access software. Soil polygons can be accessed with ArcView software.

This soil survey covers the largest portion of the VPA, with 2,477,734 acres of soils surveyed. It ranges from the Diamond Mountain area in the north to the Book Cliffs in the south and from the Duchesne County line in the west to the Colorado state line in the east.

Taxonomic classifications of VPA soils within the boundaries of this survey include a wide variety of soil types. Diagnostic soil features include cryic soils, argillic horizons, mollic epipedons, calcic horizons, petrocalcics, gypsic horizons, psamments, and fluvents. Thirty taxonomic great groups and 151 soil series have been identified in the Uintah Area soil survey.

3.13.3.1.3 Duchesne Area, Utah Soil Survey

This soil survey includes VPA lands in southeastern Duchesne County, Utah. Fieldwork has been completed for this survey, but final correlation has not been completed. Correlation and final publication of the soil survey data by the NRCS is expected sometime in 2004 or 2005. Soil polygons have been digitized and can be accessed with ArcView software. Information on soil features and use ratings is available and can be obtained from official soil series descriptions and interpretation tables; obtaining these data will simply be more cumbersome and time-consuming than obtaining data from either the Henrys Fork or the Uintah Area soil surveys.

3.13.3.2 Soil Characteristics of Greatest Management Concern

3.13.3.2.1 Presence of Biological Crusts

The presence of biological crusts in arid and semi-arid lands have a very significant influence on reducing soil erosion by both wind and water, fixing atmospheric nitrogen, retaining soil moisture, and providing a living organic surface mulch. “These crusts are a complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria“ (BLM 2001:1). They can be used as an indicator of rangelands‘ ecological health. Development of biological crusts is strongly influenced by soil texture, soil chemistry, and successional colonization by crustal organisms. The type and abundance of biological crust can be used by a land manager to determine the ecological history and condition of a site. Biological crusts are generally found where there are openings in the vascular plant cover and protect open areas from wind and water erosion. There are no data for biological crusts within the VPA.

3.13.3.2.2 Salinity

Soil salinity can have significant impacts on soil erosion and reclamation potential. Erosion of saline soils can also have significant impacts on the water quality of downstream watersheds. Soils with electrical conductivity levels of 8 dS/m (deciSeimens/meter) or greater were considered saline in all soil surveys. Saline soils occur in more than 365,851 acres, or approximately 20% of the BLM administered lands in the VPA.

Saline sediments that originate in the VPA eventually flow into the Colorado River. Salinity levels in the Colorado River are a regional, national, and international issue. Control of sediment discharged from public lands is mandated by the Colorado River Basin Salinity Control Act of 1974. Proper land use is the BLM‘s preferred method of achieving salinity control, with the planning process being the principal mechanism for implementation. Impacts are to be minimized in areas with saline soils, and revegetation of previously disturbed saline soils is to be promoted to the extent possible.

3.13.3.2.3 Sodium Absorption Ratios

Soils with sodium absorption ratios of 13 or greater are considered sodic. Infiltration of precipitation into these soils is reduced by the dispersion of soil particles caused by the higher levels of sodium. Reduced infiltration rates result in greater surface runoff rates and increased soil erosion and sediment yields. Many sodic soils have a thin layer of suitable soil above the sodic horizon, but when this layer is disturbed or removed, the resulting impact can be irreversible. Sodic soils occur in approximately 161,344 acres, or approximately 9% of the BLM administered lands within the VPA. Management of sodic soils should include minimizing the impacts of grazing and other surface disturbances, such as road construction.

3.13.3.2.4 Gypsum Levels

Soils with gypsum levels equal to or greater than 10% are highly susceptible to water erosion and are difficult to reclaim. Gypsum is very soluble in water, which results in piping and other severe erosion features. Gypsic soils occur in approximately 132,706 acres, or 7% of the BLM administered lands within the VPA. The number of soil map units in the VPA with gypsic soils is relatively small, but nonetheless, these units require careful management to minimize impacts that may cause irreversible damage. Construction of roads and other facilities is difficult in these soils.

3.13.3.2.5 Response to Disturbance

Decisions regarding management of a particular soil resource is dependent on the particular soil type‘s ability to recover from specific disturbances. Gypsum content, salinity level, and sodium content are soil characteristics that can severely limit recovery from a disturbance. Road construction and operation of OHVs commonly impact the soils in the VPA. Additionally, the presence of surface water or groundwater has an influence on the severity of a disturbance and on when the activity may be allowed. Surface disturbances can cause increased soil erosion by either wind or water.

