# SECTION 2 - ENGINEERING REPORT

## *2.1 LOCATION STANDARDS*

The following sections present the Solid Waste Facility Locations Standards and discuss the status of the BCL compliance with those requirements. Since the BCL is not a new facility or a facility seeking expansion, the locations standards are not applicable but are included for informational purposes.

### 2.1.1 Land Use Compatibility

The UDEQ Division of Waste Management and Radiation Control Rules state that no Class I, Class II or a Class V landfill will be located within:

- One thousand feet of a national, state or county park, monument, or recreation area; designated wilderness or wilderness study area; or wild and scenic river area.
- Ecologically and scientifically significant natural areas, including wildlife management areas and habitat for listed or proposed endangered species, as designated pursuant to the Endangered Species Act of 1982.
- Farmland classified or evaluated as prime, unique, or of statewide importance by the U.S. Department of Agriculture, Soil Conservation Service, under the Prime Farmland Protection Act.
- One-quarter mile of existing permanent dwellings, residential areas, and other incompatible structures, such as, schools, churches, and historic structures or properties listed or eligible to be listed in the State or National Register of Historic Places.
- Proximity to an airport.
- Areas with respect to archeological sites.

#### *2.1.1.1 Beaver County Landfill (BCL) Status*

- The BCL is not located within 1,000 feet of a national, state, or county park, monument, or recreation area; designated wilderness or wilderness study area; or wild and scenic river area.
- Ecologically or scientifically significant natural areas have not been observed within or adjacent to the current site. This site is an active landfill and has been used as such since 1994.
- There are not soils within the landfill property boundaries that are classified prime soil types for farmland use according to the Soil Conservation Service (SCS) maps of Beaver County.
- There are no schools, churches, historic structures, or properties eligible to be listed in the State or National Register of Historic Places currently located within one-

quarter mile of the property line that encloses the area currently being operated as a Landfill.

- The Landfill is not located within 10,000 feet of a public-use airport runway used by turbojet aircraft. The closest airport is located more than five miles south of the landfill.
- No archaeologically significant discoveries have been made at the site, nor are any known to exist.

### 2.1.2 Geologic Hazards and Geotechnical Engineering

The Utah State Regulations indicate "No new facility or lateral expansion of an existing facility shall be located in a subsidence area, a dam failure flood area, above an underground mine, above a salt dome, above a salt bed, or on or adjacent to geologic features which could compromise the structural integrity of the facility".

#### *2.1.2.1 Debris Flows and Alluvial Fan Flooding*

The site is located on the Last Chance Bench. The elevated nature of the bench is such that the potential for alluvial fan flooding or debris flows occurrence is considered to be extremely unlikely.

#### *2.1.2.2 Liquefaction*

Certain areas within the intermountain region also possess a potential for liquefaction during seismic events. Liquefaction is a phenomenon whereby loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from dynamic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits causing settlements of overlying layers after an earthquake as excess pore water pressures are dissipated. The primary factors affecting liquefaction potential of a soil deposit are: (1) level and duration of seismic ground motions; (2) soil type and consistency; and (3) depth to groundwater.

Because the facility is founded largely on dry sands, gravels and silts the site has a very low potential for liquefaction and it should not be considered a concern for this site.

#### *2.1.2.3 Seismicity and Faulting*

Section 3 of the Waiver Application (Appendix E), details the general geologic setting including faulting.

#### *2.1.2.4 Seismic Impact Zone*

The EPA and the UDWMRC define a seismic impact zone as any location with a 10% or greater probability that the maximum horizontal acceleration (MHA) in lithified earth

material, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 250 years.

The MHA in lithified earth material is defined in 40 CFR part 258.14 (EPA 1995) as the "maximum expected horizontal acceleration depicted on a seismic hazard map with a 90% or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on site specific seismic risk assessment." Seismic hazard maps depicting probabilistic ground motions and spectral response have been developed for the United States as part of NEHRP/NSHMP (Frankel et al, 1996; FEMA, 1997). These maps serve as the basis for the International Building Code (IBC). Using NEHRP-based interactive software developed by Leyendecker et al. (2000), probabilistic spectral accelerations corresponding to the MCE (maximum considered earthquake) seismic hazard levels were identified for the site, assuming rock-like conditions.

The MCE is often associated with a 2PE50 hazard level (equivalent to the 90% or greater probability that the acceleration will not be exceeded in 250 years). These spectral accelerations are consistent with 5% damping. To account for site effects, site coefficients which vary with the magnitude of spectral acceleration should be used to modify the bedrock-based spectral acceleration values.

#### *2.1.2.5 Seismic Impact Zone Analysis*

UDWMRC rules require that any new landfill or lateral expansion to an existing facility located in a seismic impact zone to have all containment structures, including liners, and surface water control systems designed to resist the maximum horizontal acceleration in lithified earth material for the site. The final configuration of the BCL has been analyzed under static and pseudo-static conditions to determine whether the facility will be adversely impacted from an earthquake event. The findings of the analysis, presented in Appendix H (Slope Stability), indicates that the minimum factor of safety (F.S.) under static conditions is 2.4 and the minimum F.S. under pseudo-static conditions is 1.4, both well above the critical F.S. of 1.0. Based on this analysis, the landfill disposal cells, as well as the ancillary facilities such as the drainage and water control structures, can maintain their integrity during the expected maximum probable earthquake event.

