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4.0 POST-MINING AND RECLAMATION PLANS

This section presents plans for reclamation, post-mining land use, and revegetation for the South Heart Lignite Mine (SHLM). The reclamation plan has been prepared by Norwest Corporation (Norwest) for South Heart Coal LLC (SHC). The post-mining land use and revegetation plans have been developed by Golder Associates, Inc. (Golder). These plans have been prepared in accordance with the North Dakota Laws and Rules governing surface coal mining reclamation and are described in each sub-section of this chapter.

4.1 Reclamation Plan

In accordance with:

- Section 38-14.1-14, North Dakota Century Code (NDCC);
- Section 69-05.2-09-11, North Dakota Administrative Code (NDAC); and
- Section 69-05.2-12-06, NDAC.

A reclamation plan for the SHLM has been developed taking into account local physical, environmental, and climatological conditions, including the use of hydrologic geochemical information in addressing problems of the subsurface drainage and stability.

4.1.1 Reclamation Procedures Narrative

4.1.1.1 Topsoil and Subsoil Removal

The removal of Suitable Plant Growth Materials (SPGM) will be conducted in two lifts. The first lift will remove the topsoil material to the depths indicated on the soil survey map Figure 2.4-2A, Figure 2.4-2B and Figure 2.4-2C. In the second lift, subsoil material will be removed after the topsoil to the depths indicated on the soil survey map Figure 2.4-2A, Figure 2.4-2B and Figure 2.4-2C. Method 2 outlined in Policy Memorandum No. 17 will be used to estimate the required SPGM respread depths for the Permit Area. A total of ~~99~~ 101 overburden samples holes are located within and near the Permit Boundary (Figure 4.1-10b). Using these ~~99~~ 101 holes, Table 4.1-1 was developed to estimate the total depth of SPGM required to meet the cover standards for sodic spoil found in Policy Memorandum No.3, Part l-A (l) and Figure 4.1-10a shows the estimated soil respread

thickness. The proposed SPGM respread depths range from 24 to 48 inches with 29 holes showing 24 inches, 4 holes showing 36 inches, 12 holes showing 42 inches and ~~54~~ 56 holes showing 48 inches. The average respread depth for this Permit Area is 39 inches. Based on the discussion in Section 3.1.2.3 and data in Table 3.1-5, SHC has determined that there is a deficit of 2.2 M bank cubic yards (bcy) of suitable subsoil material needed for replacement to meet the regulatory requirements. Based on the SHC overburden geochemical model, there appears to be sufficient additional suitable overburden available within the disturbance area to satisfy any potential SPGM shortfall of any landowner. SHC has highlighted a zone in green for each drill hole shown in Table 4.1-1 where suitable overburden could be used for subsoil supplement to ensure that the proper SPGM replacement depth is reached for each landowner. Table 4.1-2 summarizes the EC, SAR, and SAT qualities for each landowner on an annual basis. Figures 4.1-10c through 4.1-10o show the overburden geochemistry correlations for the ~~99~~ 101 overburden sample holes located in/near the SHC Permit Boundary.

The soil quality in these proposed borrow zones is better than that required by the suitable soil replacement guidelines found in NDAC 69-05.2-08-10-1b. SHC proposes to recover suitable soil from 10 acre areas located around the known overburden sample locations. Within the 5 foot zone, as shown in Table 4.1-1, of each drill hole 10-acre area there is approximately 80,700 bcy of suitable material. SHC estimates that approximately 2.5 feet of material will be removed from each borrow zone in order to make up the SPGM deficit. During the mine construction phase, SHC will prepare a detailed exploration program to fully delineate the exact borrow areas where suitable overburden will be removed to recover the additional cubic yards needed (as shown in Table 4.1-1) to meet respread depth requirements. This program will be submitted for approval to the PSC prior to any field work commencing.

In some areas, gravel and sand lenses have been identified in the soil material; these materials will not be salvaged as SPGM. The volume of topsoil and subsoil removed will be based on a volumetric calculation using engineering surveys or load counts of the tractor-scraper and the truck/loader fleets. The total volume of SPGM removed will be adjusted to account for any material compaction or settling caused by the handling of the material. SHC will file a SPGM removal plan at the North Dakota Public Service Commission (PSC) prior to each SPGM removal season. The seasonal removal plans will address the volume of SPGM that is projected to be salvaged during the upcoming season, and will include a map showing the areas and volumes of topsoil/subsoil to be removed. An anticipated material compaction factor will be used to calculate the proposed removal volume. Soil monuments on 200-foot (ft) centers will remain and will serve as visual indicators of salvage soil

depths. Once the subsoil lifts have been approved, the monuments will be removed and treated as subsoil material.

Tractor-scrapers, or truck/loader fleets will be used to remove the SPGM from areas where mining activities will occur prior to any disturbance. When the tractor-scraper fleet is utilized, push dozers, water trucks, and motor graders will be used as support equipment. When the truck/loader fleet is used, water trucks and motor graders will be used as support equipment. Topsoil and subsoil material will be removed from all areas disturbed by mining including all mining areas and areas where spoil material will be placed on undisturbed ground. Topsoil material will be removed from construction sites, haul roads, sedimentation pond and sediment sump areas, subsoil stockpile areas, and overburden stockpile areas.

As topsoil/subsoil material is removed, it will be placed into stockpiles based on land ownerships, except where soil mixing agreements are in place. The SPGM stockpiles will be labeled and identified with a numbered sign at all times except when equipment is working on the stockpile. To limit wind, water erosion, and weed infestation, the topsoil and subsoil stockpiles that no longer have material being added to them will be seeded with a cover crop. On an annual basis all stockpiles will be inventoried to determine the stockpile volume present, the cover crop condition, the permit number, the land owner, the emplacement data, and the mine area. The location of the proposed stockpiles can be seen on Figure 3.1-1.

In areas where it is both physically possible and economical, topsoil/subsoil will be directly respread onto the reclaimed spoil areas. Subsoil will first be removed from the active mining area and directly respread over the approved rough graded spoils. Once the proposed subsoil replacement depth has been attained topsoil will then be removed from the active mining areas and directly respread over the subsoil. Tractor-scrapers, dozers and graders will be used for this operation.

Reclamation of the SPGM stockpile areas will be conducted when all the material from the SPGM stockpiles has been removed. The extent of reclamation work performed in these stockpile areas will be dependent on the type of material that was stored in the stockpiles (i.e., topsoil, subsoil, or overburden material). Topsoil stockpiles will be reclaimed by the re-establishment of vegetation over the topsoil stockpile area. The subsoil stockpiles will be reclaimed by respreading topsoil and establishing vegetation in the disturbed area. The overburden stockpiles will be reclaimed by respreading SPGM (consisting of subsoil and topsoil) and establishing vegetation in the area as outlined in Section 4.3.1.

4.1.1.2 Hydrological Features

During the operation of the mine, storm water runoff from the affected areas will be controlled by a series of collection ditches, temporary diversions, a sedimentation pond, and a sediment sump. After completion of mining, reclamation of the collection ditches, temporary diversions, and sedimentation ponds will be performed by backfilling with material having similar consistency of the material excavated during the construction of these same structures. The material being replaced in the sedimentation pond and sediment sump will be reclaimed from the embankments of each pond. The material being replaced in the collection ditches and temporary diversions will be reclaimed from the down slope area where this material was placed during construction. After the embankments and excavations are reclaimed to the approximate original contours, the areas will be covered with SPGM and revegetated as required. The respreading of the SPGM and the revegetation process will be followed as outlined in Section 4.3.1.

A geomorphic-based approach has been used to develop the plan for the post mining topography (PMT) presented in Figure 4.1-7a. A geomorphic-based approach uses information from pre-mine channel and floodplain characteristics to establish design configurations for the hillslopes and reclaimed channels. The plans for the ~~permanent diversions~~re-established channels for the West Tributary and the South Tributary are presented in Figure 4.1-7b. The channel and floodplain systems for these ~~permanent~~ re-established channels ~~diversions~~reclaimed drainages shall be designed to safely pass the peak flow for a 100-year, 6-hour event. For a geomorphic-based re-established channel~~permanent diversion~~, "completion of the channel construction" occurs when the channel and its floodplain are mature and the floodplains are vegetated. During the relatively short transition period prior to maturity when the floodplains are not yet fully vegetated, an extreme flood could result in some erosion of the floodplains. However, the risk of an extreme flood event during the two to three year period that it takes for the floodplain to become vegetated is very low. Furthermore, any resulting erosion of the channels or floodplains during this period can be repaired and re-vegetated since manpower and equipment would be available for maintenance. Hence, regular inspection and maintenance after major storm events during the transition period will be required until the drainage system has matured and is capable of carrying flood flows similar to their natural analogues.

A comparison of the pre-mining and post-mining wetland acreage within the Disturbance Area is presented in Table 4.1-3 by water regime for each landowner. Wetlands to be disturbed are primarily located along the West Tributary between sections 15 and 17. Temporary, seasonal, saturated and semi-permanent wetlands along the West Tributary will be reclaimed as shown on Figure 4.1-7b.

Temporary wetlands in sections 15, 16, 21, 23, 27 and 28, seasonal wetlands in sections 17 and 27, and saturated wetlands in section 16 will also be reclaimed. To ensure that wetland areas outside of the disturbance area are not disturbed by mining activities, boundaries will be clearly marked with colored stakes and a minimum setback of 25 feet from the wetland areas will be adhered to.

Wetland areas are located within the disturbance area for the life of mine plan. The wetlands that are affected by mine disturbance will be restored in accordance with the plan provided in Figure 4.1-7b. The wetlands may not be reestablished at the same location prior to mining but will be restored in accordance with the same surface land ownership category as shown in Figure 4.1-7b. Design calculations ~~(Appendix 4.1-2)~~ for the wetland complexes in (Appendix 4.1-2) ~~-~~show~~ing~~ that the watersheds will be of sufficient size to contribute an ample supply of water from normal year precipitation. These calculations are based on a site-specific water balance, which incorporates site precipitation, evaporation, anticipated seepage and a 50% annual water yield from the contributing watershed ~~as~~ as described in ~~-~~USDA-SCS (1979).

Reclaimed stock ponds will generally be excavated consistent with plans shown in Figure 4.1-7c. Detailed design plans for each stock pond will be submitted through the revision process before it is constructed.

4.1.1.3 Roads and Ramps

Reclamation and regrading of roads will start when they are no longer needed in the Permit Area. Reclamation will start with the removal of all the aggregate surfacing material using the tractor-scraper fleet. The gravel removed from the roads, depending on the quality, will either be used elsewhere in the Permit Area to surface future or current haul roads or it will be buried in the bottom of the active pit. Road ditches, culverts, and approaches will all be removed and the areas will then be regraded to blend into the adjacent un-mined or reclaimed topography. In the event that there is excessive haul road fill material, it will be removed and used in the reclamation of the final highwall or the regrading of the active pit spoils.

During active mining, the main haul roads and pit ramps will be extended when required during the rough and final regrading reclamation phases in the active pit area. Each new segment of haul road will be designed using the final proposed post-mining topography (PMT) of the mining area. Each new segment will be constructed with the final road elevation being approximately two feet above the proposed final regrade contour elevation.

