OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix A

Legal Notice and Outreach Letter

A.1 Legal Notice

Public Notice
Colowyo Coal Mine, South Taylor Permit Expansion Area Mining Plan Modification
Environmental Assessment

The U.S. Department of the Interior (DOI), Office of Surface Mining Reclamation and Enforcement (OSMRE), Western Region Office, will prepare an environmental assessment (EA) for the mining plan modification for the Colowyo Coal Mine's South Taylor area (the Project). The mining plan modification was originally proposed by the Colowyo Coal Company (Colowyo) on July 3, 2006 to surface mine undeveloped federal coal leases at the existing Colowyo Coal Mine. The Colorado Division of Reclamation Mining and Safety (CDRMS) approved Colowyo's Mine Permit Revision 02 (PR02) for the South Taylor area (including federal leases C-123476-01, C-29225, and C-29226) on June 8, 2007 in accordance with its responsibilities under the federal Surface Mining and Reclamation Control Act (SMCRA) of 1977. The DOI Assistant Secretary for Land and Minerals (ASLM), in accordance with the Mineral Leasing Act of 1920 (MLA), originally approved Colowyo's mining plan modification for the South Taylor Area on June 15, 2007 based on a supplemental environmental assessment conducted by OSMRE for the Project. OSMRE's supplemental environmental analysis resulted in a Finding of No Significant Impact (FONSI) on May 8, 2007. Colowyo commenced mining in the South Taylor area in 2008 in accordance with its state mine permit and federal mining plan modification approvals, and mining and reclamation operations included within PR02 have been ongoing since that time in the approved permit area.

The Colowyo Coal Mine is located approximately 26 miles southwest of Craig, Colorado and 22 miles north-northeast of Meeker, Colorado, west of Colorado Highway 13/789 in southwest Moffat and northern Rio Blanco Counties, Colorado. The originally proposed and approved Project is occurring on federal coal leases administered by the Bureau of Land Management (BLM) Little Snake Field Office and located within the South Taylor Permit Expansion Area in the southeast portion of Coloywo's approved SMCRA Permit Area. The federal coal leases contained in the Project Area include leases C-123476-01, C-29225, and C-29226. Federal lease C123476-01 was issued by the BLM in 1982 and leases C-29225 and C-29226 were issued in 1983. PR02 proposed to add approximately 6,050 surface acres to the previously existing permit area and add approximately 5,219 coal acres and 43 million tons of recoverable Federal coal. The Colowyo Mine uses a combination of dragline, truck shovel, and highwall miner mining methods.

Because of a recent court decision, OSMRE is preparing this EA to reevaluate the environmental impacts resulting from the originally proposed and currently approved mining plan modification for the South Taylor Permit Expansion Area, pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA). *See Wildearth Guardians v. U.S. Office of Surface Mining et al.*, Case 1:13-cv-00518-RBJ (D. Colo. 2015). Under the currently approved mining plan modification issued in 2007, mining operations have disturbed 789 acres of the originally approved 1,492 acres to be disturbed. The mine estimates that 20 acres remain to be disturbed in the South Taylor Permit Expansion Area for a total of 809 acres of disturbance. To date, the company has mined an estimated 21.3 million tons of coal and an estimated 11.8 million tons of coal remains to be mined. Prior to approval of PR02, the average production rate was approximately 4.5 million tons per year (mtpy). PR02 proposed that the average production rate and the maximum production rate would increase and vary from 5.8 to 6.0 mtpy for the life of the mining operation. Since 2008, the production rate has ranged from a high of about 4.95 mtpy in 2008 to a low of about 2.1 mtpy in 2012. In 2014 the production rate was about 2.48 mtpy. Based on remaining coal reserves and the 2014 production rate mining at the South Taylor Permit Expansion Area would be completed in approximately five years. It is not reasonably foreseeable that a production rate of 6.0 mtpy could be achieved. Therefore, the EA will evaluate production rates not to exceed 5.0 mtpy.

This EA will disclose the impacts that have already occurred under the approved PR02, and the potential impacts, including cumulative impacts, associated with mining the remaining coal. Further, this EA will update, clarify, and provide new and additional environmental information based on the originally proposed mining operations. Resource values to be covered in the EA include: surface and ground water; air quality; climate change and greenhouse gases; geology; soils; topography; recreation; fish and wildlife; cultural resources; social economic composition; and environmental justice. The cumulative effects of the Project will also be addressed.