#### *2.1.2.6 Unstable Areas*

An unstable area means "a location that is susceptible to natural or human induced events or forces capable of impairing the integrity of some or all of the landfill structural components

responsible for preventing releases from a facility". Unstable areas include poor foundation conditions or karst terrain resulting in excessive differential settlement, or areas susceptible to mass movement liquefaction.

A field investigation was undertaken in the development of the Waiver Application (Appendix E) and included a subsurface drilling and sampling program. Information obtained during the investigation indicates that the soils beneath the landfill property are characterized by sandy gravel, sandy silt, and silty clay. No expansive soils are known to exist anywhere on the property. Subsidence has not been observed in old fill areas, either by soil settlement due to the overlying waste load, or due to settlement within the waste mass itself.

A study by Mulvey (1992), entitled *Engineering Geologic Problems Caused by Soil and Rock in Southwestern Utah*, presented a generalized map of the distribution of problem soil and rock in southwestern Utah which defines six types of problem soil or rock including expansive soil or rock; collapsible soil; gypsiferous soil or rock; limestone (karst); soils susceptible to piping; and, areas which contain active dunes. The study did not indicate the presence of any of these problem soil and rock types near the BCL. In addition, there are no excessively steep slopes or bedrock outcrops near the landfill. The nearest lithologic unit which has been characterized as an unstable slope having the potential for mass-wasting lies approximately five miles west of the site in Beaver Canyon (Harty, 1992). In addition, a map of landslides in southwestern Utah by Harty (1992) shows the nearest landslide to be in Beaver Canyon. Based on this information and the topographic location of the landfill on top of the Last Chance Bench, the operation of the BCL is not likely to be affected by problems of settlement or unstable slopes or foundation material.

### 2.1.3 Surface Water Requirements

UDEQ has adopted Subtitle D location restrictions for floodplains, wetlands and watersheds. The landfill site does not currently fall within a delineated 100-year flood zone. There are no known or designated wetlands within the limits of the landfill boundary. The landfill is not located in a watershed for a public water system or a location that could cause contamination of a lake, reservoir, or pond. There are no known endangered or threatened species within the landfill area.

#### *2.1.3.1 Floodplain*

There has been very little, if any, floodplain mapping performed outside of incorporated city boundaries in southern Utah. Floodplain mapping for the Beaver area does not extend to the area surrounding the landfill and as a result the site is not mapped in a potential

floodplain. Based upon the location of the landfill on the Last Chance Bench; the likelihood of being in a floodplain is extremely unlikely.

#### *2.1.3.2 Watershed Management Areas*

UDWMRC rules prohibits solid waste facilities from being located on any public land that is being used by a public water system for watershed control for municipal drinking water. The Department of Environmental Quality Division of Drinking Water has verbally indicated that Beaver County does not utilize any surface watersheds for use as a drinking water source and that all utilities in the County use groundwater extraction wells as the source of drinking water.

### 2.1.4 Groundwater Requirements

UDEQ location restrictions with respect to groundwater protection include the following:

- No new facility shall be located at a site where the bottom of the lowest liner is less than 5 feet above historical high levels of groundwater in the uppermost aquifer.
- No new facility shall be located over a sole source aquifer.
- No new facility shall be located over groundwater classified as IB (an irreplaceable aquifer).
- A new facility located above any aquifer containing groundwater which has total dissolved solids (TDSs) content below 1,000 milligrams per liter (mg/l) and does not exceed applicable groundwater quality standards for any contaminant is permitted only where the depth to groundwater is greater than 100 feet. For a TDS content between 1,000 and 3,000 mg/l, the separation must be 50 feet or greater. These separation distance requirements are waived if the landfill is constructed with a composite liner.
- No new facility shall be located in designated drinking water source protection areas or, if no such protection area is designated, within a distance to existing drinking water wells or springs for public water supplies of 250-day groundwater travel time.

#### *2.1.4.1 Beaver County Landfill Status*

The lowest point of the bottom of the landfill is at least 100 feet above the highest anticipated groundwater elevation as detailed in Section 4 (Appendix E). Groundwater beneath the Landfill area is not classified as a sole source or Class IB (irreplaceable aquifer). A groundwater transport study was conducted as part of a previous permit application, see Sections 7 and 8 (Appendix E). Based on this information the landfill does meet the requirements of the groundwater protection location restrictions.

## *2.2 PHASED DESIGN - PROPOSED LANDFILL DEVELOPEMENT*

As described in Section 3.1 of Part II; the landfill has been developed in Phases. The following sections discuss the development of the last Phase of the BCL.