Pit ramps will be constructed from the main haul roads at 1,000- to 3,000-ft intervals depending on the size of the active mining area. Individual ramp lengths will vary depending on mining conditions encountered and pit depths. Pit ramps will be extended through the mine spoils at grades ranging from two to eight percent (%) until they reach the approximate pit bottom. Once on the pit bottom, the pit ramp will proceed through the mine spoils until it reaches the active mining pit area. When the distance between the active mining area and bottom of the pit ramp reaches between 1,000 and 1,500 ft, and it becomes economically feasible to backfill the existing pit ramp, SHC will backfill a portion of the existing pit ramp and construct a new temporary haul road segment on the regraded surface and a new ramp into the active pit. The new pit ramp will be constructed at the most efficient and economic grade. Advancing the pit ramps in this manner allows SHC to complete rough grading on the road segments that are abandoned so final mine reclamation can take place.

4.1.1.4 Facilities

When the SHLM mining support facilities are no longer required, all the mine facility structures including concrete footings, foundations, floors, sewage disposal systems, pipe, cable, and numerous other facilities will be broken up, removed and/or demolished. The remaining disturbed area will be regraded and contoured to achieve a stable landscape similar to the original topography.

Topsoil and subsoil stockpiled prior to the facilities construction as part of the clearing and grading operation will be re-distributed across the final regraded area. Revegetation will be established in the area as outlined in Section 4.3.1.

4.1.1.5 Disposal of Debris

Non-hazardous debris will, as allowed by applicable regulations, be buried in the mine pit and covered with sufficient overburden material and suitable cover to allow for revegetation to occur. Debris identified as hazardous or otherwise determined to be unsuitable for disposal in the mine pits will be disposed of at off-site facilities permitted to accept those types of waste. All exposed lignite coal seams will be adequately covered. The above activities will be done to control the impact on surface and ground water in accordance with NDAC 69-05.2-16.

4.1.1.6 Regrading

In areas where the respreading of subsoil will occur, scarification, if necessary will be performed to help assist with soil adhesion and to help promote plant growth. Subsoil and topsoil will be respread on approved areas using the tractor-scraper fleet or the truck/loader fleet with assistance of dozers and motor graders. To ensure that the proper depth of respread is achieved, the respread areas will be staked on 100-ft centers with wood lath marked with the appropriate respread depth.

If necessary to relieve compaction in the regraded areas, the surface will be worked by scarifying the surface using dozers or motor graders. Once the regraded surface has been properly prepared, the subsoil will be respread over the prepared area. Once the subsoil has been replaced to a suitable depth, the subsoil surface will be scarified, if necessary, to reduce compaction and then the topsoil will be respread onto the subsoil lift. Finally, an adequate seedbed will be prepared using conventional agriculture equipment with various tillage methods to meet site specific requirements. The site will be dragged with a meadow harrow to cover the seed and cultipacked or imprinted to provide a firm seedbed following seeding.

After the initial seeding, if any rills or gullies are found that would be disruptive to the approved post-mining land use or could increase erosion and sedimentation in the regraded and SPGM respread areas, they will be filled, graded, or stabilized and then reseeded.

Once the lignite coal is removed from the pit and the pit has been backfilled with overburden, the overburden material will be graded to the approximate original contours as shown on Figure 4.1-7a. The overburden material to be graded will generally be 2 to 3 spoil rows from the active lignite removal pit. All areas of the pit within the Permit Area will be reclaimed to the gentlest topography that is consistent with the mining area's existing topography and adjacent un-mined areas. The final highwall resulting from the final cut will be graded to comply with existing applicable State and Federal regulations. This will be done by pushing a series of final spoils toward the final highwall and back sloping the highwall. If necessary, additional material will be hauled to the pit using the truck/loader fleet. The final grading activities will be done using tractor-scrapers, dozers, motor graders, water trucks, and the truck/loader fleet. All final grading will be done along the contour, and surface drainage patterns will be re-established to the approximate drainage basins that existed prior to mining. Regraded areas will stand idle through one freeze-thaw cycle during winter months when snow and ice are present to allow the regraded spoils to settle prior to the respreading of the topsoil and subsoil.

Downstream of rough graded spoils, steps will be taken to prevent runoff from the rough graded spoil areas from eroding and contaminating areas where SPGM has been respread. Sheet flow from upstream areas will be diverted from the respread SPGM areas by constructing berms at the interface areas between SPGM respread and leveled spoils and routing the runoff water to the sedimentation pond(s). It may become necessary in some areas to collect runoff from the leveled spoil areas in temporary diversions and sumps, and then pump it around the respread SPGM areas. Filter fences and/or straw bale dikes will be constructed in some areas to help reduce the flow rates, trap sediment, and to prevent erosion and contamination of the respread SPGM. Rills or gullies that could cause erosion and increase downstream sedimentation, or that could be disruptive to the approved post-mining land, will be regraded and, where SPGM has been replaced, will be stabilized and reseeded.

Reclamation of haul roads, support facilities, sedimentation pond, sediment sump, and soil stockpile areas will be completed after the facilities are no longer needed for support of current or future mining activities. Revegetation and respreading of such areas will be completed in the next favorable planting season.

4.1.1.7 Rough Grading Conditions and Assumptions

- All reclamation operations are scheduled one shift per day and 5 days per week.
- The rough grading work will be completed using a combination of the truck/loader fleet (150-t rear dump trucks and a 20-cubic yard (cy) front end loader), D11 class dozers or tractor scrapers.
- Pit widths are designed at 150 ft.
- The reclamation sequence is based on the projected pit advance as shown in the mine operations plan.
- Highwalls and all working faces are assumed to stand at 60 degrees.
- The overall pit wall angle is assumed to be 43 degrees.
- The angle of repose for spoil is assumed to be 35 degrees.
- All topsoil, subsoil and overburden are assumed to have a swell factor of 15 percent (%).
- Rough grading will be completed so that no more than four spoil piles are left ungraded in the active mining area. Normally it will be possible to maintain rough grading within four spoil ridges behind the active pit or begin regrading within the maximum allowable 180 days.

- Final grading, respreading of subsoil, respreading of topsoil, and revegetation will occur only after each phase of reclamation is approved by the PSC. SHC may prefer to allow certain regrade areas within the active mine area additional time for settling prior to final grading, topsoil/subsoil replacement, and revegetation. This will only be done after receiving approval from the PSC.

4.1.1.8 General Considerations for Reclamation

The reclamation plan for this permit application was developed after considering all local land and site conditions. A detailed review was performed of each site condition that could affect the mine operation and reclamation tasks in order to develop an environmentally sound mine plan. Site characteristics that were considered in the development of the reclamation plan are listed below.

Land use

All land use within the Permit Area was studied through the use of aerial photography with appropriate ground checking to identify each land use category in the Permit Area. These studies were used to develop the appropriate pre-mining and post-mining land use maps. The pre-mining and post-mining land use maps are presented on Figure 2.7.1-2A, Figure 2.7.1-2B, Figure 2.7.1-2C, and Figure 4.2-1, respectively.

Soils

A detailed soil survey was performed within the Permit Area to identify the types and quantities of soils that are available for first and second lift salvage removal. The quality of SPGM was also checked to define the reclamation potential of the soils. Using this information, the appropriate survey maps will be made to serve as a guideline for SPGM removal operations. This information can be found in Section 2.4.

Vegetation

Field vegetation surveys have been conducted for each of the land use categories. The studies have documented and inventoried the various types of vegetation, cover, and production by each land use category within the Permit Area. These studies were used to develop revegetation plans for the permit application. The lands will also be monitored and compared to reclaimed areas to judge the success of the SHLM revegetation plans. The vegetation survey information can be found in Section 2.7.2.

Geology

Geophysical and geochemical characteristics were determined using data collected from the field and from published information (Section 2.3). Overburden samples were taken during drilling and analyzed to characterize the overburden that will be disturbed or exposed during mine development. The overburden geochemical characteristics were evaluated to assist in mining, operational and reclamation planning. Lignite coal quality data was obtained and studied to develop a viable mining and reclamation plan.

Ground Water Hydrology

Ground water monitoring wells were installed to gather baseline water quality and quantity data. These wells will be monitored during mining to determine any change in the ground water hydrology. Data gathered from the ground water monitoring program was used to help develop the mining operation and reclamation plans. In addition, water wells within the Permit Area were evaluated in the well certification survey. The ground water data, well certification survey data and other pertinent ground water information can be found in Section 2.5.

Studies were completed to determine the location of any possible Alluvial Valley Floors and their potential effects on the mining and reclamation plans. Alluvial Valley Floor information and PSC's final determination that there are no Alluvial Valley Floors in and adjacent to the SHLM can be found in Section 2.8.

Surface Water Hydrology

A surface water management plan was developed to handle all the surface water runoff within the mining Permit Area. This plan takes into account topography, land use, ground water hydrology, vegetation, soil, climate, and the proposed mine operations plan developed for this mining application permit. Section 3.1 contains the mine operations plan and Section 3.6 contains the surface water management plan along with information pertaining to the hydrologic features and properties for this mine permit application.

Climatology Consideration

On-site meteorological monitoring was conducted to gather data on the pre-mining meteorology in the Permit Area. The meteorological monitoring program is described in Section 2.2.

Fish and Wildlife Resources

A baseline study was conducted to determine fish and wildlife resources and uses within the proposed Permit Area. The proposed reclamation plan for re-establishment of fish and wildlife habitat areas is found in Section 2.9.

The reclamation plans for the mine were based on the above factors and the cost for completing the proposed reclamation plan is discussed in Section 4.1.4.

4.1.2 Reclamation Schedule

Table 4.1-2 shows a detailed timetable for conducting reclamation activities in the Permit Area. Figure 4.1-1, Figure 4.1-2, and Figure 4.1-3 show the areas referenced in Table 4.1-2.

4.1.2.1 Pit Area 1

Mining at the SHLM is expected to commence in mid-2014. Lignite Coal production from 2014 through early 2043 will be at a maximum annual rate of 2.4 Million tons per year (Mtpy). The overburden in the initial box cut will be removed by the truck/loader/dozer fleet consisting of 150-t rear dump trucks, 20-cy hydraulic excavators, and D11 Class dozers. The box cut material will be hauled by the truck/scraper fleet to out-of-pit overburden stockpile 1 located in the northern portion of Section 22 of Township 139 North, Range 98 West as shown Figure 3.1-1. Once the box cut area is developed, the remaining mining cuts and all the overburden will be removed using the truck/loader/dozer fleet. Mining cuts having less than 70 ft of overburden over the D Seam will be mined using D11 Class dozers and all material greater than 70-ft-thick will be removed using the truck/loader fleet.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

4.1.2.2 Pit Area 2

Mining in Pit 2 is projected to start in the fourth quarter of 2021. The overburden in the initial box cut, consisting of the first three pit widths in this area, will be removed by the truck/loader fleet.

