3. Affected Environment, Potential Impacts, and Mitigation Measures

This chapter is organized by elements of the environment required for review by the SEPA Guidelines (WAC 197-11-444) and by the City of Cle Elum EIS Scoping Summary (August 6, 2009). Existing environmental conditions are described for each of these elements, followed by a description of potential impacts during construction as well as in the developed-condition of the project. Each impact analysis is followed by a description of proposed, required, and other possible mitigation measures that could be implemented to avoid or minimize potential adverse impacts of the project. For several elements of the environment, Chapter 3 text sections are summarized from reports prepared by technical experts.

3.1 Earth

This section describes the geological setting of the City Heights site and potential impacts to topography, geology and soils that may occur as a result of proposed development. Potential impacts in the form of erosion and coal mine hazard areas are also evaluated. Distinctions are made between the conceptual land use alternatives being evaluated in this Environmental Impact Statement (EIS). For ease of locating the various features described, this section refers to "proposed Development Areas" as identified on the Alternative 1 conceptual land use plan (Figure 2.6-1 in Draft EIS Chapter 2). The Earth element analysis is based primarily on the planning-level engineering geology and geotechnical study performed by Aspect Consulting, LLC, and on the *Coal Mine Hazards Risk Assessment* prepared for the site by SubTerra, Inc. (October 2009). The *City Heights Preliminary Geology and Geotechnical Evaluation* (Aspect Consulting, October 2009) included a review of existing information and collection of field data to develop planning-level geotechnical conclusions and recommendations.[1] The *Geotechnical Evaluation* concludes that the primary Earth impacts would result from grading. Risks associated with seismic conditions, steep slopes, abandoned underground mines and existing uncontrolled fills, and potential erosion will be minimized by adhering to applicable regulations, accepted engineering design standards, and prudent construction practices.

3.1.1 Topography

AFFECTED ENVIRONMENT

The City Heights site is located in an upland region above the Yakima River valley, on the south face of Cle Elum Ridge. A 100-foot high slope oriented roughly parallel to the southern site boundary rises above the Yakima River flood plain. The subject property lies on and above this slope. Elevation increases to the north across the site toward Cle Elum Ridge. Ground surface elevations at the site generally range from 2,000 to 2,300 feet. Total relief is approximately 360 feet. Four north-south oriented drainages transect the property creating local relief up to 200 feet. Steep slopes up to 60 percent occur as natural slopes, and up to 65 percent in uncontrolled fills left by past mining activities.

Several relatively flat-lying terraces occupying the lower portions of Cle Elum Ridge to elevations of approximately 2,100 feet are located primarily in the western and eastern thirds of the City Heights site. Terraces slope gently (up to 10 percent) to the south and are generally characterized by steep southwest, south, and southeast facing slopes up to 60 percent. Prominent terraces that are relatively flat compared to the surrounding topography have been identified during conceptual planning as areas that are favorable for development.

[1] A glossary of geotechnical terms is included in Appendix A of this EIS.

Past modifications to topography include grading, cuts, and fills that likely began with mining activities in the late 1800s through the mid-1900s. Mining activities resulted in substantial modification to topography, primarily from placement of uncontrolled fills like the coal mine waste pile located in the western third of the site. Mine waste in uncontrolled fills consists of coal waste and waste rock. Underground mine workings on a portion of the site were determined to have subsided in the time since mining activities stopped in approximately 1947 (SubTerra, Inc., October 2009). Subsequent modifications to topography include cut slopes and embankments related to road construction undertaken by Northland Resources, LLC in approximately 2003 to support development of properties north of the City Heights site.

Steep Slopes

City of Cle Elum Municipal Code (CEMC) Title 18.01.320 identifies slopes greater than 25 percent as presenting a moderate risk of erosion or landslides. Areas with slopes 60 percent or greater are considered to have high risk of erosion and/or landslides. Kittitas County Code is less specific, and addresses geologically hazardous areas as areas with high risk of erosion or landslide potential (KCC Chapter 17A.06). Slopes greater than 25 percent are primarily located in drainages and along the southern boundary of the City Heights site (Figure 3.1-1). The steepest natural slopes are 60 percent in glacial deposits and residuum overlying bedrock on the west side of Greens Canyon (Deer Creek, adjacent to Montgomery Road); 35 percent in glacial deposits overlying bedrock and exposed bedrock along the southern boundary of the site, south of proposed Development Area F3; and a near-vertical outcrop of weathered bedrock standing 15 to 20 feet in relief on the northern side of proposed Development Area E. Steep slopes (up to 60 percent) were also observed in the coal waste pile in proposed Development Area A, and 65 percent slopes in the waste rock pile north of proposed Development Area D2 (see Figure 2.6-1 in Draft EIS Chapter 2 for the location of proposed Development Areas).

No landslides are mapped by others on the City Heights site. A relatively large landslide is mapped approximately 1 mile northeast of the site (Tabor et al. 1982). Failures on natural slopes on the property observed by Aspect Consulting include:

- A recent small landslide along the southern site boundary near proposed Development Area G that occurred in glacial deposits.
- Slope creep observed in glacial deposits along the west side of the Deer Creek drainage, south of the power line corridor and east of proposed Development Area F2.
- Several shallow slope failures in road cuts excavated approximately 6 years ago (2003) along Summit View Road and Deer Creek Road.
- A recent small shallow landslide in unconsolidated soils along a steep slope (approximately 60 percent) in the lower portion of the Balmers Canyon drainage, west of proposed Development Area I2.

Failure was observed in the coal waste pile in a 60 percent slope along the south side of proposed Development Area A. Slopes on these waste piles are likely near their respective angles of repose because more than 50 years have elapsed since placement of these waste piles; however, both the coal waste and waste rock piles have the potential for failure where steep slopes exist.

Insert Figure 3.1-1. Site Explorations and Engineering Geology Units (11x17-inch color)

Unique Physical Features

The site topography has several unique natural and artificial features. Terraces present in the lower elevations of the property are primarily glacial depositional features overlying bedrock. The largest bedrock outcrop at the site forms a south-facing slope inclined up to 60 percent, visible from downtown Cle Elum. This feature south of proposed Development Area F3 is identified on the conceptual land use plans as "Slick Rock" Park.

A waste rock pile within and north of proposed Development Area D2 is visible from parts of downtown Cle Elum. The waste rock was placed during mining activities that occurred between the late 1800s and approximately 1950. Identified on conceptual land use plans as "Red Rock" Park, this waste rock pile stands up to 100 feet above grade and has slopes up to 65 percent. Approximately half of the waste rock pile lies within proposed Development Area D2. The waste rock could potentially be used as a borrow source of on-site structural fill for construction (subject to compliance with City of Cle Elum Municipal Code requirements for grading, excavation, and landfilling (CEMC Chapter 15.30).

A coal waste pile in the western end of the site (within proposed Development Area A) was placed during the same historical mining activities as the waste rock pile described above. The top of the coal waste pile lies up to 40 feet above surrounding grade, with slopes up to 60 percent. Field observations indicate the coal waste was placed on top of a low terrace comprised of natural soils (Aspect Consulting, October 2009), and therefore the thickness of the coal waste is likely much less than the height of the mound.

POTENTIAL IMPACTS DURING CONSTRUCTION

Site development under any conceptual land use alternative would result in permanent modifications to topography as a result of grading to construct roads, utilities and building sites. Approximately one-half of the Red Rock waste rock pile, the portion having lower slope gradients in proposed Development Area D2, would require some re-grading to support development. Development in the former coal washing waste rock pile area (proposed Development Area A) would require either removal of the coal waste or engineering solutions to provide structural support (Aspect Consulting, October 2009). Coal waste rock areas with a significant percentage of coal content would provide a weak subgrade for pavements, utilities, or structures (see Draft EIS Section 3.1.5). If the coal waste pile is removed to facilitate development in Area A under Alternative 1, 2 or 3A, the local topography would be modified by up to 20 feet in grade in this area. If Alternative 3B were selected for implementation, reduced grading requirements to construct approximately 375 fewer dwelling units would lessen the likelihood that marginal areas with steep slopes or coal waste piles would be graded. No development is proposed under any alternative in the lower portion of Balmers Canyon where unconsolidated soils resulted in a recent landslide.