Use ratings and soil characteristics listed in the soil surveys are intended to be used as general guidelines for land use planning, but site-specific investigations should be done to determine the suitability of soils at specific locations.

3.13.3.2.6 Erosion

3.13.3.2.6.1 Water Erosion

There is significant potential for severe soil erosion by water at several locations within the VPA. Erosion potential ratings were not available in the NRCS soil surveys at the time this analysis was conducted. The VPA area has determined the approximate locations of soils with potential for severe erosion by evaluating the k-factor, T factor, percent slope, and hydrologic group rating for each soil map unit. These are designations given to soils by the NRCS, which show the relative erodibility of each soil unit. Site specific and map unit specific determinations for erosion hazard ratings will continue to be developed and utilized within the VPA.

In the interim, for preliminary delineation of water erodible soils, soil mapping units with a k-factor of 0.32 or greater and slopes greater than 10% were considered susceptible to water erosion. Using these factors, water erodible soils were determined to cover 232,042 acres, or approximately 13% of the VPA. Current management activities are designed to minimize impacts so that erosion and sediment yield are not accelerated. Additional mitigation measures are to be taken, as necessary, to minimize impacts on soils determined to have severe erosion hazard potential.

3.13.3.2.6.2 Wind Erosion

Many of the soils in the VPA are coarse-textured and very susceptible to wind erosion when the vegetative community is disturbed. The NRCS soil surveys classify each soil series into wind erodibility groups (1, 2, 3, 4L, 4, 5, 6, 7, and 8). Soils that are in wind erodibility groups 1, 2, 3, or 4L have erosion potentials ranging from extremely erodible to erodible, respectively. Wind erosion increases when the vegetative community is disturbed by intense grazing, fire, road construction, and other events that reduce the amount of vegetative cover. Disturbance of biological crusts on coarse-textured soils will also increase the potential for wind erosion. Wind-erodible soils cover 1,361,645 acres, or 79% of the VPA. To preserve soil resources in these areas, disturbance of the vegetative community and biological crusts are managed and minimized.

3.13.3.2.6.3 Reclamation of Drastically Disturbed Areas

Many of the soils within the VPA have limiting features that make reclamation and revegetation very difficult. These limiting features include salinity, sodium content, clayey and sandy textures, drought conditions, alkalinity, low organic matter content, shallow depth to bedrock, stones and cobbles, and wind erosion. Sometimes the soil limitations are so severe that areas cannot be reclaimed from disturbance. Preventing disturbance to such limited soil resources is the most effective way to reduce impacts of road construction, grazing, fire, and other activities that drastically disturb the soil surface. Whenever impacts are deemed necessary in an area, salvaging and stockpiling soil materials to replace the disturbed, limited soils is the most effective management decision regarding soils.

3.13.3.2.6.4 Road Construction and Maintenance

Construction and maintenance of roads within the VPA will continue to be a prominent aspect of management. Soil properties that are limiting to construction of roads within the VPA include soils with high sodium content, high gypsum content, high soluble salts, low strength, shrink-swell potential, and frost action. A soil‘s large-stone content, its depth to hard bedrock, and its slope are also important physical features that must be considered when determining a soil‘s suitability for road construction.

Suitability ratings for construction of local roads assume that the roads will have an all-weather surface (commonly of asphalt or concrete) and are expected to carry automobile traffic year-round. Since the majority of roads constructed and maintained within the VPA do not have an all-weather surface, it should be assumed that site-specific evaluations would need to be conducted prior to construction of any new roads. Roads are graded to shed water, and conventional drainage measures are installed properly. With the exception of hard surface all-weather roads, most of roads in the VPA are constructed from the local soils, which may or may not be suitable for road construction.

3.13.4 Water Resources

3.13.4.1 Surface Water Supply and Use

Surface water in the VPA is used for agricultural, municipal, industrial, power generation, and recreational purposes. Surface water is stored in several large and small reservoirs, both natural and human-made. The largest use of surface water is for agricultural irrigation, with almost 800,000 acre-feet of water per year being diverted to irrigate more than 200,000 acres of land (UDWaR 1999). Water diversions for municipal and industrial purposes (including residential water use, industrial water use, power production, and irrigation of parks, golf courses, and other outdoor areas) average approximately 14,000 acre-feet per year (UDWaR 1999). The Diamond Mountain portion of the VPA also has 15 hydropower site withdrawals covering approximately 93,900 acres along the Green River (BLM 1993).