The box cut material will be hauled by the 150-t rear dump trucks to out-of-pit overburden stockpile 2 located in the eastern portion of Section 16 of Township 139 North, Range 98 West as shown on Figure 3.1-1.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

4.1.2.3 Pit Area 3

Mining in Pit 3 is projected to start during the fourth quarter of 2038. The overburden in the initial box cut, consisting of the first three pit widths in this area, will be removed by the truck/loader fleet. The box cut material will be hauled by the 150-t rear dump trucks to out-of-pit overburden stockpiles 3 and 4 located in the central portion of Section 27 of Township 139 North, Range 98 West as shown on Figure 3.1-1.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

4.1.2.4 Pit Area 4a and 4b

Mining in Pit 4a is projected to start in late 2040. The overburden in the initial box cut, consisting of the first three pit widths in this area, will be removed by the truck/loader fleet. The box cut material will be hauled by the 150-t rear dump trucks to out-of-pit overburden stockpile 5 located in the central portion of Section 23 of Township 139 North, Range 98 West as shown on Figure 3.1-1.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

Mining in Pit 4b is projected to start mid-2042. The overburden in the initial box cut, consisting of the first three pit widths in this area, will be removed by the truck/loader fleet. The box cut material will be hauled by the 150-t rear dump trucks and added to out-of-pit overburden stockpile 6 located in the northern portion of Section 23 of Township 139 North, Range 98 West as shown on Figure 3.1-1.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

4.1.2.5 Pit Area 5

Mining in Pit 5 is projected to start the mid of 2042. The overburden in the initial box cut, consisting of the first three pit widths in this area, will be removed by the truck/loader fleet. A portion of the box cut material will be hauled by the 150-t rear dump trucks to Pit Area 1 and Pit Area 2 and used to fill the last opened pits. The remained will be stockpiled in the box cut area of Pit Area 5 until sufficient room is available to begin backfilling.

After mining has advanced five cuts, material from the out-of-pit overburden stockpile will be hauled back to the initial box cut of the pit and be placed on the dozer regrade area. As mining advances, the overburden material will be hauled using the truck/loader/dozer fleet from the active pit area into the adjacent mined out open pit area. The truck/loader fleet will continue to haul overburden from the overburden stockpile to the regrade area until all the material has been removed from the stockpile.

4.1.3 Reclamation Costs In accordance With:

- Section 69-05.2-12-07, NDAC.

This section presents reclamation cost estimates and supporting calculations. Reclamation costs were estimated assuming the worst reclamation case scenario and considering mining disturbances, earthwork calculations, SPGM respread hours, seed cost summary and revegetation cost summary. Figure 4.1-5 shows the Worst Case Bonding Plan Map.

The reclamation costs for the SHLM of $7,513,800~~10,877,878~~ have been calculated by utilizing the methods and procedures as outlined by the PSC "Guideline for Estimating Reclamation Costs for Establishing Performance Bond Amounts for Permit Areas" dated December 31, 1985 and as revised

on July 2~~0~~2, ~~2009~~2010. The following is a summary of the reclamation costs calculations determined for backfilling and grading, replacing SPGM, and revegetation.

4.1.3.1 Worst Case Reclamation Liability

The worst case reclamation liability was determined by choosing the pit area which had the greatest volume of material to backfill in conjunction with the area where the greatest amount of SPGM has been removed. The worst case scenario incorporates the most conservative approach for reclamation. For the SHLM, the worst case pit will occur in Year 2018.

General assumptions were made when determining the reclamation costs for each of the three operations. They are as follows:

- Reclamation work will be completed by utilizing a combination of Caterpillar 993K loader, 777F trucks, 657G push-pull tractor-scrapers, D11T and D9T dozers, 16M motor graders, and a water wagon or equivalent. The projected operating cost per hour for each piece of equipment ~~was based on Mine & Mill Equipment Cost 2008 Estimation Guide and~~ North Dakota's PSC Reclamation Division's Reclamation Cost Estimate Guidelines updated July 2009.

- Equipment and associated costs (Total Estimated Hourly Cost from Policy Memorandum No. 16):

Equipment Description	**Cost per Hour ($)**
657G Push-Pull Tractor-Scraper	316.72~~235.30~~
D11T Dozer	318.65~~287.87~~
D9T Dozer	189.98~~174.03~~
16M Motor Grader	143.56~~128.86~~
Water Wagon	143.56~~128.86~~
993K Front End Loader	279.67~~269.22~~
777F Haul Truck	233.02~~214.48~~

The scraper-truck breakeven haul distance was calculated to be 4,300 ft and the truck/loader fleet was utilized where haul distances were in excess of 4,300 ft.

- Support equipment usage:

Equipment Description	**Process**	**Cost Factor**
16M Motor Grader	Final Grading	1 hour/6 scraper hours
	SPGM Respread	1 hour/6 scraper hours
	Truck/Loader Fleet	1 hour/loader hour
Water Wagon (777 Class)	SPGM Respread	1hour/12 scraper/loader hours
D11 Dozer	SPGM Respread	1 hour/loader hour

- Backfilling and grading assumptions:

Description	D11 Dozer	Truck/Loader/Scraper Fleet
Average Pit Width	150 ft	150 ft
Average Angle of Repose	35°	35°
Average Highwall Angle	60°	60°
The overburden with swell after being removed from the coal.	15%	15%

- Additional assumptions for normal spoils:
  - The spoil regrade costs were based on grading the area occupied by four spoil piles from the active open pit area.
  - The spoil piles will be regraded utilizing a D11 class dozer and 657G push-pull tractor-scrapers.
  - The average push distance for the D11 class dozer was based on the cross sections developed from the mining topography.
- Open pit and spoil placement activities:
  - The balance of cut and fill material for the backfilling of the open pit is shown on Figure 4.1-4.
  - The average push or haul distances will be determined using the centroid of the cut areas and the fill locations of the open pit area.
- Out of pit slopes:
  - The out of pit spoil material for Pit 1 has been included in the earthwork calculations for mining disturbance.
- Pit slope ramps (down to the bottom of the pit):
  - The average slope of the pit ramp to access the active pit will be approximately 8-10%. Dozers will be utilized to regrade the pit ramps.

4.1.3.2 Assumptions for Associated Disturbance

Associated disturbance refers to all vegetation disturbances caused by the construction of facilities in support of the mining operation. Support facilities include a sedimentation pond, a sediment sump, haul roads, topsoil stockpiles, subsoil stockpiles, overburden stockpiles, scraper trails, buildings, diversions, and any other facilities not occurring within the mining disturbance area which have been constructed for the specific purpose of supporting the mining activities.

The following assumptions were used in calculating the volumes for reclaiming the associated disturbance area under the worst case conditions.

- Stockpiles (topsoil, subsoil, and overburden) were removed as a part of the SPGM respreading.
- SPGM thickness ranges from 24, 36, 42, and 48 inches depending on the soil characteristics of the area.
- Pond cost will be based on regrading fill material and subsoil material with a D11 Class dozer or 657G Class tractor-scrapers.
- Diversion costs were calculated taking the length of the diversion times the average cross sectional area. Two designs were used to create the diversions: 1) diversions in bedrock material and 2) diversions in alluvial material. The average cross sectional dimensions used for diversions in bedrock material was 15 ft bottom and 4 ft deep, with 3:1 side slopes; Cross Sectional Area – 105 ft^2.
- For the purpose of the worst case bonding, the haul road was assumed to have been built out of subsoil or overburden that is to be used as topsoil/subsoil replacement. The haul roads shown on Figure 4.1-5 represent the location of the haul roads at the time of the worst case pit. The locations of roads and facilities to be constructed can be found on Figure 3.1-1 and Figure 3.5-1. Assumptions for the reclamation cost calculation are listed below:

Mine Site Access Road	4,765 ft
Explosive Materials Storage Access Road	2,367 ft
Gravel Surfaces	50 ft
Gravel Removal	1.30 cy/ft of haul road
Haul Road Length	15,137 ft
Pit Access Road	7,313 ft
Average Road Base Width	92 ft
Average Depth	2 ft
Push Distance	150 ft

- Respread of topsoil/subsoil was estimated using a 657G Class tractor-scraper.
- Support Equipment costs were estimated using a 16H Class motor grader and a 10,000 gallon water truck.
- The average haul distance for the SPGM was determined by utilizing a haul road or existing route between the centroid of the respread area and the stockpile when possible.

- Reclamation of roads are accounted for as follow:
  - Normal regrading of a mined area covers the regrading of these roads.
  - Respread of SPGM in road ditches are covered by normal SPGM respread.
  - Grading costs for public roadway construction (section line roads) – 4.4 miles (mi) – assumed 28 ft wide by 4 ft deep for 2,000-ft haul.
  - Gravel respread is assumed to be 0.5 ft by 28 ft wide for 2,000-ft haul.
  - Gravel is assumed to cost $6.00/ton.

Appendix 4.1-1 presents the bond calculations prepared by Norwest for Worst Case Scenario.

4.1.4 Performance Bond

The ~~per acre~~total bond cost for mining and non-mining areas are listed below:

- Affected by Mining $7,333,310~~9,338,209~~
- Affected by Non-Mining $89,160~~1,342,976~~
- Administrative Cost $91,333~~196,693~~
- Total Required Bond Amount $7,513,800~~10,877,878~~

The worst case bond determination for the SHLM permit is not incremental and will be covered by a surety bond. The actual bond amount may be higher than the calculated total required bond. This reserve amount is maintained to cover small bond increases from future potential revisions. The worst case bond covers all surface and coal mining and reclamation operations to be conducted within the Permit Area described in Table 4.1-4.

4.1.5 Post-mining Topography Map Generation

Norwest used Carlson Software's Carlson Mining 2009 mining software to generate the PMT. This software has the capabilities to simulate the effects of removing the recoverable lignite coal, swelling the waste material, and creating the final spoil regrade. Norwest was able to increase accuracy of the final contours and had greater flexibility in designing the PMT using this software. The computer generated topography will be further modified to account for topographic features such as wetland and drainages.

Using Carlson Mining 2009, the final mining topography of the pit area was generated by first creating a series of cross sections on 500-ft spacing which showed the mining progress for the bond area (Years 2014-2018) of the mine. After these sections were created, they were used to create a grid of the final mining surface showing the spoil piles and valleys prior to any rough grading. Using this final mining topography, the Carlson Mining 2009 software was used to create a cut/fill balance across each individual cross section. These new sections showing the proposed rough graded surface were then used to create a grid of the rough graded surface. Proposed PMT contours were generated using the rough graded grid map. After these two grid surfaces were completed, the final mining topography (spoil piles and valleys) and the PMT were compared to calculate the cut and fill volumes between the two grid surfaces. It was calculated that the overall cut volume, the amount of material removed from the pit area, was 6.7 Mcy and the overall fill volume that was placed back into the pit area was 6.6 Mcy. Figure 4.1-6 shows the topography prior to any disturbance. Figure 4.1-7a shows the PMT for the mining area.

Note that the unadjusted proposed post-mining contour map was computed as stated above. Prior to rough grading, proposed post-mining contours will be developed based on actual aerial or ground surveys after mining is completed in the pit area. These new post-mining contours will be submitted to the PSC for approval. Upon PSC approval, rough grading will commence.