Bedrock at the site is overlain in most places by unconsolidated sediments and bedrock residuum ranging from approximately 5 to 100 feet thick (Aspect Consulting, October 2009). Where mechanical means of excavation by hoe rams and rippers prove to be ineffective, rock fracturing methods that may include minor blasting techniques may be required to remove obstructions in areas planned for the construction of roads, utilities and home sites. The blasting method would generally consist of drilling shallow holes to the desired depth, loading holes with small amounts of explosives, connecting holes in a designed sequence, covering the area to prevent dispersion, and detonating explosives to fracture rock in localized areas for excavation. Blasting would be conducted to minimize construction-related loosening of the rock mass beyond the design excavation line. It is expected that blasting, if required at all, would be minimal. Impacts to subjacent/lateral support on adjacent properties would not be anticipated because development activities would be conducted in accordance with applicable regulations, geotechnical standards, and prudent construction practices.

Construction activities to implement Alternative 1 would occur in all proposed development areas of the site (see Figure 2.6-1 in Draft EIS Chapter 2). Construction activities would involve excavation, fill and site grading to build roadways, utilities, and home sites. It is estimated that total earthwork on the order of approximately 2,106,800 cubic yards (cy) would be required to implement Alternative 1, most of which would be balanced on-site. Approximately 227,534 cy of material may be exported, and approximately 52,670 cubic yards of select fill material may be imported to the site over the course of the 6- to 12-year development period. Some fill material could be obtained from on-site borrow sources including the existing waste rock pile. These activities would create temporary excavations and stockpiles and would likely require construction of temporary haul roads and equipment staging areas. These activities could impact slope stability during construction of temporary slopes, temporary surcharging of the tops of existing slopes, and excavation at the base of existing slopes.

The construction impacts of Alternative 2 would be similar to those described above for Alternative 1, except that earthwork quantities would be proportionately less with 110 fewer dwelling units to be constructed. The total estimate of earthwork to implement Alternative 2 is approximately 1,917,200 cy of which approximately 191,912 cy may be exported from the site, and approximately 34,510 cy of select fill may be imported over 6 to 12 years.

The construction impacts of Alternative 3A would be essentially the same as with Alternative 2 due to the same number of dwelling units in the conceptual land use plan. Alternative 3A would be subject to Kittitas County Critical Area regulations that pertain to steep slopes.

Construction impacts under Alternative 3B would likely occur over a longer period of time and in a less coordinated manner. Overall topographical variation may be less and fewer community access roads would likely be required with this alternative due to fewer dwelling units (approximately 500 d.u.) compared to Alternative 1 (985 d.u.), Alternative 2 or 3A (approximately 875 d.u. each). The total estimate of earthwork to implement Alternative 3B is approximately 1,538,000 cy, of which approximately 80,745 cy may be exported from the site, and approximately 38,450 cy of select fill may be imported over 6 to 12 years or longer. As with Alternative 3A, Alternative 3B would be subject to Kittitas County slope regulations.

If the No Action Alternative were selected, existing topographical features would remain as they are and there would be no construction alterations to topography.

POTENTIAL DEVELOPED-CONDITION IMPACTS

The open space proposal under Alternative 1, 2 or 3A would preserve unique physical features of the site in permanent open space. These include the Slick Rock feature south of proposed Development Area F3, and approximately one-half of the Red Rock waste rock pile, the area with the highest elevations and steepest gradient. Under Alternative 1 or 2, there would be park improvements surrounding these features. Under Alternative 3A, these areas would be preserved in unimproved open space. Under Alternative 3B, it is unlikely that the Slick Rock and Red Rock features would be preserved in the smaller parcels that would be sold for development within the County.

Under the No Action Alternative, processes currently affecting existing topographical features would likely continue. Coal slag piles in the former coal washing area at the west end of the site, and waste rock piles east of Summit View Road are potentially unstable in their existing condition. Occasional landslides and instability in the undeveloped slopes of these stockpiles would continue. Erosion and gullying of the land surface and potential debris flows would continue to modify topography in drainage courses. Continued use of undeveloped dirt roads on the site by off-road vehicles would result in minor

modifications to topography. The potential human-contact chemical hazard associated with the coal washing waste pile at the west end of the site would remain unaddressed (see Draft EIS Section 3.1.5).

MITIGATION MEASURES

Mitigation Measures Included in the Development Proposal. Development would be clustered on existing prominent terraces to the maximum extent practicable in order to minimize development in steeper areas that would require more grading. Under Alternative 1, 2, or 3A, a substantial portion of the Red Rock waste rock pile area would be preserved in a park, rather than grading its slopes to make it suitable for development. Potentially unstable slopes in the waste rock pile would be graded as necessary to improve public safety.

Additional geotechnical investigations will be performed in proposed Development Area A to determine best construction practices as they relate to the coal waste pile. Engineering solutions could involve measures to either strengthen the soil or to transmit structural loads to the underlying native soil. Driven piles are a typical solution for supporting residential structures located on weak soil. Ground improvement options could include a preload surcharge, where excess fill would be placed on proposed building areas to compress and densify the soil over time, producing a stronger, less compressible subgrade. Ground improvement, over-excavation or a combination of these methods would likely be required to provide a stable subgrade for the construction of roads and utilities through the area where the coal waste pile is located. Specific geotechnical recommendations for pavements and utilities will be developed in the design phase if development is proposed within Area A.

The applicant proposes to maximize use of on-site sources of fill material to minimize the number of haul trips to/from the site. The proposal also includes using excess excavated material and stockpiled soils to reclaim on-site borrow areas. Under Alternative 1 or 2, construction haul routes and plans will be submitted to the City of Cle Elum PublicWorks Director for approval prior to the start of construction activity.

As development proceeds, if it is determined that blasting will be needed in localized areas, a detailed blast specification would be prepared by a Project Engineer to integrate the findings and recommendations of the *Geotechnical Evaluation* (Aspect Consulting, October 2009) and the *Coal Mine Hazards Risk Assessment* (Subterra, Inc., October 2009), and to outline blasting objectives and activities for the project. The blasting contractor would then prepare a site-specific blast plan that identifies all details and procedures for blasting on-site.

Soil and rock slopes created by blasting (if any) shall be maintained according to the recommendations of the Geotechnical Engineer. Slope inclinations may have to be modified by the blasting contractor if localized sloughing or rockfalls occur. In order to minimize the potential for erosion from areas where blasting is performed, erosion control measures would be installed as soon as practicable, surface water would be diverted away from blast areas, and slopes would be inspected daily until stabilized.

Consistent with conditions of the property owner's easement to Puget Sound Energy (Kittitas County Auditor, April 14, 1986), no blasting shall be done within 300 feet of the electrical transmission line corridors through the site without PSE's written consent, and PSE shall not unreasonably withhold this consent.

Applicable Regulations. Construction slopes will be required to conform to Washington Industrial Safety and Health Act (WISHA) requirements for excavation and trenching.

Site grading under Alternative 1 or 2 would be required to comply with Title 15, Chapter 15.30 of the Cle Elum Municipal Code including obtaining a grading permit. Representative requirements are listed below.

- Cut slopes shall be no steeper than is safe for its intended use and shall be no more than 2H:1V or as recommended by a Geotechnical Engineer.
- Fills for building sites shall be constructed in accordance with the latest edition of the International Building Code (IBC) as adopted by the City of Cle Elum.
- Fills shall be constructed using earth materials, compaction methods, and construction techniques so that a stable fill is constructed.
- Excavation, grading or filling is prohibited:

    - Within 50 feet of the top of the bank of any water course except as required by an approved drainage plan.
    - If the work would result in the deposit of materials or otherwise have effects on public rights-of-ways, easements and property, and
    - On slopes greater than 40 percent.