Through the EA process, OSMRE will determine whether or not the current and existing FONSI reached for the original Project is still valid considering new and additional environmental information. If a FONSI is reached the Western Region Director will make a recommendation to the DOI's ASLM on the previously proposed and approved federal mining plan modification, and the ASLM will approve, approve with conditions, or disapprove the mining plan modification as required under the MLA. If the EA identifies significant impacts, an Environmental Impact Statement will be prepared.

OSMRE will hold an "open-house" style public outreach meeting that will include displays and handouts explaining the status of the existing and approved Project, and will provide opportunities to ask questions of OSMRE and Colowyo representatives about the Project and the NEPA process, and opportunities to provide written comments on the project. ***The meeting will be held on, June 10, 2015 from 4-8 pm at The Center of Craig, located at 601 Yampa Avenue in Craig, Colorado.***

Additional information regarding this Project may be obtained from Nicole Caveny, telephone number (303) 293-5078. When available, the EA and associated decision document, outreach summary report, legal notice, and outreach letter, will also be posted at:

http://www.wrcc.osmre.gov/initiatives/colowyoMineSouthTaylor.shtm

OSMRE is soliciting public comments on this Project. You are invited to direct these comments to: OSMRE Colowyo Mine EA, C/O Nicole Caveny, Western Region Office, OSMRE, 1999 Broadway, Suite 3320, Denver, CO 80202-3050, Email: OSM-Colowyo-Mine-EA@OSMRE.gov. OSMRE will accept comments through June 15, 2015. Comments received, including names and addresses of those who comment, will be considered part of the public record for this Project and will be available for public inspection.

A.2 Outreach Letter

United States Department of the Interior

OFFICE OF SURFACE MINING
RECLAMATION AND ENFORCEMENT
Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050

May 21, 2015

Dear Interested Public Land User,

The U.S. Department of the Interior (DOI), Office of Surface Mining Reclamation and Enforcement (OSMRE), Western Region Office, will prepare an environmental assessment (EA) for the mining plan modification for the Colowyo Coal Mine's South Taylor area (the Project). The mining plan modification was originally proposed by the Colowyo Coal Company (Colowyo) on July 3, 2006 to surface mine undeveloped federal coal leases at the existing Colowyo Coal Mine. The Colorado Division of Reclamation Mining and Safety (CDRMS) approved Colowyo's Mine Permit Revision 02 (PR02) for the South Taylor area (including federal leases C-123476-01, C-29225, and C-29226) on June 8, 2007 in accordance with its responsibilities under the federal Surface Mining and Reclamation Control Act (SMCRA) of 1977. The DOI Assistant Secretary for Land and Minerals (ASLM), in accordance with the Mineral Leasing Act of 1920 (MLA), originally approved Colowyo's mining plan modification for the South Taylor Area on June 15, 2007 based on a supplemental environmental assessment conducted by OSMRE for the Project. OSMRE's supplemental environmental analysis resulted in a Finding of No Significant Impact (FONSI) on May 8, 2007. Colowyo commenced mining in the South Taylor area in 2008 in accordance with its state mine permit and federal mining plan modification approvals, and mining and reclamation operations included within PR02 have been ongoing since that time in the approved permit area.

The Colowyo Coal Mine is located approximately 26 miles southwest of Craig, Colorado and 22 miles north-northeast of Meeker, Colorado, west of Colorado Highway 13/789 in southwest Moffat and northern Rio Blanco Counties, Colorado. The originally proposed and approved Project is occurring on federal coal leases administered by the Bureau of Land Management (BLM) Little Snake Field Office and located within the South Taylor Permit Expansion Area in the southeast portion of Coloywo's approved SMCRA Permit Area. The federal coal leases contained in the Project Area include leases C-123476-01, C-29225, and C-29226. Federal lease C123476-01 was issued by the BLM in 1982 and leases C-29225 and C-29226 were issued in 1983. PR02 proposed to add approximately 6,050 surface acres to the previously existing permit area and add approximately 5,219 coal acres and 43 million tons of recoverable Federal coal. The Colowyo Mine uses a combination of dragline, truck shovel, and highwall miner mining methods.