4.1.6 Plan to Manage Mining Openings and Exploration Boreholes

In accordance with:

Section 69-05.2-14, NDAC.

The SHLM will case, seal, or otherwise manage each drill hole, borehole, or well within the Permit Area to prevent potential toxic drainage from entering ground or surface waters, minimize disturbance to the prevailing hydrologic balance, and ensure the safety of people, livestock, fish and wildlife, and machinery in the permit and adjacent areas. Unless approved for monitoring, the SHLM will permanently close or otherwise acceptably manage openings uncovered or exposed by mining activities (except for holes drilled and used solely for blasting).

The existing ground water monitoring wells installed for the SHLM were constructed in accordance with NDAC 33-18-02 Ground Water Monitoring Well Construction Requirements. Generally, the wells were sealed above the filter pack with at least 2 ft of hydrated bentonite chips to isolate the monitoring interval. Where shallow ground water occurs, the bentonite chip seal above the filter pack

was either reduced to between 1 and 2 ft or was continued to the ground surface. A bentonite grout was used as an annulus seal above the bentonite chip seal except in wells where the chips continued to the ground surface. Steel surface protective casings with locking caps were placed around the monitoring well risers extending above the ground surface and secured by a ground surface concrete pad. The ground surface pads were sloped to promote drainage away from the protective casing and well riser. These wells will be periodically inspected and maintained by the SHLM.

When the wells and boreholes are no longer needed for monitoring or other use approved by the PSC, the SHLM will permanently close the drill holes and boreholes. If new ground water monitoring wells are required for further monitoring during operations, they will be sealed following the same procedure describes above.

4.2 Post-mining Land Use

In accordance with:

- Section 38-14.1-14, NDCC;
- Section 69-05.2-09-13, NDAC; and
- Section 69-05.2-23, NDAC.

This section describes the post-mining land use plan for the land to be affected within the Permit Area during mining operations. The plan has been developed by Golder for making the surface mining and reclamation operation consistent with landowner plans and State and local land use plans and programs. Copies of the landowner's post-mining preference statements mailed to all landowners affected by the proposed permit and returned by them to SHC are included in Appendix 4.2-1.

4.2.1 Post-mining Land Use Plan Considerations

All land uses for portions of the Permit Area to be affected either directly or indirectly by mining will be converted to the land uses and capacities requested by the landowners of the affected lands. All existing public roads and private section line trails on rights-of-way, however, will be reclaimed. Acreages for roads and trails include public easement for right-of-way over congressional section lines as granted by Act of Congress in 1866 and accepted by Chapter 33 of the Session Laws of the Dakota Territory in 1871, giving the public the right to travel over land within two rods (33 ft) on either side of the section line.

Most of the post-mining land will be reclaimed as cropland, riparian woodland and tame pastureland. A detailed description of the pre-mining land use classification within the Permit Area including land use acreage is presented in Section 2.7.1. Figure 2.7.1-2A, Figure 2.7.1-2B, and Figure 2.7.1-2C show the distribution of the pre-mining land uses with the Permit Area. A comparison of pre- versus post-mining land use acreages per landowner within the Permit Area is presented in Table 4.2-1. A comparison of pre- versus post-mining land use acreages by land use classification is provided in Table 4.2-2. Figure 4.2-1 presents the proposed post-mining land use plan.

All existing public roads and private section line trails on rights-of-way will be reclaimed to a condition equal or better than their pre-mining conditions. A typical cross section for trails reclamation is presented on Figure 4.2-2. Plans for roads and trails that are to be reclaimed will undergo the required public notice, public hearings, and public approval process from the Stark County Board of County Commissioners. Road construction will only start after the agreements and approvals are final from the Stark County Board of County Commissioners.

In certain portions of the Permit Area where existing structures including but not limited to residential homes, farm structures, farm buildings, storage containers, silos and barns will need to be removed prior to any nearby mining activity, structure and residence land uses will be reclaimed to the land use surrounding these land uses. SHC has signed a coal lease and surface use agreement with the landowners that includes the areas upon which residence homes and structures are situated. In accordance with the terms of the agreement, SHC will compensate the landowners for the damage to occur to their structures and residence homes located within their property prior to mining activities. Figure 3.2-1a shows the residence homes and farm structures that will be affected.

Similarly, pre-mining acreages of wetlands occurring within the Permit Area to be affected directly or indirectly by mining will also be restored following mining. Pre-mining wetlands were identified and delineated using the routine on-site approach as described in the 1987 US Army Corps of Engineers (USACE) Wetland Delineation Manual and Interim Regional Supplement to the USACE Manual for the Great Plains Region (Appendix 2.10-1). Pre-mining wetlands were also delineated in consultation with the United States Department of Agriculture Natural Resource Conservation Service and will be restored to ensure future compliance with 1985 Food Securities Act provisions. A reclamation plan for wetlands to be impacted by proposed mining is shown on Figure 4.1-7b. A comparison of pre- versus post-mining wetland acreage by landowner is provided in Table 4.1-3.

When necessary for SHC to remove or re-route any existing utilities, SHC will inform the owners of the roads, telephone service lines, water lines, natural gas pipelines, transmission lines, and underground power lines of the need to relocate those facilities and will work with the facility owners to relocate the existing non-mining structures to locations that will not be affected by future mining activities.

Pre-mining land use, landowner preference, proposed post-mining topography, available soil quality and quantity, and land uses in the surrounding areas were the factors considered to develop the post-mining land use plan. Landowner's post-mining preference statement forms were mailed to all landowners who will be affected by the proposed mine with the surface owner notification letters provided in Appendix 1.4-1. Appendix 4.2-1 presents the statements completed by the landowners and returned to SHC. The preferences of the landowners and wishes of SHC are reflected in the post-mining land use plan.

4.2.2 Landowner's Post-mining Land Use Preference

Landowner post-mining preference statements are described below and provided in Appendix 4.2-1. A comparison of pre-mining versus post-mining land use acreage is presented in Table 4.2-1 by landowner ~~and in Table 4.2-1~~. Rights-of-way/lanes and road surfaces reclaimed will be reclaimed as part of the Road Re-Route and Closing Plan developed by Norwest for the SHLM (Section 3.5.1 and Figure 3.5-11b) and are based on the general design considerations presented on the Post Mining Land Use Map Figure 4.2-1. Farm structures and residential homes will be removed prior to mining activities as described in (Section 4.2.1). Developed water resources will be reclaimed as described in Section 4.1.1.2 and as shown on Figure 4.1.7b and Figure 4.1-7c. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming wetlands for each landowner as described below and as shown on Figure 4.1-7b. Wetland acreage for pre versus post mining is provided in Table 4.1-3. Wetland areas will be reclaimed following the procedures described in Section 2.10.2.

The landowner's post-mining preference statement prepared for and returned by Mr. John Buckman requested that SHC convert the entire 5.74 acres within his property (T139N R98W Section 15: Tract in the SE1/4SE1/4) back to pre-mining conditions. In accordance with the terms of the coal lease and surface use agreement that SHC has signed with Mr. John Buckman, the farm structures and residence home located within his property will be removed prior to mining activities (Section 4.2.1). As a result, SHC is showing the residence, structures and the driveway that provides access to the

structures and residence home as being disturbed and reclaimed to farmstead yard. As discussed above in Section 4.2.1, rights-of-way/lanes and road surfaces within Mr. John Buckman's property will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. There are no wetlands within the disturbance area.

As of February 1, 2008, the landowner's post-mining preference statement prepared for and sent to Leocadia Emmil, Family Trust has not been returned to SHC. SHC, therefore, is assuming that no post-mining land use changes are requested and will return the entire 44.1 acres (T139N R98W Section 34: N1/2) within Leocadia Emmil's lands similar to pre-mining land use conditions. Rights-of-way and road surfaces within Leocadia Emmil's property will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming 0.18 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Mr. Larry Klein requested that SHC convert the entire 2.24 acres within his property (T139N R98W Section 33: NE1/4) back to pre-mining land uses. Rights-of-way and road surfaces within Mr. Larry Klein's property will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. There are no wetlands within the disturbance area.

The landowner's post-mining preference statement prepared for and returned by Mr. Kenneth Kudrna requested that SHC convert cropland to grain farming. He also requested that SHC convert 0.12 acres of cropland waterway, 0.06 acres of tame pastureland and 0.15 acres of right-of-way within his property (T139N R98W Section 20: SE1/4) back to pre-mining conditions. SHC is considering grain farming as cropland and will, therefore, convert the existing 4.49 acres of cropland to the same land use following mining. Rights-of-way will be reclaimed as part of the Road Re-Route and Closing Plan developed by Norwest and based on the general design considerations. There are no wetlands within the disturbance area.

The landowner's post-mining preference statement prepared for and returned by Patrick and Katherine Kuylen requested that SHC convert the entire 798.4 acres (T139N R98W Section 20: NW1/4 less a tract in the NW1/4NW1/4, NE1/4 less a tract in the SW1/4NE1/4; T139N R98W Section 27: All; T139N R98W Section 28: NE1/4; and T139N R98W Section 28: W1/2, SE1/4) they own back to pre-mining conditions. Rights-of-way and road surfaces within Patrick and Katherine Kuylen's property will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. In accordance with the terms of the coal lease and surface use

agreement that SHC has signed with Patrick and Katherine Kuylen, the farm structures and residence home located within their property will be removed prior to mining activities. As a result, SHC is showing the residence, structures and the driveway that provides access to the structures and residence home as being disturbed and reclaimed to farmstead yard. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming ~~6.53~~ 6.44 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Robert and Brenda Kuylen requested that SHC convert the 76.6 acres of tame pastureland to cropland and the remaining 1098.4 acres of land within their property (T139N R98W Section 16: SW1/4; T139N R98W Section 17: All less a tract in the SW1/4SW1/4; and T139N R98W Section 21: All) to pre-mining conditions. Rights-of-way and road surfaces will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. In accordance with the terms of the coal lease and surface use agreement that SHC has signed with Robert and Brenda Kuylen, the farm structures and residence home located within their property will be removed prior to mining activities. As a result, SHC is showing the residence, structures and the driveway that provides access to the structures and residence home as being disturbed and reclaimed to farmstead yard. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming ~~6.06~~6.31 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Gary and Barbara Meduna requested that SHC return the 42.97 acres of land within their property (T139N R98W Section 9: SW1/4) to pre-mining land uses. SHC will be reclaiming 0.0 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Mr. Robert Pavel requested that SHC return the 86.32 acres of land within their property (T139N R98W Section 10: SW1/4 less railroad tracts; and T139N R98W Section 14: NW1/4) to pre-mining land uses. Rights-of-way and road surfaces will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. The post-mining land use plan proposed for Mr. Robert Pavel is presented on Figure 4.2-1.

The landowner's post-mining preference statement prepared for and returned by James and Rosella Perdaems requested that SHC return the 1034.88 acres of land within their property (T139N R98W Section 14: E1/2 less a tract in the NW1/4NE1/4; T139N R98W Section 14: SW1/4; and T139N R98W Section 22: N1/2, Section 23 All) to pre-mining land uses. In accordance with the terms of the coal lease and surface use agreement that SHC has signed with James and Rosella Perdaems, the farm structures and residence home located within their property will be removed prior to mining activities.