If Alternative 3A or 3B were selected for implementation, site grading would be required to comply with the Kittitas County Code, which currently does not require a grading permit. Therefore, the International Building Code (IBC) and standard construction and geotechnical engineering practices would apply to site grading and topographical alteration. Representative requirements are listed below.

Placement of backfill. Excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted, in a manner that does not damage the foundation or the waterproofing or damp-proofing material.

Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet measured perpendicular to the face of the wall.

Potential construction impacts associated with steep slopes would be mitigated by complying with applicable regulations, accepted geotechnical and building standards, and Washington Industrial Safety and Health (WISHA) requirements. Alternative 1 or 2 would be required to comply with Title 18, Chapter 18.330 of the Cle Elum Municipal Code that states moderate and high risk erosion/landslide geologic hazard areas (defined by CEMC as 25 percent slopes or greater) shall comply with the City of Cle Elum Building Code (which refers to IBC), and that specialized engineering may be required by the City Building Inspector to mitigate such risk. Alternative 3A or 3B would be required to comply with Title 17A, Chapter 17A.06.015, Kittitas County Code which requires specialized engineering to ascertain the suitability of geologically hazardous areas for development. According to applicable provisions of the IBC, setbacks for structures from the top and bottom of slopes exceeding 33 percent should be as follows:

Tops of slopes. The face of footings of foundations should be no closer than one-third of the slope height to the tops of slopes, not to exceed 40 feet.

Bottoms of slopes. Foundations should be no closer than half of the slope height, measured from the top of the foundation horizontally to a 45 degree tangent with the slope, not to exceed 15 feet.

Specific geotechnical evaluation would be required where development is proposed closer to steep slopes than described above.

Other Possible Mitigation Measures. Coordinated planning could minimize impacts to topography. Coordinated planning during construction could include consolidating the location of construction access roads, borrow areas, and construction staging areas. Coordinated planning for developed conditions could include consolidating the location of roadways, utility corridors and stormwater management facilities, and sizing infrastructure sufficiently to support future phases of development. In areas that would require substantial modifications to topography such as the coal waste pile at the west end of the site, areas on or adjacent to steep slopes in the waste rock pile, and slopes greater than 40 percent, development proposals should be reviewed by a Geotechnical Engineer on a site-specific basis at the time of the actual site development proposal.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Site development would result in some permanent modifications to topography to achieve design grades for the construction of roadways, utilities, and home sites. It is not expected that these modifications would constitute significant adverse impacts.

3.1.2 Geology and Soils

AFFECTED ENVIRONMENT

This section describes the geologic setting and geologic units on the site that have distinct geotechnical properties referred to as engineering geologic units and soils. Appendix A of the EIS contains a glossary of the geotechnical terms used in this section.

Regional Geology

The City Heights site is located in the Upper Kittitas Valley, in the foothills of the eastern flank of the Cascade Mountain Range. The Cascades were tectonically uplifted beginning in the late Eocene epoch (approximately 37 million years ago) as a result of the collision of offshore oceanic tectonic plates at the Cascadia subduction zone. Coincident volcanism emplaced igneous intrusive rocks, lava flows, and ash throughout the Cascades.

The Yakima Fold Belt sub-province of the Columbia Plateau was formed by tectonic forces beginning during mid- to late-Miocene time (approximately 15 to 10 million years ago) and continued into the Quaternary from 2 million years ago to present (United States Department of Energy 1988). Structural folds control much of the topography in Kittitas, Chelan and Yakima Counties. Active tectonic folding and faulting has slowed since the Pliocene (approximately 5 to 2 million years ago), and incised river valleys and fault scarps have since filled in with sediments.

The Upper Kittitas Valley at Cle Elum underwent several alpine glaciations during the Pleistocene epoch (approximately 2 million to 11,000 years ago). Glacial sediments including outwash, till and lacustrine deposits are mapped in the vicinity of Cle Elum.

Site Geology

The site lies near the base of Cle Elum Ridge, on a limb of an asymmetric anticline in Tertiary-age (approximately 65 million to 2 million years ago) sedimentary bedrock. Bedrock strata generally dip to the south at angles less than 30 degrees. Cle Elum Ridge, located within the Upper Kittitas Valley, is one of several large synclinal structural basins within the Yakima Fold Belt. The presence of down-valley glacial deposits indicates that the entire site was glacially overridden.

Bedrock on the City Heights site is mapped as the non-marine sedimentary upper member of the Roslyn Formation, deposited during the late Eocene epoch approximately 35million years ago (Tabor et al. 1982). A coal seam 4 feet to 6 feet thick within the Roslyn Formation was extensively mined beneath the City Heights site and in the greater Cle Elum area. Unconsolidated sediments, primarily consisting of bedrock residuum and glacial deposits, are present over most of the site. Bedrock residuum resulting from weathering of Roslyn Formation rocks overlies bedrock to varying depths. Glacial deposits up to 100 feet thick locally overly bedrock and bedrock residuum. Glacial deposits consisting of outwash, till and lacustrine (former lake) deposits are most evident in several low-gradient terraces present on the lower elevations of the bedrock-cored slope. Other less extensive geologic units include alluvium occupying local drainage bottoms and artificial fill (coal waste piles) at the western end of the site.

Site Engineering Geologic Units

Six general engineering geologic units are present on the City Heights site (Figure 3.1-1). Two units are associated with uncontrolled fills (coal waste and waste rock) and four units are naturally-occurring (alluvium, glacial deposits, bedrock residuum, and sedimentary bedrock). Bedrock residuum is mapped with the sedimentary bedrock unit, as these units occur together. A conceptual cross section of subsurface conditions across the full length of the site is illustrated in Figure 3.1-2. The engineering geologic units are divided based upon origin and general engineering characteristics, and are described below in order from most recent to oldest.

Uncontrolled Fills. Two large uncontrolled fills comprised of coal waste and waste rock were placed at the site during historic mining activities that began in the late 1800s and continued through the mid-1900s – a coal waste pile within proposed Development Area A, and a waste rock pile within and to the north of proposed Development Area D2 (see Figure 3.1-1).

Coal Waste. Coal waste appears to have originated as fines and pond sediment resulting from coal processing operations. Coal waste generally consists of dark gray to black, clayey silt, silty clay and sandy silt containing abundant angular fragments of coal. By volume, it appears to be composed predominantly of fine-grained coal fragments with a lesser component of mineral grains. The thickness of clayey silt and very moist silty clay coal waste ranges from 1 foot to greater than 12 feet, and could be as thick as 20 feet or more overlying sand and cobble-gravel glacial deposits in proposed Development Area A at the west end of the site. Coal waste consisting of sandy silt with angular fragments of coal was observed in several piles on top of the waste rock pile (described below), and may also be present within the waste rock pile. Coal waste appears to have been mixed with waste rock during placement of the pile.

Waste Rock. Waste rock is believed to have originated from mining operations during the first half of the twentieth century. Waste rock consisting of red to brown silty sand and angular gravel-size rock fragments, is present in proposed Development Area D2 and in the area north of the Red Rock waste rock pile. The waste rock pile overlies glacial deposits. The thickness of waste rock ranges from a few feet to up to 100 feet in the interior of the waste rock pile.

Reclaimed mine lands also represent uncontrolled fills along the northern boundary of the site in proposed Development Area E.

Insert Figure 3.1-2. Cross-Section Diagram A-A' (11x17-inch color)

Field observations indicate the south-facing hillside in proposed Development Area G was graded into a series of approximately 12 terraces measuring roughly 4 feet high by 8 feet deep associated with past activities on the site. Further investigation would be required to determine whether the slope in proposed Development Area G contains uncontrolled fills.

Naturally-Occurring Deposits

Alluvium. Alluvium deposited in local drainages during the Holocene epoch (approximately 10,000 years ago to present), generally consists of sand with gravel and cobbles. It is present along the southern boundary of proposed Development Area A, in the low-lying region adjacent to Crystal Creek, in thicknesses that exceed 10 feet.