The hydrology of the VPA is primarily dominated by spring runoff and from brief, intense storms that generally occur in late summer. The several large reservoirs that have been constructed on the Green and Strawberry Rivers have altered the natural hydrology of these major rivers by reducing the annual spring peak and providing higher minimum flows during the summer and winter months. Water diversions for agricultural, municipal, and industrial uses have also altered the natural hydrology of the VPA by reducing instream flows below diversion points.

Surface water flow supports riparian vegetation along the floodplains of the rivers and streams in the VPA. Approximately 92,226 acres of the VPA occur within the 100-year floodplains of the major drainages in the VPA. While the preliminary status of the functioning condition of riparian vegetation along major waterways has been documented in preparation for this RMP, the condition of the floodplain and the stability of stream banks have not yet been determined for all areas (Strong 2002b). Surface water flow also supports riparian vegetation associated with other water features such as Stewart Lake, Pelican Lake, and the Pariette Wetlands.

3.13.4.2 Groundwater Supply and Use

The primary use of groundwater in the VPA is for municipal and industrial purposes. Unconsolidated or alluvial aquifers are relatively limited within the VPA, with major use only in the Duchesne-Myton-Pleasant Valley area and east of Neola. Consolidated or bedrock aquifers form a major component of the groundwater system in the VPA. Major consolidated aquifers include sandstone beds within the Uinta Formation and the Bird‘s Nest and Douglass Creek aquifers within the Green River Formation. Total water withdrawal from all aquifers for municipal and industrial use is approximately 21,000 acre-feet, which is relatively minor compared to the estimated 350,000 acre-feet naturally discharged to streams and springs and the nearly 250,000 acre-feet lost to evapotranspiration (UDWaR 1999).

3.13.4.3 Water Quality

Surface water quality problems are detailed in Utah‘s 303(d) list of impaired waters, required under the Clean Water Act. Lower Ashley Creek was listed due to total dissolved solids (TDS) and selenium concentrations, likely the result of irrigation return flows. Portions of the Duchesne River and tributaries were listed primarily due to TDS concentrations, also attributable to irrigation return flows. Several reservoirs within the VPA were also listed, mostly for phosphorous levels, dissolved oxygen (DO) levels, and high temperatures.

Water bodies on Utah's 303(d) List of Impaired Waters are listed below in Table 3.13.2.

TABLE 3.13.2. WATER BODIES ON UTAH'S 303(D) LIST OF IMPAIRED WATERS, 2000

HUC Code	Name	Stressor
	Calder Reservoir	DO, Total Phosphorous
14060001	Brough Reservoir	DO, Temperature
14060002	Lower Ashley Creek	TDS, Selenium
	Red Fleet Reservoir	DO, Temperature
	Steinaker Reservoir	Temperature
14060003	Antelope Creek	TDS
	Deep Creek	TDS
	Duchesne River from confluence with Green River to Randlett	TDS
	Duchesne River from Randlett to Myton	TDS
14060005	Pariette Draw	TDS, Boron
	Willow Creek from confluence with Green River to confluence with Meadow Creek	TDS

Source: UDEQ 2002

Excess salinity, the major surface water quality problem in the VPA, is of regional significance under the Colorado River Basin Salinity Control Act of 1974. Salinity contributions come from naturally occurring groundwater during low flow periods and from erosion of saline soils. A large part of the saline soil contribution is attributable to poor road construction practices and management (Strong 2002a). Other factors in water quality are salt-loading from irrigated agriculture, water and land contamination due to oil/gas well drilling, and elevated levels of total phosphorous and TDS in several basin streams (UDEQ 2003). Watersheds of particular concern include the Pariette, Red Creek, and Buckskin Hills watersheds.

The groundwater hydrology in the VPA is primarily dependent on rock structure. Concentrations of dissolved solids range from 19 to 112,000 mg/L and depend on changes in rock type and physical environments.

Locally, the groundwater salinity in the VPA is caused by natural geologic sources. The Tertiary Green River, Wasatch, and Uinta Formations and the Mesozoic Mancos Shale range from very saline to briny at depth (>500 ft.) and generally less saline at shallow depths (<500 ft.). High selenium and boron concentrations are of particular concern and have been studied at Stewart Lake, Lower Ashley Creek, and the Pariette Wetlands. The salinity of water produced in oil, gas, and CBM development may change significantly within a few months or years particularly if vertical movement of water in faults and fractures is induced by the production of hydrocarbons and water from oil and gas wells (USGS 1987).

THIS PAGE INTENTIONALLY LEFT BLANK.