As a result, SHC is showing the residence, structures and the driveway that provides access to the structures and residence home as being disturbed and reclaimed to farmstead yard. Rights-of-way and road surfaces will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming ~~8.96~~10.45 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Jerry and Sandra Perdaems requested that SHC return the 317.99 acres of land within their property (T139N R98W Section 22: S1/2 less a tract in the N1/2SE1/4; and T139N R98W Section 22: Tract in the N1/2SE1/4) to pre-mining land uses. In accordance with the terms of the coal lease and surface use agreement that SHC has signed with Jerry and Sandra Perdaems, the farm structures and residence home located within their property will be removed prior to mining activities. As a result, SHC is showing the residence, structures and the driveway that provides access to the structures and residence home as being disturbed and reclaimed to farmstead yard. Rights-of-way and road surfaces will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming 0.24 acres of wetlands.

The landowner's post-mining preference statement prepared for and returned by Mary Louise Peters ~~(PHP, LLP~~) requested that SHC return the land she owns to cropland (T139N R98W Section 15: All less a tract in the SE1/4SE1/4; and T139N R98W Section 16: N1/2, SE1/4). Mary Peters also requested to keep the existing ponds located along the northern and southern borders of Section 16. In addition, she requested to keep a pond that will be developed for the project and will be located in the northeast corner of Section 15. The two existing ponds located in Section 16 will be mined through during operations and will be restored post-mining as requested. SHC will construct a pond in the northeast corner of Section 15 during operations (Figure 4.1-7b). This pond will not be reclaimed but will remain post-mining to satisfy Mary Peters's post-mining land use preferences (Figure 4.2-1). In addition, SHC will create a one-acre pond in the south area of Section 15 as requested by Mary Peters. She also requested to have two rows of native trees (25 ft apart) along the northern and southern borders of Section 16, 3 rows of trees (25 ft apart) along the south side of Section 15, and two rows of trees (25 ft apart) along the east end of Section 15. The rows of trees have been classified under the shelterbelt land use type. Rights-of-way and road surface will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming ~~7.9~~9.71 acres of wetlands and water reservoirs.

The landowner's post-mining preference statement prepared for and returned by Mr. Glenn Wagner requested that SHC convert 0.07 acres of cropland and 0.08 acres of tame pastureland within his property (T139N R98W Section 29: All less a tract in the SW1/4SW1/4) back to pre-mining conditions. There are no wetlands within the disturbance area.

The landowner's post-mining preference statement prepared for and returned by James and Lisa Wagner requested that SHC return the entire 80.52 acres of land they own (T139N R98W Section 9: SE1/4 less railroad tracts) to pre-mining land uses. Rights-of-way will be reclaimed as part of the Road Re-Route and Closing Plan and based on the general design considerations. To ensure future compliance with 1985 Food Securities Act provisions, SHC will be reclaiming 0.20 acres of wetlands.

The dominant post-mining land use will remain cropland. There will be a net increase of ~~91.8~~89.6 acres of cropland throughout the portions of the Permit Area due mainly to conversions of pre-mining acreages in Sections 15, 16, 17 and 21 to cropland in accordance with the wishes of landowners: Mary Louise Peters ~~(PHP, LLP)~~ and Robert and Brenda Kuylen. This has resulted in an 81.2-acre decrease in tame pastureland and a 47.1-acre decrease in tame pastureland-woodland. Structures, residence homes and driveways to access the residence homes and structures will be removed as ~~described in~~shown on Figure 3.2-1a because of a coal lease and surface use agreement between SHC and landowners. As a result, these three land use categories will be converted to farmstead yard following mining (Table 4.2-2).

A ~~23.4~~22.8-acre increase in shelterbelt is due to a conversion of pre-mining acreages into rows of trees in Sections 15 and 16 in accordance with the wishes of Mary Louise Peters ~~(PHP,LLP)~~ (Table 4.2-2). Increases in road surface and right-of way of 16.~~3~~ 2 acres and 30.~~6~~ 1 acres, respectively, are due to the new general design considerations (e.g. road width) proposed for section line roads and trails on Figure 4.2-2. An increase in developed water resources and wetlands of 15.6 and 9.3 is planned to support the re-establishment of wetland regimes, enhance post-mining uses with stored water, and to slow down the flow during storm events. Besides the changes described in this section, no other changes to pre-mining land use categories presented within the Permit Area are being proposed at this time.

The manner in which the proposed post-mining land uses will be achieved and the support activities which may be needed to achieve the proposed land uses are described in Section 4.3. Utility and

capability of the reclaimed land will be the same as those of the pre-mining land described in Section 2.7.1.

4.3 Revegetation Plan

In accordance with:

- Section 69-05.2-22, NDAC.

The NDAC section referenced above calls for a diverse, effective, and permanent vegetative cover to be established on disturbed lands that is of the same seasonal variety native to the area, or will otherwise support the planned post-mining land uses. As required by NDAC 69-05.2-09-11(6), revegetation plans have been prepared for all disturbed areas. Seed mixtures and revegetation procedures are designed to meet the requirements of the aforementioned regulations. Revegetation plans for post-mine cropland, native grassland, tame pastureland and riparian woodland will be addressed in this section. Sampling methods and standards for reclamation success for cropland, tame pastureland, riparian woodland and wetlands are described in this section.

General revegetation and management plans which apply to all lands disturbed, either directly or indirectly by mining activities within the Permit Area (regardless of post-mining land use), are addressed initially. The general plans address such topics as seedbed preparation, seeding techniques, mulching, use of cover crops, weed and pest control, litter reduction techniques on established stands, and interseeding and reseeding. A discussion of specific revegetation and management plans as they apply to each post-mining land use follow. This discussion addresses the seed mixtures for various land use categories, including temporary reclamation areas.

4.3.1 Revegetation Techniques

A suitable seedbed will be prepared following topsoil and subsoil replacement. One or more of the following techniques will be used to prepare the seedbed: chisel plowing or discing to initially break up clods and work the topsoil, rock picking if necessary, and final light discing or harrowing (or use of a chain drag or flexible meadow harrow). Other tillage equipment may be used, as necessary, to prepare a final seedbed having characteristics most favorable for the type of seeding technique to be used. If the site is to be broadcast seeded, then the seedbed should be prepared such that a loose, moderately rough condition results (DePuit et al. 1980). If drill seeding techniques will be used, then

the seedbed should be prepared such that it is very firm and relatively rock-free (USDA-SCS-North Dakota 1981).

Seeding will be performed along the contour using a drill, except where it is unsafe or infeasible to do so, such as on steep slopes exceeding 30%. Where use of a drill seeder proves either unsafe or infeasible, broadcast seeding will be used. The seeding rate will be increased by 50 to 100% above the drill seeding rate presented in the seeding mixtures below, depending on the condition of the site, if broadcast seeding methods are used. The site will be dragged with a meadow harrow to cover the seed and cultipacked or imprinted to provide a firm seedbed following broadcast seeding. Drill seeding will occur at depths of ¼ to ½ inch.

Erosion control measures to stabilize newly respread topsoil will vary according to the soil conditions, land use, and season of respread. The erosion control and seeding options used by SHC for newly respread topsoil areas are listed by land use and date of respread in Section 4.3.2. Generally speaking, however, SHC will begin seedbed preparation and erosion controlling activities as soon as feasible after topsoil is respread.

4.3.2 Revegetation Schedule

Seeding dates for the reclaimed areas addressed by this permit application will depend on the dates associated with the replacement of SPGM. Seeding will ideally occur either in the spring or fall directly following preparation of the seedbed outlined above. As a general guide, spring seeding will be conducted prior to mid-June, whereas fall seeding will occur after mid-August. Fall seedings intended to result in germination and stand establishment in that year will occur from mid-August to the end of September, depending on soil moisture conditions. Dormant fall seedings will be conducted after mid-October. If replacement of a given section of SPGM is completed in the summer (mid-June to mid-August), seeding may take place but only if soil moisture is sufficient to support seed germination. If conditions are not appropriate for a summer seeding, soils must be mulched with 2-tons per acre weed-free straw and crimped with an agricultural crimper designed for this purpose ("mulched") to protect from erosion until a fall seeding can take place.

Seeding and/or mulching will normally follow topsoil respreading activities on a given reclaimed area, unless some unforeseen circumstance such as adverse weather or soil conditions prevent SHC from meeting the planned schedule. Seeding will generally precede mulching, except in those situations where seeding is not possible, as noted above.

The specific composition of each land use seed mix (pre-cropland, native grassland, tame pastureland, riparian woodland or temporary) is given in Section 4.3.4.

4.3.2.1 Pre-cropland

The potential options for seeding on cropland vary, depending on when the SPGM is finally regraded and the desires of the landowner.

If regrading is complete and seeding is ready in spring (March to June), the area may be seeded to cereal grain (such as oats, wheat, or rye) or to sudan grass and then to the pre-cropland seed mix after harvest or the following year. Alternatively, the area may be seeded directly to the pre-cropland seed mix and then mulched.

If the area is ready to be seeded between late June to mid-August, the area again may be seeded to cereal grain or sudan grass and then to the pre-cropland seed mix either after harvest or the following year. Summer seeding to pre-cropland seed mix may proceed identically to spring seedings given favorable weather and soil moisture conditions. Otherwise, the area will be mulched and the pre-cropland seed mix may be planted later in the fall.

Beginning mid-August through the end of September, the area will be direct-seeded to the pre-cropland seed mix and mulched. Cereal grains would be seeded in the following spring. Finally, if the area is ready in late fall, after freezing weather has stopped growth, the area will be seeded to the pre-cropland seed mix and mulched for the winter.

Areas seeded to cereal grains or sudan grass will be allowed to grow to maturity and harvested, or will be mowed periodically until freezing weather kills them. The pre-cropland mix will then be planted in the fall after freezing weather as a dormant seeding, or the next spring. The pre-cropland mix will be seeded directly into the standing stubble, or a minimum tillage done to facilitate seedbed preparation, if necessary, incorporating the stubble.

4.3.2.2 Native Grassland and Tame Pastureland

Seeding of the native grassland seed mix will be done by either one of two seeding methods: 1) The complete mix of warm- and cool-season grasses will be seeded in mid-to-late June after soil temperatures have warmed to above 55 °F. This seeding will be late for the cool season grasses, to

counteract their initial competitive advantage and allow the warm season grasses a better chance to establish. 2) A split seeding method may be used. In this method, the warm-season grasses will be seeded in June, as soil temperatures warm. The cool season grasses will be seeded separately in late fall, as a dormant seeding, to emerge the following spring. Tame pastureland will receive the pre-cropland seed mix unless directed otherwise by landowner preference. This land use area will be seeded anytime after soils have warmed to above 55 °F, following the restrictions placed on summer seeding outlined above, after mid-August or a fall dormant seeding, to emerge the following spring.