Glacial Deposits. Glacial drift is believed to have originated from Quaternary alpine glaciations of the Cascade Mountains and Kittitas Valley. Glacial deposits consist primarily of outwash with till and lacustrine deposits. These units generally are composed of sand with gravel and variable proportions of silt, clay, and cobbles. Most glacial deposits mantle the bedrock surface and are present throughout much of the lower elevations of the City Heights site where they form numerous terraces on the property. The thickness of glacial deposits likely ranges from a few feet to more than 100 feet.

Bedrock Residuum. Residuum, consisting primarily of silty fine to medium sand, is present on the surface over much of the higher elevations of the City Heights site. It was formed from the in-place weathering of sedimentary bedrock, and becomes increasingly less weathered and harder with depth, eventually grading to unweathered bedrock. The observed thickness of residuum varies from being absent to 39 feet. Typical residuum thickness encountered is 6 to 12 feet. Residuum is mapped with sedimentary bedrock in Figure 3.1-1.

Sedimentary Bedrock. Sedimentary bedrock at the site is the upper member of the Roslyn Formation (Tabor et al.1982). Bedrock consists of interbedded sandstone, siltstone, and mudstone with occasional coal seams. Bedrock is exposed west of proposed Development Area F3 identified on conceptual land use plans as “Slick Rock” park, in road cuts along Deer Creek Road, and in the northern portion of proposed Development Area E. Except for these outcrops, sedimentary bedrock is mantled by residuum, which is overlain by glacial deposits and/or fill in places. The upper member of the Roslyn Formation is up to 2,400 feet thick (Walker 1980).

Seismic Setting and Hazards

The City Heights site is located within a region subject to earthquakes on shallow crustal faults and in the Cascadia Subduction Zone (CSZ). No surface faults are mapped on the property, and no evidence of surface faulting was observed by the Geotechnical consultant (Aspect Consulting, October 2009). Two faults are mapped approximately 4.5 and 6 miles south of the property (Tabor et al. 1982). These faults trend west-northwest to east-southeast and dip nearly vertically with down-to-the-north movement. Trend direction and location of these faults indicates they are associated with the Yakima Fold Belt. A fault of unknown age was identified in underground mine workings in the Roslyn No. 5 Mine, west of the City Heights site (Saunders 1914).

Evidence exists of Quaternary movement along faults in the Yakima Fold Belt, and earthquakes have recently occurred in the central Columbia Basin within basalts of the Yakima Fold Belt (U.S. Department of Energy 1988). The largest known earthquake in the Columbia Basin occurred in 1936 at Milton-Freewater, Oregon (U.S. Department of Energy 1988). This earthquake had a magnitude estimated as high as 6.1 (Woodward-Clyde Consultants 1980). The largest recorded earthquake occurred in 1973, east

of Cle Elum near Othello, with a magnitude of 4.4 (Noson et al. 1988). Records maintained since 1969 indicate that all earthquakes measured in the Columbia Basin are shallow.

A shallow earthquake within the Cascade Mountains occurred in 1872, north of Cle Elum near Entiat, with an estimated magnitude of 6.8 (Bakun et al. 2002). The U.S. Geological Survey predicts that future earthquakes within the Cascades would likely be shallow and could exceed magnitude 7 (Noson et al., 1988).

Other large earthquakes in Washington and Oregon are associated with the Cascade Subduction Zone, which lies approximately 150 miles west of Cle Elum in the Puget Sound area (Washington Department of Natural Resources 2008). Hazards associated with the CSZ include deep (Benioff zone) earthquakes and subduction zone earthquakes. Deep earthquakes generally originate during rupture of the sinking oceanic plate, have magnitude 7.5 or less, and occur approximately every 10 years to 30 years. Subduction zone earthquakes occur due to rupture between the subducting oceanic plate and the overlying continental plate. These earthquakes have magnitude up to 9 and a recurrence interval on the order of 500 years.

Surficial ground rupture hazard for the City Heights site is considered low due to the distance to known active faults and the long recurrence intervals for earthquakes on these faults. Liquefaction potential for the site is generally considered to be low. However, the alluvium and coal waste pile on the western end of the property in proposed Development Area A is designated in the Washington Department of Natural Resources Liquefaction Potential Map for Kittitas County (Palmer, et al., 2004) as having moderate to high liquefaction potential. Except for a small area that is underlain by alluvium and shallow groundwater, most of proposed Development Area A is underlain by fine-grained coal waste that presents a low liquefaction potential.

POTENTIAL IMPACTS DURING CONSTRUCTION

Subgrade preparation in areas that would support new fills, structures, and pavement will begin with removal of vegetation and deleterious matter. Certain on-site geologic units will be suitable for producing structural fill for the proposed development. Glacial deposits − natural on-site soils consisting of sands and gravels − are generally considered suitable sources of structural fill since they contain a relatively low percentage of fines (silt and clay particles). Other soils found on the site, including bedrock residuum and the waste rock pile north of proposed Development Area D2 contain a relatively high percentage of fines and will be moisture-sensitive, making them difficult to work with in wet weather. These materials can be used for structural fill if earthwork is performed during dry weather conditions and the contractor's methods are conducive to proper compaction. If weather conditions and/or other factors make it impractical to use moisture-sensitive soils derived from on-site sources for structural fill, these soils can be used as general fill in areas not sensitive to settlement, such as in areas to be landscaped (Aspect Consulting, October 2009).

Development within areas containing past uncontrolled fills would have no impact on construction activities to implement any conceptual land use alternative, other than to require an increased level of effort if unsuitable subgrade material is modified or removed/replaced to develop the site.

Uncollapsed areas of underground mines would have the potential to affect construction activities associated with any conceptual land use alternative if earth stability is compromised. Construction activities occurring near abandoned mine openings and in the vicinity of shallow mine workings could be impacted by voids. These potential impacts would be addressed by the mitigation measures described below.

No impact to construction activities from seismic events is anticipated with site development under any conceptual land use alternative because the predicted recurrence interval for major seismic events in this region is substantially longer than the anticipated construction period.

If the No Action Alternative were selected, there would be no ground-disturbing activities or construction at this time. Therefore, there would be no construction impacts to geology and soils associated with this alternative.

POTENTIAL DEVELOPED-CONDITION IMPACTS

Most impacts to geology and soil units would be caused by grading modifications to implement any of the conceptual land use alternatives. These are discussed above in Section 3.1.1, Topography.

Under any build alternative, seismic events could impact the structural integrity of residential and commercial structures, roadways and utilities, and could destabilize steep slopes; however, risk of surficial ground rupture and liquefaction is considered low due to the distance to known active faults and the long recurrence intervals for earthquakes on these faults.

Under the No Action Alternative, there would be no alteration of geology and soils on the site. Steep slopes in existing uncontrolled fills (coal waste and waste rock) would remain and could fail during a seismic event, potentially presenting a hazard to public safety. Slope hazards are discussed in more detail in Draft EIS Section 3.1.1, above.

MITIGATION MEASURES

Mitigation Measures Included in the Development Proposal. Design of structures to be built within the project would comply with applicable seismic design codes.

Applicable Regulations. Alternative 1 or 2 would be required to comply with the Cle Elum Municipal Code structural design provisions of the International Building Code (IBC). Alternative 3A or 3B would be required to comply with the Kittitas County-adopted version of the Uniform Building Code (KCC 17A.06.010).

Other Possible Mitigation Measures. If additional geotechnical investigations to be conducted during the design phase discover abandoned mine hazards that were not previously identified, additional geotechnical investigation of these features may be warranted.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

To the extent that site development complies with applicable regulations and accepted engineering design standards, the recommendations of the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009), and prudent construction practices, no significant unavoidable adverse impacts related to geology or soils would be expected to occur with implementation of any of the conceptual land use alternatives.

3.1.3 Erosion

AFFECTED ENVIRONMENT

Nine soil types are mapped on the City Heights property by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), including soil units associated with mining activities. Site soils, most of which are classified as loam, are derived from the weathering of underlying parent material such as glacial drift and sedimentary bedrock, and are mixed with loess and volcanic ash. These soils typically extend from the ground surface to a depth of 3 to 5 feet. Teanaway loam, found on 10 percent to 25 percent slopes, is the most common soil type mapped on the property (see Figure 3.1-3).