### 2.2.1 Design and Operation

The BCL is operated as a mass fill landfill. For the sake of volume analysis and construction staging; the development of the landfill has been broken into Phases. The drawing (Appendix I) detail the approximate extent of each of the Phases and the contours of the final cover.

### 2.2.2 Liner Requirements

The BCL is designed without a synthetic liner. Previous studies and site investigations by Vector Engineering have demonstrated that a synthetic liner was not required. Appendix E and F contain the initial liner exemption data.

### 2.2.3 Estimated Life

The projected waste stream for the Landfill will come from Beaver County. Estimated daily waste tons being delivered to the BCL operations is approximately 30 tons per day based on recent records. Only limited distinction is made in the records between residential and commercial waste disposal. The anticipated future air space consumption has been evaluated based upon a 4.4% waste stream increase rather than the originally anticipated escalation of 2.38%. Actual data suggests that the landfill growth is near 0% with 9,952 tons disposed of in 2007 and 9,392 tons in 2016.

The Landfill life projections are only estimates; the actual life of the Landfill will depend on several variables including the actual rate of waste being delivered, densities, settlement and the potential use of alternate daily cover materials. Appendix J – Landfill Life contains the detailed evaluation of the consumption of airspace.

#### *2.2.3.1 Phase 1*

Beaver County has been accepting municipal solid waste at the current site since 1996. Consumption of airspace between 1996 and the preparation of this application have been reflected in the Landfill life analysis with the initial Phase 1 lasting until approximately 2012.

#### *2.2.3.2 Phase 2*

Phase 2 began operation as Phase 1 was completed. The airspace available in Phase 2 will provide landfilling capacity for approximately 8 years with capacity being reached in approximately 2020.

#### *2.2.3.3 Phase 3*

Phase 3 will be the final Phase for the BCL and will have capacity for approximately 19 years with capacity being reached in approximately 2039.

## *2.3 DAILY, INTERMEDIATE AND FINAL COVER*

### 2.3.1 Daily and Intermediate Soil Cover

Daily cover soils must meet the 6-inch State requirements for protection against odors, litter and vectors at the working face. The daily 6-inch thick cover will typically be obtained from the excavation of the surrounding slopes and from previously excavated materials.

Intermediate cover soil requirements are governed by R315-303-4. The outside face of the daily modules and waste areas that are expected to remain inactive for more than 30 days will be protected with an additional 12-inch intermediate cover. The borrow area for intermediate cover soils is the same as for daily cover soils.

Before the start of waste placement each day, cover soils on top of the previous lift will be stripped back and stockpiled for reuse as soil cover at the end of the day or as needed or as practical. These recycled cover soils will be used first; the remainder of daily cover soils will be provided from cell excavation or stockpiled soils.

C&D waste will be processed in a common operational face with the MSW and be covered daily.

### 2.3.2 Alternate Daily Cover

BCL may utilize a 1.5 mil plastic membrane as an alternate daily cover. Soil is used as daily cover no less frequently than weekly to provide both trafficable surfaces and to isolate potential fires should they develop.

### 2.3.3 Final Cover

The final cover at the BCL will be constructed as described in Section 3.2.

## *2.4 MONITORING SYSTEM*

### 2.4.1 Ground Water Monitoring System

The BCL was not required to install ground water monitoring wells.

### 2.4.2 Leachate Monitoring

The BCL was not required to install a synthetic liner system nor install a leachate collection system.

### 2.4.3 Landfill Gas

The decomposition of solid waste produces methane, a potentially flammable gas. The accumulation of methane in site structures can result in fire and explosions that can injure employees and property, users of the Landfill, and occupants of nearby structures. In accordance with Subtitle D and Utah rules, BCL will conduct surface and facility structure gas monitoring at least quarterly for methane detection. The concentration of methane gas generated by the Landfill must not exceed 25% of the lower explosive limit (LEL) in the facility structures (excluding gas control or recovery system components). The concentration of methane gas generated by the Landfill must not exceed the LEL at the facility boundary. As outlined in EPA Subtitle D, Subpart C and the State of Utah Regulations, BCL will take all necessary steps to protect human health and will immediately notify UDEQ of methane levels detected above required limits and actions taken, if any. Within 10 days of an incident, BCL will place documentation of the methane gas levels detected and a description of the interim steps taken to protect human health in the operating record. Within 60 days of detection, BCL personnel will implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify UDEQ that the plan has been implemented. The remediation plan will describe the nature and extent of the problem and describe the proposed remedy.

## *2.5 DESIGN AND LOCATION OF RUN-ON/RUN-OFF CONTROL SYSTEMS*

The main objectives of surface water management for the landfill operation are to provide adequate landfill drainage, to prevent off site run-on, preventing unnecessary surface water infiltration and subsequent leachate production, to contain surface run-off from open areas on-site; and to prevent erosion. Federal regulations require: 1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 24-hour, 25-year storm; and 2) Run-off control system from the active portion of the landfill to collect and to control at least the water volume resulting from a 24-hour, 25-year storm. Appendix K – Drainage System Design contains the details and assumptions utilized to calculate run-on and run-off volumes.