Regardless of seeding method, if standing stubble or previously applied mulch is not on the area to be vegetated, the area will be mulched directly after seeding or a cover crop (e.g. oats) will be added to the seed mix. Native prairie hay, cut from selected areas inspected by the SHC's Environmental Specialists, may also be placed over seeded areas as available during its establishment to introduce as much diversity as possible into the community. Special care will be taken when selecting the native hay to exclude any undesirable weedy species. If available, mulch will be certified noxious weed free under the Regional Certified Weed-Free Hay Program.

4.3.2.3 Riparian Woodland

Woody species should be planted only in the spring of the year, after frost is out of the ground but by May 31st, as recommended by the United States Department of Agriculture (USDA) - National Resources Conservation Service (NRCS) document *Tree Care and Management* (2002a). Container grown stock planted through properly-placed fabric can be planted up to a month later, through the end of June.

4.3.2.4 Temporary Seed Mix Areas

Areas being seeded to the temporary seed mix, such as ditches, embankments, and stockpiles, will be seeded as soon as feasible after disturbance. This seed mix will be used throughout the frost-free season, and late in the fall as soon as the area requiring seeding is prepared by light discing, chiseling, or blading. Ditches will generally be mulched after seeding. However, for any temporary areas that are too steep for mulching, SHC will consider broadcast seeding a fast-germinating, non-persistent sterile hybrid such as Regreen to stabilize areas that are not conducive to the safe operation of equipment such as tractors, discs, or drills. Embankments and subsoil stockpiles will be mulched after seeding if soil conditions and slope necessitate it to prevent erosion. Topsoil stockpiles revegetated quickly enough generally do not require mulch as an erosion control. Subsoil stockpiles

require mulch to prevent erosion only if they are composed of very dry material and are steeply sloped. SHC may use mulch alone or a cover crop of cereal grain to stabilize stockpiles to be respread within one year of placement. Seeding of stockpiles will be completed during the first normal period for favorable planting conditions after placement.

4.3.3 Soil Testing Plan

Soils replaced and regraded will be soils originally removed from the mine area where baseline studies showed a healthy vegetative community (Section 2.7.2). Stockpiled soils should retain sufficient nutrients for the reestablishment of the seeded species that are either native or are adapted to the natural nutrient status of these soils. Numerous publications recommend no additions of nutrients for areas reclaimed to the native or adapted species (Biondini and Redente 1986; Franzen 2007) in the seed mixes developed in this section. With no planned nutrient additions, no nutrient testing is planned before the initial revegetation. If an area is to be planted to crop production within the liability period, however, nutrient testing will be done at that time. The number of tests per field or management unit will be determined by consultation with current guidelines published by the North Dakota Extension Service. Nutrient level testing will be performed by a qualified laboratory and results compared to values suggested by Franzen (2007 or the most current version) to determine how much and what type amendment, if any, should be added to the area for the projected crop and yield.

If vegetation cover fails to establish in specific areas, soils may be tested to determine likely causes. All soil tests will be performed by a qualified laboratory using standard methods. If, from these tests, it is determined that nutrient levels are responsible for the failure of vegetation establishment, nutrients and soil amendments will be applied to the redistributed surface soil layer in these specific areas. Amendment and fertilizer application will be added at the minimum amount necessary to support the approved post-mining land use and meet revegetation requirements in accordance with NDAC Section 69-05.2-15-05.

4.3.4 Planting Rates

Seed mixes recommended here were developed through research of previous permit applications with similar revegetation needs and in consultation with the PSC. Species names given are according to the accepted name by the USDA PLANTS database (USDA, NRCS 2007). If the name used in baseline studies is different, it is given in parentheses the first time it is referenced. For some seed

mixes, a specific variety is recommended. The ultimate decision on seed variety, however, will be determined through discussion – about both what is best adapted to the region and most available at the time of reseeding - with the local Cooperative Extension office. The targeted origin of seed harvest will be North Dakota, South Dakota, eastern Montana, eastern Wyoming, or northern Nebraska, but here again, SHC may defer to input from local expertise.

4.3.4.1 Cropland

Areas reclaimed to this post-mining land use will be directly seeded to crops following topsoil respread or seeded initially to a mixture of perennial grass and leguminous forb species prior to rotation into small grain crop production. The pre-cropland seed mix, described in Table 4.3-1, and subsequent vegetation cover is proposed as an aid in restoring organic matter, structure, tilth, and erosional stability to the newly respread mine soils. The pre-cropland vegetation may be left throughout the responsibility period to serve as a hay crop or broken by strip planting in some locations for small grain crop production for the purposes of revegetation success determination.

On areas used for small grain production, grassed waterways, contour planting, minimum tillage, and other conservation techniques will be used to control erosion, where necessary. Grassed waterways will be maintained in the main drainages of all reclaimed cropland that is tilled during the liability period. In general, the waterways will be established simply by leaving areas of established pre-cropland vegetation intact. The pre-cropland seed mixture meets the criteria of the critical area planting guidelines for grassed waterways developed by the Soil Conservation Service (SCS).

4.3.4.2 Tame Pastureland

Disturbed portions of areas identified as tame pastureland on Figure 2.7.1-2A, Figure 2.7.1-2B and Figure 2.7.1-2C referenced in Section 2.7.1 will be seeded to the pre-cropland seed mix.

Pre-mine land use of most tame pasture was grazing, however vegetation success standards are based on percent cover and productivity. Livestock grazing should not be recommenced on tracts designated in this land use until after success standards have been met. This will allow for the cover to establish itself and provide an adequate degree of erosional stabilization. Portions of the perennial grass cover may be hayed or burned occasionally to reduce or eliminate excessive litter accumulation which may, if left untreated, reduce overall health and vigor of the stand.

4.3.4.3 Native Grassland

All areas reclaimed to native grassland will be seeded to a basic mixture of cool- and warm-season native species that will support the post-mining land uses of grazing or haying (Table 4.3-2). The basic mix was developed in consultation with representatives at the PSC using knowledge of previously successful revegetation efforts. Seed application rate equivalent is to approximately 90 pure live seeds (PLS) per square foot. This seed mix is designed favoring warm-season species with a ratio of 2:1 (in terms of PLS/square foot). This is critical because, while criteria are based heavily on their success, warm-season grasses are less competitive than cool-season species during the initial establishment period (Holzworth 2006).

Pre-mining vegetation surveys (Section 2.7.2) showed some areas with a slightly different make-up of dominant or co-dominant species based on ecological site description (ESD) (USDA-NRCS, 2003). These ecological groups will be seeded with supplemental species of shrubs, forbs, or other grasses in addition to the basic seed mix (Table 4.3-3).

A number of management tools to control litter, encourage seasonal diversity, and control non-native invaders will be utilized on the reclaimed native grasslands during the liability period. Controlled haying will be a common element in this plan. Grazing and very selective herbicide use may also be employed. When they are, grazing and herbicide plans will be developed and discussed with the PSC for their approval. SHC will utilize NRCS, Extension Service, and University expertise from NDSU in developing these plans on a case-by-case basis.

4.3.4.4 Temporary Areas

The temporary seed mixture outlined in Table 4.3-4 will be used to stabilize ancillary mining features or facilities such as topsoil and subsoil stockpiles; haul road and diversion ditches; sedimentation pond embankments; etc. The mixture was designed to provide a quick stabilizing cover, but also has the ability to reduce or eliminate erosion on facilities in place for several years.

4.3.4.5 Riparian Woodland

Approximately 5.5 % of the area within the Permit Boundary is designated as riparian woodland in the Vegetation Baseline study. Vegetation baseline studies show green ash (*Fraxinus pennsylvanica*) and boxelder (*Acer negundo)* and occasionally American elm (*Ulmus americana)*, while understories

were dominated by smooth brome *(Bromus inermis)*, Kentucky bluegrass (*Poa pratensis)* and frequently western snowberry (*Symphoricarpos occidentalis)*. Common chokecherry (*Prunus virginiana*), woods rose (*Rosa woodsii)* and silver buffaloberry (*Shepherdia argentea*) are minor shrub components in these areas.

Potential success for direct seeding of woody species is low (USDA, 1999) and therefore woody species will be planted as bare root or containerized seedlings at the rates described in Table 4.3-5. Guidance for other methods can be found in the North Dakota NRCS Design and Installation Guide No. 612, Tree/Shrub Establishment (NRCS 2002b).

Since woody seedlings do not compete well with herbaceous species, the SHLM may delay planting of herbaceous cover to reduce competition for enhanced survival, if approved by the PSC. If quick establishment of an herbaceous cover is required to control erosion, a native grassland seed mixture (Table 4.3-2) will be planted at the specified rate, but leaving five to eight foot wide strips where the trees and shrubs will be planted.

The seed and plant mixtures presented here are considered capable of attaining their proposed purposes based on the most current information obtained to date. Carefully selected varieties of each species have been included with the seed mixtures to further ensure that the species are all adapted to local site conditions and possess the specific growth characteristics necessary to achieve their intended use. However, the SHLM would also like to retain some flexibility regarding modifications to these mixtures (e.g., species, varieties, and seeding rates used) in the event that new information or availability indicates that such changes are warranted. Changes in species composition or seeding rate changes greater than two pounds (PLS) per acre will be submitted to the PSC for approval prior to implementation. Any changes in varieties will be made using only northern-origin, or North Dakota adapted cultivars or ecotypes.

4.3.5 General Management Plans

The SHLM will conduct all management and normal husbandry practices necessary to achieve and maintain an adequate vegetation cover which will both stabilize the soil and support post-mining land uses. These management practices will be applied whenever necessary to achieve the revegetation goals. These practices include, but are not limited to, the following: weed and pest control, litter reduction, interseeding, reseeding, fertilization, and remulching.

Weed control will be conducted, when necessary, according to the following plan. Weedy annual forbs will be controlled using post-emergent herbicides such as 2,4-D. Annual weed infestations in stands comprised of seeded forb species will be controlled by mowing. Infestations of noxious weed species will be controlled through the selective use of herbicides. Pests will also be controlled through the use of pesticides if they pose a severe enough threat to the developing stands of vegetation. All weed and pest control activities will be conducted in coordination with, and following the recommendations of the local Cooperative Extension Service and its publications such as the North Dakota Weed Control Guide (Zollinger 2007), Soil Conservation District offices, both in Dickinson, North Dakota, the North Dakota Weed Control Association and County weed officers. No pest control spraying on reclaimed land will be done without the specific recommendations of at least one of these bodies and the concurrence of the surface owner.

Sparsely vegetated areas discovered during vegetation monitoring activities will be treated accordingly. These treatments may include the application of soil amendments (if necessary), interseeding or reseeding. Areas requiring reseeding will be prepared, seeded, and mulched using the techniques described above for initial vegetation establishment.

Seeded grasslands will be managed to promote healthy stands. Burning is an example of a natural method of rejuvenation and may be used to reduce or eliminate excessive accumulations of litter in the seeded stands. Haying, a mechanical method of rejuvenation, may be implemented as an alternative to the above method of litter reduction and/or elimination in the seeded sands. Other methods of mechanical rejuvenation, such as spiking or harrowing, may also be implemented on the seeded stands to break up the sod. Chemical fertilizers such as nitrogen and phosphorous may be applied to the seeded stands to stimulate growth if deemed necessary.