The permeability of most soils on the site is described as moderate to high, with moderate to severe erosion hazard, especially on most steep slopes along the southern site boundary and in drainage courses. Dystroxerepts soils, found on 45 percent to 65 percent south slopes, occur in the westernmost drainage between proposed Development Areas A and B, and are listed by NRCS as having a severe to very severe erosion hazard. Soil units associated with mining activities are not evaluated by NRCS for erosion hazard and permeability; however, observation of the coal waste pile by the Geotechnical Engineer indicates erosion potential is likely moderate to severe, and permeability is likely low to moderate (Aspect Consulting, October 2009). Observation of the waste rock pile indicates erosion potential is low and permeability is high.

Substantial gully erosion was observed south of proposed Development Area D1 near the southern site boundary where the seasonal stream crossing under Summit View Road (Stream C discussed in Draft EIS Section 3.4) is downcutting into the underlying glacial deposits sediment terrace (see Figure 3.1-1). Erosion has created a near vertical-walled gully up to 10 feet high, 15 feet wide, and approximately 200 feet long. Observations of local topography indicate that this stream was diverted from its natural watercourse by an earthen dam located approximately 300 feet upstream, east of Summit View Road (Aspect Consulting, October 2009). The watercourse diversion was likely related to historical mining activities involving placement of the waste rock pile. Evidence of more than one debris flow was observed at the mouth of this gully resulting from erosion of the gully. Based on field observations, the most recent event likely occurred within the past two years. Similar events could periodically occur during exceptionally high flows in this stream.

Moderate erosion was observed along existing road cuts and roadside ditches and in the eastern portion of the coal waste pile (Aspect Consulting, October 2009). Minor erosion was encountered in unimproved dirt roads including the power line access road that is frequently used by off-road vehicles. Sedimentation from erosion of roadside ditches, road cuts and unimproved dirt roads was observed in the wetland created by a low earthen dam east of Summit View Road (Wetland C discussed in Draft EIS Section 3.4) and is assumed, but was not specifically observed, to be occurring in the lower, off-site reaches of all drainages.

Debris flows are common in the Upper Kittitas Valley, typically resulting from rapid snow melt or high intensity rainstorms. Potential for debris flows exists in all drainage courses through the site. Deer Creek and the Balmers Canyon drainage at the east end of the property likely have the greatest potential for debris flows (see Figure 3.1-1).

Insert Figure 3.1-3. NRCS Soils (11x17-inch color)

POTENTIAL IMPACTS DURING CONSTRUCTION

Ground-disturbing activities during construction of any conceptual land use alternative would increase erosion potential on the site. If stripped of vegetation, the erosion hazard of most natural surface soils on the property is considered moderate to severe, particularly on most steep slopes along the south site boundary and in drainage courses. Soils that occur on 45 to 65 percent slopes in the western-most drainage between proposed Development Areas A and B (Stream D) present a severe to very severe erosion hazard. Erosion potential for past uncontrolled fills is considered moderate. Best Management Practices required by Ecology's 2004 *Stormwater Management Manual for Eastern Washington* will be implemented to control erosion potential during earthwork activities on the site.

No development is proposed in the lower portion of Balmers Canyon where unconsolidated soils resulted in a recent landslide.

Construction activities would involve excavation, fill and site grading to build roadways, utilities, and home sites. Unsuitable material would be exported from the site, select fill would be imported to the site, and earthwork in general would require redistribution of material within areas proposed for development.

Excavation dewatering may be required where shallow groundwater is present, causing water to be temporarily discharged to the land surface. If improperly managed, these activities could result in erosion, especially during wet weather conditions.

If the No Action Alternative were selected, there would be no clearing or grading activities, and therefore no change in existing conditions of erosion that occur on the property.

POTENTIAL DEVELOPED-CONDITION IMPACTS

Stabilization of site soils and construction of a coordinated stormwater management system by proposed development under Alternative 1, Alternative 2 or Alternative 3A would eliminate areas where erosion presently occurs on the property including substantial gullying in proposed Development Area D1 caused by the seasonal stream that crosses beneath Summit View Road (Stream C), along existing roadside ditches and road cuts, and at the coal waste pile. A less coordinated stormwater management system would likely result from site development in 17 individual parcels under Alternative 3B. The multi-use trail proposed with Alternative 1 or 2 would stabilize soils on existing unimproved dirt roads within the power line easements on the property. Trail construction is not an element of the proposal under Alternative 3A or 3B.

Development under any conceptual land use alternative could be subject to the impacts of debris flows in drainage courses. Road and utility crossings of drainage courses may be at most risk.

Impacts associated with the No Action Alternative include continued substantial erosion of the Stream C gully west of Summit View Road and associated downstream deposition of sediment; continued erosion of existing road cuts and roadside ditches; continued minor erosion on unimproved dirt roads and associated downstream deposition of sediments; and persistence of the potential for erosion of the coal waste pile by wind and precipitation. Erosion in the Stream C gully approximately 100 feet downstream of Summit View Road has created near-vertical sidewalls up to 10 feet high, 15 feet wide, and approximately 200 feet long. Head-cut erosion of the upstream migration of the gully will continue until stream gradient equilibrium is achieved. This erosion has the potential to reach Summit View Road if channel stabilization measures are not implemented (Aspect Consulting, October 2009).

MITIGATION MEASURES

Mitigation Measures Included in the Development Proposal. Elements of the proposed City Heights development would eliminate or minimize erosion from existing unstable soil areas of the site. The proposal includes re-grading the Stream C gully concurrent with site improvements in proposed Development Area D1, constructing a coordinated stormwater management system, and eliminating, re-grading and/or paving unimproved dirt roads. Proposed stormwater management measures to avoid or minimize erosion and sedimentation (described in Draft EIS Section 3.18.3) would also minimize potential adverse effects to topography and soils.

Applicable Regulations. Conditions of erosion from the site during construction and in the developed condition under any conceptual land use alternative would be mitigated by compliance with applicable regulations including, but not necessarily limited to:

- A Construction Stormwater General Permit issued by the Washington Department of Ecology (Ecology) for compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES).

- A site-specific Temporary Erosion and Sedimentation Control Plan (TESCP) prepared and implemented during construction in accordance with Ecology's Stormwater Management Manual for Eastern Washington.

- Stormwater management systems installed on the site during construction and in the developed condition of the site designed, operated, and maintained in accordance with the requirements of Ecology's Stormwater Management Manual for Eastern Washington for new developments.

Additional detail regarding the proposed stormwater management system is provided in Draft EIS Section 3.18.3.

Other Possible Mitigation Measures. The Development Agreement could specify larger setbacks from drainage courses through the site as these areas are susceptible to debris flow hazards. Balmers Canyon (identified as Stream A in this analysis) and Deer Creek (identified as Stream B) were observed to have the greatest potential for debris flows. Channel stabilization measures are recommended for the Stream C and Stream D drainage courses. Design of these measures would require further study (Aspect Consulting, October 2009).

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

To the extent that site development complies with applicable regulations, accepted engineering design standards, and prudent construction practices, no significant unavoidable adverse impacts in the form of erosion would be expected to occur with any of the conceptual land use development alternatives.

3.1.4 Coal Mine Hazard Areas

The area that includes the City Heights site was extensively mined for coal between the late 1800s and the mid-1900s, primarily using underground extraction techniques. Most of the City Heights site is underlain by former mine workings at varying depths. A site-specific investigation was conducted, and the depths of underground mine workings were mapped (SubTerra, Inc., October 2009). Some areas in the northern and eastern portions of the site were identified as having relatively shallow underground mine depths. The *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) describes potential risks associated with abandoned mine lands and provides recommendations to guide proposed development. Detailed illustrations of the features described below are provided in the *Coal Mine Hazards Risk Assessment* that is a technical appendix to this EIS.