The specific method or methods used to rejuvenate the seeded stands of vegetation will incorporate the recommendations and suggestions regarding the use of the various methods described above made by appropriate State and Federal wildlife and land agencies obtained from available literature and/or personal communication.

4.3.6 Sampling Methods and Success Standards

Revegetation success will be determined for all the land uses affected either directly or indirectly by mining. These areas will be reclaimed within the Permit Area in accordance with landowner preferences, the procedures and performance standards outlined in NDAC 69-05.2-22-07, PSC policy

document entitled “Standards for Evaluation of Revegetation Success and Recommended Procedures for Pre- and Post-mining Vegetation Assessments”; Revised July 2003” (“Standards document”); and State Policy Memorandum No. 10. Success standards for post-mining native grassland, cropland, tame pastureland, and riparian woodland are summarized below.

4.3.6.1 Cropland

Revegetation success on cropland will be evaluated using productivity standards contained in the PSC Standards document. Cropland productivity standard No. 2, i.e., NRCS productivity indexes (USDA-NRCS, 2000), will be used, with climatic correction method No. 1 (annual county yield data published by the North Dakota Agricultural Statistics (NDAS) in conjunction with the county average yield from SCS County Soil Surveys), climatic correction method No. 2 (control area) or climatic correction method No. 3 (regression equation based on NDAS data in conjunction with precipitation data). The decision regarding whether to use climatic correction method No. 1 or 3 will be based on the speed at which the results of a given revegetation success determination are needed. The annual county yield data necessary to calculate method No. 1 is not published until the year following the fall of harvest within a given county; whereas, the precipitation data necessary to calculate method No. 3 is available at the time of harvest on a given cropland tract.

For final bond release, separate yield will be developed for each land owner’s property and compared to the standards. Data and calculations will be submitted which demonstrate that the standards established for crop yield have been met or exceeded with 90% statistical confidence for any two years after year six of the responsibility period.

The post-mine cropland tracts will either be directly farmed following topsoil respread or seeded to a pre-cropland seed mixture consisting of grass and legume species (Table 4.3-1). For the purposes of revegetation success determination and in accordance with PSC Policy Memorandum No. 10, the pre-cropland vegetation will be broken in some locations for small grain crop production starting after the third year of growth. Post-mine productivity measurements will be collected immediately and will begin after pre-cropland vegetation is broken and cropping begins on pre-cropland tracts. If the entire reclaimed tract (field) will not be used for proving small grain production, a minimum of three representative strips that total at least 10% of the entire field will be established and harvested yearly. These strips will be considered representative of the entire field in accordance with methods described in the PSC Standards document. Where land is put into crop production, the SHLM will

coordinate with surface owners to ensure that management of reclaimed lands provides the greatest chance of revegetation success.

The only exception to this general rule is on cropland areas where the land, after mining, will be managed for perennial hay production, in which case, yields of hay will be used to determine revegetation success. However, this will apply only to areas specifically approved in the Post-mining Land Use Plan as perennial hayland or to areas where the pre-mine land use was perennial hayland (Section 4.2). On cropland areas where the post-mining land use is managed for perennial hay, yields of hay crops will be used to determine revegetation success during those years when yield measurements are taken to determine acceptability for final bond release. Success of revegetation on hayland will be evaluated using the tame pastureland productivity standards contained in PSC Standards document. These standards will apply only to areas specifically approved as perennial hayland in the post-mining reclamation plan.

4.3.6.2 Tame Pastureland

Per guidance in the Standards document section II-E, sampling of post-mine tame pastureland will be conducted to determine production and ground cover. Third-stage bond release will be based on ground cover estimates only, and fourth-stage will require meeting success standards for ground cover and productivity. Successful revegetation will be judged as either cover or cover and productivity (depending upon stage of bond release) equal to or greater than the approved standards with ninety percent statistical confidence any two years after year six of the responsibility period.

For both third- and forth-stage bond releases, cover on reclaimed areas will have 73% total cover, which includes both live vegetation and litter, based on basal hits, or 83% total cover based on first hits using the point frame method. Species present must be either part of the approved seed mix or not detrimental to the planned use of the tame pasture. For productivity standards, post-mining success will be determined by comparisons to technical standards using climatic correction factors for NRCS Major Land Resource Area number 54, Rolling Soft Shale Plains (USDA-NRCS 2006) outlined in the Standards document section II-E.

4.3.6.3 Native Grassland

Sampling of post-mine native grassland will be conducted to determine production, cover, seasonality, diversity and permanence. Pre-mine native grassland was sampled by ecological site

(Section 2.7.2). An ecological site represents a distinctive kind of native grassland which has the potential to support a native plant community typified by an association of species different from that of other sites. This differentiation is based upon significant differences in kind or proportion of species, or total productivity. Native grassland vegetation is closely related to soil characteristics. For this reason, the United States Department of Agriculture – Natural Resource Conservation Service has identified a specific ecological site for each soil mapping unit identified (USDA, NRCS 2003). A particular ecological site may be found on several different soil mapping units, but each mapping unit has only one ecological site, unless it is mapped as a complex of different soils.

Post-mine vegetation success will be based on productivity, cover, diversity, seasonality and permanence. Productivity and cover will be compared to technical standards developed in consultation with PSC to achieve fourth stage bond release, and will equal to or greater than those standards (with 90% statistical confidence) in each of the last two, consecutive years or any three years starting no sooner than the sixth year. Diversity, seasonality and permanence will be equivalent to the approved standard, but will not be held to statistical comparisons. If reference or control areas (as defined in the Standards document section II-B-1) are deemed to be necessary to evaluate revegetation success, they will be selected in consultation with PSC during an ensuing permit term.

Productivity

For productivity standards, post-mining success will be determined by comparisons to technical standards and to reference areas just off the mine disturbance area, if established. If reference areas with the same ecological sites as found on the mine are not or cannot be established, NRCS production values for Major Land Resource Area number 54, Rolling Soft Shale Plains, will be used (USDA-NRCS 2006), with climatic correction factors as outlined in the Standards document.

Cover

Post-mining cover will be evaluated against both off-mine reference areas, if established, and against the technical standard ascertained in consultation with PSC.

Diversity/Seasonality

Relative live basal cover or production data will be used to evaluate these parameters in accordance with methods contained in the Standards document.

Permanence

The Permanence standard will be met by meeting all requirements for ground cover, productivity, diversity and seasonality.

4.3.6.4 Riparian Woodland

Revegetation success for woodland revegetation will be determined following the procedures and success standards in Section II-F of the PSC Standards document. Fourth stage bond release will be based on meeting or exceeding the standards in the final year of the responsibility period. Stocking rates (stems/acre) for woodland vegetation (Table 4.3-5) were developed based on input from the NDPSC (Welch 2007)) regarding successful woodland revegetation efforts in North Dakota, rather than from information obtained from the baseline data evaluations. Thus, revegetation success will be evaluated by comparing both the overall number and diversity of species of tree, low shrubs, and tall shrubs present in the evaluation period to the stocking rates (stems/acre) set forth in this reclamation plan.

Successful fourth stage bond release will meet the calculated woody species density set out in NDAC 69-05.2-22-07(4)(e)(1). At the time of final bond release, at least 70% of all the trees planted will remain, tall shrub and low shrub plantings will at least triple in number by suckering. With the stocking rate proposed in Table 4.3-5 this translates to a final density of 364 trees/acre, 3,000 tall shrubs/acre and 1,305 low shrubs/acre.

In addition to the density, species diversity will be measured. At final bond release, all eight of the woody species planted will be present. Per the guidelines in the Standards document, at least 60% of the number of tree species will be present at 50% of the initial planting rate. With green ash and box elder the only two species proposed for planting, both species will have to be present at no less than 50% of their initial stocking rate (i.e., 185 stems/acres or 75 stems/acre, respectively). At least 60% of the tall shrub and low shrub species will comprise at least 10% of the standard-required density. With three species each in the proposed tall and low shrub layers, this translates to at least two tall shrub species at a density of 300 stems/acre and at least two low shrub species at a density of 131 stems/acre. No stocked trees or shrubs less than two growing seasons old will be counted in these measurements of stocking adequacy, but those stems growing as a result of natural regeneration will be counted.

In addition to measurements taken in the final years of the responsibility period, measurements will also be made on permanent quadrats in order to demonstrate that the final success of the stand has been based on survival and reproduction. The average number of plants in the quadrats in year one will be provided to PSC. At year four of the 10-year responsibility period, average density in the permanent quadrats will be equivalent to 80% of the original number planted, or 1,560 stems/acre. At the time of final bond release, documentation will be provided to PSC verifying that not more than 20% of the numbers present in year four have been replanted. This verification will include a worksheet listing the annual replanting and receipts and/or records from nurseries or people hired to do the replanting.

Finally, total cover – live herbaceous layer, litter and the woody species canopy - will be least 83% at the time of final bond release. This total cover will be sufficient to provide protection from erosion. The herbaceous contribution will be comprised of desirable species that will not be detrimental to the growth of the woody species.

4.3.6.5 Wetlands

Wetlands and riparian areas are an integral component of the ecosystem. In addition to contributing to plant community and landscape diversity, they provide habitat for a number of wildlife species. It is, therefore, necessary to ensure that reclamation efforts for wetlands and riparian areas are well designed and executed.

Success criteria are established to objectively evaluate the success of the wetland/riparian creation effort. These criteria can also aid in determining if remedial action is necessary. General success standards for revegetation on post-mining wetlands will be evaluated using the standards and assessment techniques contained in the PSC Standards document. Reclamation success, for most land uses, is generally based on an assessment of vegetation production and cover. When areas meet an "equal-to-or-better-than" production and cover standard, they may be released from bond. Wetlands, however, are important as wildlife habitat and for water retention. A wetland may produce a tremendous amount of forage but lack the diversity necessary to satisfy its utility as good wildlife habitat. Therefore, it is proposed that the success standards be comprised of an assessment of water quality and quantity, vegetation community patterns indicating levels of diversity, and wildlife use patterns. Specific hydrologic and vegetation goals may vary slightly from one wetland area to another. If necessary, special detailed reclamation plans, with modified success standards, will be submitted in the permit term prior to the initiation of reclamation activity.

Water Quality and Quantity

Reclaimed wetland surveys will be conducted on a semi-annual basis (late spring and early fall) starting in the first year after reclamation of the wetland. The survey will include observations of the extent of free water surface and general vegetation characteristics at the time of survey. Water quality and quantity data will be collected in the reclaimed wetlands during the last three years of the bond liability period. The extent of seasonal open water (developed water resources) will be evaluated from annual aerial photos taken during the early fall. Maps will be created showing the extent of developed water resources during each of the final three years prior to bond release. Wetland water regimes will be characterized on the basis of the previous years' surveys. Developed water resource surfaces within the wetland area will be sampled for water quality at the time of the semi-annual survey. If the low flow conditions are dry, then samples will not be obtained. Water quality samples will be analyzed for the following parameters: total iron, pH, specific conductance, and total suspended and dissolved solids.