AFFECTED ENVIRONMENT

Six mines in the project area extracted coal from a single 4- to 6-foot thick seam called the Roslyn Bed or the No. 5 Bed described as uniform with few impurities. The seam was typically overlain by a thin, soft shale or mudstone layer grading to sandstone and underlain by sandy shale. The coal parted cleanly at these contacts so that little if any coal was left after mining. Coal was extracted using room and pillar methods with subsequent pillar removal. Turn-of-the-century mining was performed by hand using pick and shovel, with later introduction of drilling and blasting using black powder in the early 1900s.

The westernmost part of the City Heights site is underlain by workings from the Roslyn or No. 5 mine, opened in 1905. Approximately 6.4 million tons were mined between 1907 and 1947. This mine was originally accessed by a slope driven from outcrop, then from a rock tunnel. It is not expected that surface expressions of these features will be encountered on the City Heights site due to the depth of the mine workings.

The central part of the site is underlain by workings from the Roslyn No. 7 mine opened in 1907. Approximately 7.6 million tons were mined between 1908 and 1936. This mine was initially accessed by driving a rock tunnel to the top of the coal, then driving drifts down-dip in the coal seam. Rock tunnel portals to this mine are present on the City Heights site.

The eastern portion of the City Heights site is underlain by workings from the Cle Elum No. 1, No. 2, and No. 3 mines opened in 1895. Approximately 4.1 million tons were mined between 1895 and 1943, with the majority of production prior to 1918. These mines were accessed by drainage tunnels driven from outcrop. Drainage tunnel portals are located adjacent to Deer Creek that flows approximately north-south through the City Heights site adjacent to Montgomery Road. Sinkholes and shallow mine workings are located near the northern edge of the center of the site. Shallow mine workings are also located at the eastern end.

Independent Coal and Coke Company's No. 1 mine (ICC No. 1), also known as the Queen Mine, was located in the east half of Section 26, Township 20 North, Range 15 East, WM, and opened in 1916. Approximately 724,000 tons of coal were mined between 1916 and 1927. The mine workings are located at depth beneath the east central part of the City Height site. Abandoned coal mine entries to ICC No. 1 are therefore not expected to affect the City Heights project.

Since the early 1980s, the U.S. Department of Interior, Office of Surface Mines (OSM) in Denver, Colorado has implemented a program to identify and mitigate abandoned mine features that typically include abandoned shafts, abandoned adits (horizontal tunnels), abandoned declines (downward-inclining tunnels), and sinkholes above abandoned coal mines in the State of Washington. In 1984, Maddox and Associates (1984) were commissioned by OSM to locate and document the condition of a subset of small

Roslyn and Cle Elum mines on non-railroad-owned property. Additional work was performed by Hart Crowser & Associates in 1999 to identify and locate abandoned mine openings in Sections 26 and 27, Township 20 North, Range 15 East, WM, Kittitas County. Neither of these studies claimed to have found all of the abandoned mine features that they identified on mine maps.

Historic mine data summarized above was verified in 2009 by SubTerra, Inc. by surface reconnaissance on the City Heights site to locate abandoned mine surface features, and by drilling exploratory boreholes to confirm the thickness of mined coal and the current condition of the collapsed mine workings. Detailed descriptions of the work performed and the basis for conclusions drawn are provided in the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009). Based on examination of mining records and the results of the proof-drilling program conducted on the City Heights site, SubTerra concludes that significant subsidence has already occurred and any future potential for sinkhole occurrence should be limited to abandoned mine areas that are 50 feet deep or less. Shallow mine workings at the northern edge of the central part of the site and at its eastern end remain of concern with regard to sinkhole potential.

POTENTIAL IMPACTS DURING CONSTRUCTION

The *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) defines six categories of Coal Mine Hazard Areas (CMHAs) on the City Heights site, formulates development criteria appropriate for each level of hazard, and describes additional potential mitigation for site development in areas with these characteristics. The description and proposed development criteria for each of the six CMHAs are as follows:

Coal Mine Hazard Area 1: CMHA 1 includes areas where abandoned mine workings are less than 50 feet deep and where abandoned mine features[2] are present. These areas are deemed not suitable for development at the present time.

Coal Mine Hazard Area 2: CMHA 2 includes those areas where the abandoned coal mines are between 50 feet and 100 feet deep beneath the site, and abandoned mine features are present. This classification does not include areas where there are significant accumulations of mine waste (see CMHA 6). CMHA 2 areas may be developable after detailed site investigation to prove the absence of remnant voids and/or after mitigation (described below). Otherwise, these areas should be considered a buffer zone between CMHAs 1 and 3. Very detailed abandoned mine site investigations, to include at least 2 boreholes per acre with proof-drilling below proposed building foundation areas and access roads, may be used to demonstrate the suitability for site development of areas designated CMHA 2.

Coal Mine Hazard Area 3: CMHA 3 includes those areas where the abandoned coal mines are between 100 feet and 200 feet deep beneath the site and abandoned mine features are not present. This CMHA does not include areas where there are significant accumulations of mine waste (see CMHA 6). Development may occur in CMHA 3 areas subject to standard site investigation; civil engineering design; and local, State, and Federal code compliance. In addition, proof-drilling shall be conducted at the location of each proposed building site (minimum of one hole per 5 acres) to demonstrate that subsidence is substantially complete.

Coal Mine Hazard Area 4: CMHA 4 includes those areas where the abandoned coal mines are between 200 feet and 300 feet deep beneath the site and abandoned mine features are not present. This CMHA does not include areas where there are significant accumulations of mine waste (see CMHA 6).

[2] Abandoned mine features include (but are not limited to) spoil piles, adits, portals, and shafts exposed at the ground surface.

Development may occur in CMHA 4 areas subject to standard site investigation; civil engineering design; and local, State, and Federal code compliance.

Coal Mine Hazard Area 5: CMHA 5 includes areas where coal mines are deeper than 300 feet and where abandoned mine features are not present. This CMHA does not include areas where there are significant accumulations of mine waste (see CMHA 6). Development may occur in CMHA 5 areas subject to standard site investigation; civil engineering design; and local, State, and Federal code compliance.

Coal Mine Hazard Area 6: CMHA 6 includes areas covered by abandoned coal mine spoils. No development is permitted in these areas until a qualified Geotechnical/Civil Engineer has conducted investigation, stability analyses, and foundation evaluations, and certified that this portion of the site is suitable for building construction.

The *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) then evaluates and describes potential impacts and mitigation recommendations for each of the proposed Development Areas shown on the Alternative 1 and Alternative 2 conceptual land use plans for the City Heights development. These land use plans are included in Draft EIS Chapter 2 as Figures 2.6-1 and 2.6-2. Recommended development criteria for specific development areas on the site are listed below in relation to the coal mine hazard area (CMHA) classification of each area.

Development Area A. Proposed Development Areas A1 and A2 are underlain by coal mine waste piles composed of waste rock excavated from mines west of the City Heights site. This places proposed Development Area A in CMHA 6. Areas A1 and A2 may be developed from a mine subsidence perspective, but require investigation, stability analysis, evaluation and design by a qualified Geotechnical/Civil Engineer before their development potential can be confirmed.

Development Area B. Coal mine workings are between 550 feet and 650 feet deep below proposed Development Area B, placing this area of the site in CMHA 5. No development restrictions are proposed. However, surface inspection is required to confirm the absence of coal mine spoils.

Development Area C. Coal mine workings are 600 to 700 feet deep beneath proposed Development Area C, placing this area in CMHA 5. No development restrictions are proposed. However, as with Development Area B, surface inspection is required to confirm the absence of coal mine spoils.

Development Area D. Similar to proposed Development Area C, coal mine workings are 500 to 700 feet deep beneath proposed Development Area D, placing this area of the site in CMHA 5. Section 27 rock tunnels identified above Development Area D2 will need to be remediated during site development. No additional development restrictions are proposed.