Vegetation Community

For vegetation, data will be collected on an annual basis (early fall) starting in the first year after reclamation of the wetland. Primary species will be the focus of initial revegetation efforts. These species constitute the dominant elements of the community type flora and will eventually determine the structure of the vegetation. Success standards for revegetation of specific reclamation sites depend upon the establishment of specific plant species which constitute the core of the community type. If successful establishment of particular species is achieved on a site, the succession process has been initiated even though ultimate expression of the desired community type in a mature ecological form may take decades. The standards are based on what is needed to initiate the succession process to produce the desired community type. The development of species diversity is a long-term process. Immediate expression of a naturally diverse plant community should not be expected. Success of revegetation efforts will be judged in the short-term on the basis of successful establishment of primary species populations specific to the chosen community type or combination of community types, and a degree of recolonization of the general flora typical of the specific community types or types. Within a five year time-frame following initial revegetation or at the time of bond release, the vegetation of the site should have progressed to the point where colonization of primary species can be measured and evaluated for successful establishment.

The vegetation of each reclaimed wetland will be inventoried annually to show that the basin or linear drainage-side wetland exhibits vegetation characteristics of the wetland class it was designed to become. The inventory will be conducted in the field by trained personnel. Permanent vegetation transect endpoint-markers and permanent photography stations will be established at each wetland reclamation area to support the inventory. Panoramic photographic coverage will be completed, which will provide a visual baseline for comparison to photographs taken each subsequent year.

A complete species list of each vegetation zone which ranks the occurrence of each species will be compiled. The inventory and species list compilation will occur in the early fall of each year to coincide with the peak growth period of most wetland species. The percent cover of each non-native, invasive species will be recorded as part of the vegetation inventory along with percent cover of primary species. Annual checks of previous inventories are made at this time to determine shifts in community dominance, changes in water level, and to assess the survival rate of shrub and tree plantings to determine whether success standards are met.

Wildlife

Data on the wildlife use of wetlands will be recorded in various forms (waterfowl brood and pair counts, shorebird use, etc.) for the last three years of the bond liability period.

Reporting

Wetland monitoring and inventory data will be interpreted and summarized in an annual monitoring report. A Year 0 “As Built” report will document the grading, seeding and planting efforts implemented on the site and will include photographs of the site from fixed locations. Thereafter, the reports will include:

- An overview of all significant wetland creation activities for that year;
- A chronological photographic summary and comparison of selected photos (aerial and ground);
- A brief discussion of the monitoring goals, objectives and success criteria;
- A description of the inventory and monitoring methodology;
- A discussion of the hydrologic, physical, and vegetative conditions as they relate to corresponding success criteria; and
- A discussion of any noted problems and recommendations to correct them.

Each monitoring report will focus on data for that year. To the extent that problems become apparent, trend information from other years will be referenced.

Corrective Action

Corrective action will be taken as needed within the five-year period following the completion of planting. Corrective actions may include additional plantings, re-seeding, or control of non-native vegetation, as necessary. If these actions fall within the range of activities that are considered to be normal husbandry practices, then the period of responsibility will not be extended.

However, if success standards are still not achieved within the initial 5 year period of responsibility, even after corrective actions have been taken, the period of responsibility will be extended until minimum standards are met. The monitoring program will continue on a yearly basis until the reclaimed area is released.

4.4 Predicting Potential for Re-establishing Vegetation

In accordance with:

- Section 69-05.2-08-08(4), North Dakota Administrative Code (NDAC)

4.4.1 Introduction

NDAC 69-05.2-08-08(4) requires that any application for strip mine permit contain a narrative description which includes information adequate to predict the potential for re-establishing vegetation on all areas to be disturbed. This section reiterates specific reclamation methods identified in the reclamation plan and presents narrative referencing research supporting the soil handling and reclamation procedures described in this application.

4.4.2 Research Supporting Reclamation Methods

SHC proposes that all land uses in portions of the Permit Area to be affected either directly or indirectly by mining will be reclaimed to the land uses and capacities requested by the landowners of the affected lands. Most of the post-mining land will be reclaimed as cropland, riparian woodland and tame pastureland. The dominant post-mining land use will remain cropland.

Seed mixtures and revegetation procedures are designed to meet the requirements of regulations identified in Section 4.3. SHC will conduct all management and normal husbandry practices necessary to achieve and maintain an adequate vegetation cover that will stabilize the soil and support post-mining land uses. These practices, including (but not limited to) weed and pest control, litter reduction, interseeding, reseeding, fertilization, and remulching, will be applied whenever necessary to achieve the revegetation goals.

Revegetation success on cropland will be evaluated using productivity standards contained in the PSC Standards Document. Revegetation success on tame pastureland and for other land uses will meet standards contained in the permit application. SHC is committed to achieving these standards.

The soil handling and reclamation procedures are designed to support required revegetation and land uses. A detailed soil survey has been conducted to identify the types and quantities of soils that are available for first and second lift salvage removal within the Permit Boundary. The quality of SPGM was compared to suitability criteria established by the PSC as an initial step in the assessment of the soil's reclamation potential. Following this evaluation the two-lift soil salvage plan was developed to ensure unsuitable materials would be excluded from use in reclamation. As noted by Doll, Wollenhaupt, et al. (1984), "The importance of adequate pre-mine characterization of soil and overburden materials which indentifies the amount and extent of materials with desirable or undesirable strata cannot be overemphasized." This survey is thus a very important step in ensuring establishment of a sound reclamation plan (Doll, Wollenhaupt et. al.1984) focused on re-establishing the required post-mine vegetation production and land use.

This application identifies the total volume of suitable topsoil/subsoil and overburden required to meet the final reclamation requirements for each landowner. Should an unanticipated deficit in soil or subsoil be encountered based on the SHLM overburden geochemical model, suitable overburden material is available and will be used to make up the deficit of suitable topsoil.

The topsoil and subsoil removed will be placed in separate stockpiles when it cannot be directly hauled to final respread on final graded areas. Stockpiling of soil is an acceptable procedure, and segregation of topsoil from subsoil is a recommended reclamation strategy (Power et.al. 1979; Sandoval et.al. 1978). When requested by the landowner, soil will be stockpiled according to ownership to prevent mixing of topsoil from one ownership parcel with another.

Where practicable, soil will be directly respread onto the regraded spoil areas immediately following salvage (i.e., direct haul). In all reclamation operations, subsoil will first be removed from the active mining area and directly respread over the approved graded spoils. Once the proposed subsoil replacement depth has been attained and approved by the PSC, topsoil will then be removed from the active mining areas and directly respread over the subsoil. This practice is intended to enhance the likelihood of spontaneous succession of soil fauna and soil development, and revegetation, which are assets in restoring post-mining sites to pre-mine conditions (Frouz 2006; Howard et.al. 1979; Schuman et.al. 1981). Depuit (1984) found that direct respread of topsoil increases diversity by providing a viable seed bank and maintaining soil microbial communities.

The total amount of topsoil and subsoil removed will be sufficient to respread SPGM to a uniform thickness of 24, 42, or 48 inches (Table 4.1-1), depending on the projected regrade spoil characteristics. These respread soil depths and considerations are suggested by various researchers to be at least adequate to re-establish vegetation production equal to or better than that of the pre-mine condition (Barth 1983; Doll, Merrill et.al. 1984; Doll, Wollenhaupt, et.al. 1984; Halvorson et.al. 1980; Musslewhite et.al. 2006; Power et.al. 1978, 1979, 1981, 1982; Sandoval et.al. 1978; Schroeder et.al. 1980; Schuman et.al. 1980, 1981, 1985).

Additional studies have similarly documented the importance of soil thickness in achieving desired revegetation results. Barth (1983) found that depth of soil required to maximize forage production averaged 50 cm (approximately 20 in) for generic spoil, 71 cm (approximately 28 inches) for sodic spoil, indeterminate for acid spoil, and 0 cm for soil-like spoil. Buchanan (Buchanan et.al. 2006) found that, “Grass cover is lowest where shrub cover is highest; at the shallow depths, and the opposite occurs at the deeper depths of cover soil. Diversity of species is consistently the highest at cover soil depths between 20 and 30 cm” (approximately 8 to 12 in). Several authors support this conclusion (Schladweiler et.al. 2003 and 2005; Power et.al. 1981).

A separate study by Doll, Merrill et.al. (1984) found that on highly sodic spoils even 2 inches of topsoil markedly increased vegetative establishment and dry matter production. This research, largely consistent with other researchers, suggested that, “When available, at least 1 foot of topsoil should be respread on all reclaimed soils. When the underlying spoil is coarse-textured (sandy loam or coarser) and no more than slightly saline (EC > 4) or somewhat sodic (SAR > 10), from 24 to 30 inches of subsoil which is loam or finer in texture should be applied. If the underlying spoil is silt loam or finer in texture, 12 to 18 inches of subsoil should be respread. If the underlying spoil is moderately sodic (SAR 10 to 20); the subsoil depth should be increased to 24 to 36 inches. When the

spoil is sodic (SAR > 20); from 36 to 48 inches of subsoil should be applied. If topsoil and subsoil materials are sandy loam or coarser, it is proposed that the suggested depths of subsoil replacement be increased by about 12 inches."

The reclamation methods presented in this application are consistent with the recommendations of these studies demonstrating the capability to reclaim the pre-mine productivity of the mined area.

Prior to replacing soil on the regraded surface, scarification will be performed to help assist with soil adhesion and to help promote plant growth. If necessary, to relieve compaction in the regraded areas, the surface will be worked by scarifying the surface using dozers or motor graders. Once the subsoil has been replaced to a suitable depth, if necessary, the subsoil surface will be scarified to reduce compaction. Vining et.al. (1993) and other researchers have noted the benefits of such scarification practices with respect to revegetation, establishment of important soil microorganism, infiltration of precipitation, etc.

Topsoil will always be placed onto the top of the subsoil lift. The use of topsoil as a substrate topdressing is suggested by various researchers as a best practice to encourage and ensure successful reclamation (e.g. Doll, Merrill, et.al. 1984; Doll, Wollenhaupt, et.al. 1984; Frouz 2006; Bowen et.al. 2005). An adequate seedbed will be prepared from the soil materials using conventional agriculture equipment with various tillage methods to meet site specific requirements; a standard recommended practice (e.g. Vining et.al. 1993). The conditions resulting from these careful and deliberate SPGM handling methods have proven to be as suitable for supporting the desired vegetation as the soils existing onsite prior to mining.

During the life of the mine, SHC will employ qualified technical and professional staff and contract qualified consultants and contractors dedicated to reclaim mined lands to equal or greater productivity than pre-mine. Special consideration will be given to ensure that personnel, equipment and procedures are in place to achieve reclamation standards. Please refer to other sections of this permit for detailed discussions of methods of baseline soil assessment and the proposed methods of mining and reclamation.

TABLES

FIGURES

APPENDIX 4.1-1

BOND CALCULATIONS

APPENDIX 4.1-2

POST MINING WETLANDS DESIGN

APPENDIX 4.2-1

LANDOWNER'S POST-MINING PREFERENCE STATEMENTS