Development Area E. Proposed Development Area E is underlain by mine workings ranging from outcrop (exposed at the ground surface) to 150 feet deep, placing this area of the site in CMHAs 1, 2, and 3. The CMHA 1 portion of Area E is deemed not suitable for development at this time, and the CMHA 2 portion is deemed marginally suitable for development subject to proposed development criteria for this category of CMHA. Boreholes identified voids, indicating that collapse of coal mine workings beneath this portion of the site is not yet complete. Borehole data indicate that these voids are migrating toward the surface. Development in the CMHA 3 portion of proposed Development Area E is considered more feasible, subject to proposed development criteria for this category of CMHA (described above).

Development Area F. Conceptual land use plans for the proposed City Heights development segregate Development Area F into four subareas: F1, F2, F3, and F4. Proposed Development Areas F1 and F4 are

underlain by coal mine workings that are 300 to 500 feet deep, placing these areas in CMHA 5 with no development restrictions. Proposed Development Area F3 is underlain by coal mine workings 200 to 300 feet deep; therefore this area is subject to proposed development criteria described for CMHA 4. Proposed Development Area F2 is underlain by coal mine workings that are 150 to 300 feet deep, subject to proposed development criteria for CMHAs 3 and 4 (described above).

Development Area G. Proposed Development Area G is underlain by coal mine workings that are 200 to 280 feet deep, subject to proposed development criteria for CMHA 4.

Development Area H. Proposed Development Area H is underlain by coal mine workings that are 200 to 240 feet deep. As with Area G, Development Area H is subject to proposed development criteria for CMHA 4.

Development Area I. Conceptual land use plans for the proposed City Heights development segregate Development Area I into Areas I1 and I2 along a north-south access road (an extension of Columbia Avenue). Proposed Development Area I1 is underlain by coal mine workings that are 270 to 320 feet deep, placing this area of the site in CMHAs 4 and 5. SubTerra (October 2009) recommends that Area I1 be subject to proposed development criteria for CMHA 5 as the shallowest coal mine workings are on the order of 270 feet below the developable surface and no abandoned mine features are indicated to be present. Proposed Development Area I2 is underlain by coal mine workings that are 150 to 200 feet deep. An air shaft was located east of Area I2. Therefore, Area I2 is subject to proposed development criteria for CMHAs 3 and 4 (described above).

Development Area J. Proposed Development Area J is underlain by coal mine workings that are 260 to 340 feet deep, placing this area of the site in CMHAs 4 and 5. As with Area I1, SubTerra (October 2009) recommends that Area J be subject to proposed development criteria for CMHA 5 as the shallowest coal mine workings are located on the order of 280 feet below the developable surface and no abandoned mine features are indicated to be present.

Development Area K. Proposed Development Area K is bisected into two segments (K1 and K2) by a north-south access road. Proposed Development Area K1 located west of the access road is underlain by coal mine workings that are 100 to 150 feet deep, placing this area in CMHA 3. Area K2 located at the easternmost end of the property is underlain by coal mine workings that are 10 to 90 feet deep, placing this area in CMHAs 1 and 2.

POTENTIAL DEVELOPED-CONDITION IMPACTS

The potential for adverse impacts to occur to improvements constructed on the site as a result of the presence of abandoned mine areas on the City Heights property would be minimized or avoided by implementing proposed development criteria and mitigation measures identified in the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) prepared for the site, summarized in Draft EIS Section 3.1.4.

MITIGATION MEASURES

Mitigation Measures Included in the Development Proposal. The applicant proposes to implement mitigation measures for the six different categories of Coal Mine Hazard Areas (CMHAs) identified in the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009), as follows:

Coal Mine Hazard Areas (CMHAs) 1 and 2: Drill and grout remnant voids beneath the site and seal air shafts and adit/decline/incline portals. If grouting or some similar method of fill is applied in

conjunction with additional proof-drilling and stability analyses, Area K2 at the east end of the site would be developable under the criteria for CMHA 2.

Coal Mine Hazard Areas (CMHAs) 3, 4 and 5: Clean up abandoned mine structures.

Additional development criteria and mitigation for construction in CMHAs 1 through 4 include:

- Building designs shall accommodate standard requirements for construction in abandoned mine areas including, at a minimum, the use of rigid foundations (conventional reinforced concrete spread footings) supporting a flexible superstructure (metal or wood frame).
- Concrete slab-on-grade construction should use rebar rather than wire mesh for added strength.
- There would be no brick or rock construction in CMHAs 1 through 4 other than for fireplaces, non-structural facades, or landscape features.
- Any additional abandoned mine lands work and/or studies shall meet, at a minimum, the requirements and King County guidance outlined in Attachment A to the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009).

Coal Mine Hazard Area (CMHA) 6: Completely or partially remove coal waste (spoil) material from the proposed development area to the satisfaction of the qualified Geotechnical/Civil Engineer. Guidance on coal mine spoil pile hazard mitigation is provided in King County guidelines attached to the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009).

Applicable Regulations. The City of Cle Elum has no adopted regulations regarding development above abandoned coal mine areas. King County guidelines included in Attachment A to the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) are provided for the City's consideration when reviewing site development applications submitted for City Heights Alternative 1 or Alternative 2.

Alternative 3A or 3B would be subject to the Kittitas County Critical Areas Code (Title 17A) as it relates to mine hazard areas. Mine hazard areas are defined in Kittitas County Code (KCC) Section 17A.02.210. The siting of structures on mine hazard areas is addressed in KCC 17A.06.030, cited below.

> *Mine hazard areas are geologically hazardous areas, directly underlain by, adjacent to, or affected by abandoned mine workings such as adits, tunnels, ducts or shafts with the potential for creating large underground voids susceptible to collapse. Closed and abandoned mines shall be presumed not hazardous unless specifically identified by the U.S. Department of Mines or other relevant information.*
>
> *Siting of structures on known mine hazard areas should be avoided.*

Given the provision in the Kittitas County definition of mine hazard areas that closed and abandoned mines shall be presumed not hazardous, and the fact that site-specific investigation has been performed to provide relevant information concerning the development potential of each area of the site, it is presumed that the City Heights proposal under Alternative 3A or 3B (if either of these alternatives were selected for implementation) would be evaluated by the County in the context of the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009) and the proposed development criteria and mitigation measures therein.

Other Recommended Mitigation Measures. Qualified Geotechnical/Civil Engineering consultant services could be retained to develop and implement closure designs for abandoned mine features in Sections 25, 26, and 27 (Township 20 N., Range 15 E, WM, Kittitas County, WA). This task would involve liaison with the U.S. Department of the Interior, Office of Surface Mining.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

There would be no known significant unavoidable adverse impacts associated with implementing site development in accordance with the proposed development criteria and mitigation measures identified in the *Coal Mine Hazards Risk Assessment* (SubTerra, Inc., October 2009), which include additional proof-drilling in some identified areas to confirm the absence of remnant voids, or drilling and grouting to fill identified voids that could otherwise pose a risk of settlement in the developed-condition of the site.

3.1.5 Hazardous Substances Investigation

A *Phase I Environmental Site Assessment* (ESA) was conducted for the City Heights site by Aspect Consulting, LLC (August 2009). The purpose of a Phase I ESA is to provide information concerning the past land use and history of the subject property and immediately adjacent properties, to assess current site conditions for the potential presence of hazardous materials. The Phase I ESA was performed in general accordance with the processes prescribed in the American Society for Testing and Materials (ASTM) E-1527-05 guidelines, and summarizes the results of data research, site observations, interviews, and regulatory agency file review. The site was inspected on June 9, 2009 to observe existing conditions, and to observe activities on neighboring properties. Current owners of the property and other persons known to have knowledge of the property and property history were interviewed. Government agencies (the Washington Department of Ecology; U.S. Department of the Interior, Office of Surface Mining; U.S. Geological Survey; and Kittitas County Assessor's Office) were contacted to inquire about information in their records regarding the subject property and adjacent parcels. Reasonably ascertainable and standard environmental record sources were reviewed. And the site history was assessed by utilizing a combination of local aerial photographs, historical topographic maps, and Sanborn maps and municipal directories, as available. The complete record of this investigation is provided in the *Phase I Environmental Site Assessment* (Aspect Consulting, August 2009) prepared as a technical appendix to this Draft EIS.

Subsequent to preparation of the *Phase I ESA*, Aspect Consulting collected samples from two large coal waste deposits on the City Heights site and submitted these for laboratory analysis to determine chemical properties and whether there are any potential hazards associated with this material. The results of the *Coal Waste Rock Sampling and Analysis* (Aspect Consulting, November 2009) are also summarized below.

AFFECTED ENVIRONMENT

The City Heights site is currently undeveloped except for two paved roads (Summit View and Montgomery) that serve properties to the north, high-voltage electrical transmission lines in Puget Sound Energy and Bonneville Power Administration easements, cleared dirt access roads in the power line easements, former logging roads through forested areas of the site, abandoned coal mine workings and coal waste piles. There are no buildings on the property.

Six small areas containing normal household refuse, appliances, and/or old vehicles were identified on the City Heights site during the June 9, 2009 site inspection conducted for the *Phase I Environmental Site Assessment*. Visual inspection did not reveal conditions indicative of significant environmental impact. The potential for a release from these materials, such as petroleum products from the automobiles, was considered a *de minimus* environmental condition, generally not presenting a threat to human health or the environment. Subsequent to the site visit, these materials were removed and properly disposed at the direction of Northland Resources (current property owner), eliminating the potential for any future release. During the removal process, no apparent hazardous materials were noted by the parties removing

the material. Locked gates have now been installed at all site access points, limiting the potential for any additional waste disposal to occur.

No significant environmental issues were identified on adjoining properties (Aspect Consulting, August 2009).

Historical coal mining activities produced large quantities of waste rock (e.g., overburden, waste coal, and coal slag) on the property. Two surface features remain that contain significant quantities of this material: an area at the west end of the property containing primarily waste coal, mineral rock, and coal fines from historic coal washing operations; and a waste rock pile in the "Red Rock" area of the site consisting of primarily non-coal-bearing bedrock overburden with a smaller volume of apparent coal slag (mineral residue from coal burning). The location of these features is shown on Figure 3.1-1.

Coal Washing Area Waste Rock (west end of the site). The coal waste pile at the western end of the property has an approximate thickness of 1 foot to more than 12 feet. The waste coal consists of a mixture of coal and non-coal rock. Laboratory analysis found the presence of low concentrations of carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in this material. Naturally-occurring cPAHs are commonly found in coal (U.S. Department of Health and Human Services 1995). The cPAH concentration detected in the composite sample collected from this feature slightly exceeded the human health screening level of 1 mg/kg, indicating a potential risk for direct human contact with coal waste at the western end of the site. The concentration detected does not, however, present a risk of leaching into groundwater, for which the screening level standard is 2 mg/kg. The metals: arsenic, barium, chromium and lead were detected in the coal washing area waste rock samples, but not at levels that present an environmental risk (Aspect Consulting, November 2009).

The coal washing waste area rock was also sampled for total organic carbon (TOC) content as a means to estimate the coal content of the material. Materials with high coal content present potential risks for methane gas generation, spontaneous combustion, and/or settlement of soils as the material degrades. There are no regulatory standards above which coal content is considered to present a hazard. TOC content in the former coal washing area at the west end of the site was 45 percent. The potential for methane gas generation is uncertain; however, there is no evidence and there have been no reports that combustion has occurred since deposition of this material on the site approximately 50 years ago. Therefore, the potential for spontaneous combustion of this composited material under existing conditions appears to be low (Aspect Consulting, November 2009).

Red Rock Area Coal Slag. Chemical concentrations in the Red Rock area coal slag were below all environmental screening levels; therefore, this material does not pose any identifiable environmental risks. The TOC content in the Red Rock coal slag sample was about 27 percent, likely indicating the presence of unburned coal material. There is a relatively small volume of coal slag with limited thickness in the Red Rock area; therefore, is not expected to pose a risk of methane gas generation or spontaneous combustion. However, the potential for settlement in this material due to degradation of the 27 percent coal over time likely makes it unsuitable for use as fill elsewhere on the site (Aspect Consulting, November 2009).

Red Rock Area Waste Rock. Chemical concentrations in the Red Rock waste rock were all below screening levels; therefore, this material also is not considered to pose any identifiable environmental risks. The low TOC content of this material (less than 10 percent) indicates that it does not pose a risk for methane gas generation or spontaneous combustion, and should not undergo significant degradation of coal materials that could result in settlement. Based on these results, this material could be left in-place and, subject to geotechnical suitability, could be used as fill elsewhere on the site or off-site (Aspect Consulting, November 2009).

POTENTIAL IMPACTS DURING CONSTRUCTION

Because the relatively high total organic carbon (TOC) content of the former coal washing area waste rock indicates that this material could exhibit significant settlement as the coal continues to degrade over time, measures would be taken during construction of roads, utilities and structures in proposed Development Area A to minimize or eliminate this risk.

Strategies to minimize the potential for spontaneous combustion of coal washing waste rock will focus on minimizing airflow, erosion, and infiltration of precipitation. Typical measures include compaction of the coal material, grading slopes to minimize erosion potential, and/or capping with coal-free soil and installing plantings to stabilize these soils (Aspect Consulting, November 2009).

Development under Alternative 1, 2, or 3A may address the development constraints of proposed Development Area A. Under Alternative 3B or 4 (No Action), surface exposure of coal waste with an unacceptable concentration of cPAHs would remain in the former coal washing area waste rock pile at the west end of the site.

POTENTIAL DEVELOPED-CONDITION IMPACTS

The open space proposal under Alternative 1, 2, or 3A includes public amenity/park features along the east side of proposed Development Area A2. At such time as development is proposed in this area, it will be important to either confirm that soils in public park or public amenity areas do not contain levels of coal waste with unacceptable levels of cPAHs for direct human contact, or for these areas to be cleaned up for park use. Clean up may involve excavation and removal of the material from the site in areas where direct human contact would be of concern, or capping in-place with coal-free soil and revegetating these areas.

If structures are proposed in areas where coal waste rock remains on the site, engineered controls will be installed to prevent potential methane gas accumulation. Control measures typically consist of a sub-slab vapor barrier and passive venting system to minimize accumulation of gases beneath or within structures.

MITIGATION MEASURES

Mitigation Measures Included in the Development Proposal. The applicant proposes to comply with the recommendations of the Geotechnical consultant with regard to handling, disposal, compaction, and/or capping (as necessary) coal waste deposits on the site. A common approach for addressing soils that present only a direct-contact risk is to cap these areas with clean soils to prevent contact. This would be consistent with both the Washington State Model Toxics Control Act (MTCA)[3] remediation requirements and coal mine waste reclamation practices. Alternatively, this material maybe excavated and disposed off-site as a non-hazardous waste at a Subtitle D landfill (Aspect Consulting, November 2009).

Measures to address potential future settlement in areas where coal waste rock would remain on the site will be addressed by additional geotechnical evaluation and engineering design at the time of actual site development applications for proposed Development Areas A and D2.

[3] Chapter 70.105D Revised Code of Washington (RCW), and Chapter 173.340 Washington Administrative Code (WAC).

Applicable Regulations. The Washington State Model Toxics Control Act (MTCA) establishes soil cleanup levels for unrestricted land use considered protective of human health for direct contact with the soil, and protective of groundwater assuming leaching of chemicals to a drinking water source. Screening levels for these standards were used to interpret the results of laboratory analysis performed on samples collected from the former coal washing area waste rock, Red Rock area coal slag, and Red Rock area waste rock on the City Heights property. Corrective action will be taken to mitigate the one parameter that exceeded MTCA standards protective of human health for direct contact with the soil (carcinogenic polycyclic aromatic hydrocarbons in the former coal washing area waste rock).

Other Recommended Mitigation Measures. No additional mitigation measures for potentially hazardous substances have been identified.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

To the extent that site development under any of the conceptual land use alternatives complies with applicable regulations and Geotechnical recommendations regarding potentially hazardous substances and weak subgrade materials on the site, no significant unavoidable adverse impacts are anticipated.