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OSMRE is soliciting public comments on this Project. You are invited to direct these comments to:

ATTN: Colowyo Coal Mine South Taylor Area Mining Plan Modification EA

C/O: Nicole Caveny
Office of Surface Mining Reclamation and Enforcement
1999 Broadway, Suite 3320
Denver, CO 80202

Comments may also be emailed to: OSM-Colowyo-Mine-EA@OSMRE.gov. Be sure to send emails ATTN: Colowyo Coal Mine South Taylor Mining Plan Modification. Please indicate on your comments whether you wish to be kept on any mailing lists to receive updates from this project and whether you wish to receive them via email or hardcopy. Additional information regarding this Project may be obtained from Nicole Caveny, telephone number (303) 293-5078. When available, the EA and associated decision document, outreach summary report, legal notice, and outreach letter, will also be posted at:

http://www.wrcc.osmre.gov/initiatives/colowyoMineSouthTaylor.shtm

Comments should be received no later than June 15, 2015, in order to be considered during the preparation of the EA. Comments received, including names and addresses of those who comment, will be considered part of the public record for this project and will be available for public inspection.

Sincerely,

Marcelo Calle, Manager
Field Operations Branch

OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix B

Design Features and Resource Protection Plans

Contents

I. PROJECT DESIGN FEATURES

A. Introduction

The resource protection plans and environmental protection measures below were approved by CDRMS in 2007 for PR02 for the South Taylor/Lower Wilson permit expansion area and incorporated in the permit as design features. The permit stipulations were added by CDRMS as PR02 requirements in 2007. The applicable plans, design features and stipulations below are excerpted verbatim, with no editorial or other revisions made to the original text, directly from Colowyo Coal Company's approved PAP, Volume 15, Rule 2, Permits, and Rule 4, Performance Standards Permit Revision (PR) – 02, approved by CDRMS on June 8, 2007. As a result of excerpting the applicable design features directly, there are numerous references to various sections, Figures, Exhibits, Maps, etc. that are contained in the approved PAP, but are not included in this appendix. The PAP can be accessed on the CDRMS website (http://drmsweblink.state.co.us/drmsweblink/search.aspx?dbid=0). Simply type the permit number c1981019 into the Permit No field, on the left side of the page, and click search; the entire PAP will be available.

In the event that the conditions encountered, or other relevant factors are different from those originally anticipated that were the reason for an EPM and/or permit stipulation contained in the PAP, there are regulatory processes in place for CDRMS and OSMRE to consider approval of modifications to the mitigation measures.

B. Design Features Excerpted from the Approved PAP for PR02

2.05.4 (1) Reclamation Plan

The reclamation objective for the South Taylor area is to restore the mined area to a land use capability which will, be equal to or better than that which currently exists. The first objectives of all reclamation practices are to stabilize the soils, maintain hydrologic and vegetation resources, and to restore the approximate original contour of the mined area. Ultimately, the areas being mined will be returned to their approximate original use as rangeland with watersheds having their approximate pre-mining character. In general, the long term appearance and usefulness of the mine plan area will be similar to that which would have been encountered prior to any mining.

The reclamation plan for the existing mining areas provides information relevant to the reclamation of the South Taylor mining area, which can be found in Volume 1, Section 2.05.4 [see below]. Specific topics requested by the regulations and not incorporated into Volume 1 are included in the following subsections.

2.05.4 Reclamation Plan

The reclamation objective of Colowyo is to restore the mined area to a land use capability that will, be equal to or better than that which currently exists or even better than existed pre-mining. Colowyo is the landowner and does not desire to harm the post-mining value of the property, but to the contrary return a financially superior parcel of land that could command a greater market price if sold. The first objective of all reclamation practices is to stabilize the soil, maintain hydrologic and vegetation resources, and to restore the approximate original contour of the mined area. Ultimately, the areas being mined will be returned to their approximate original use as rangeland with watersheds having their approximate pre-mining character. In general, the long term appearance and usefulness of the mine plan area will be similar to that which would have been encountered prior to any mining.

From the beginning planning stages of the Colowyo mine, environmental concerns and reclamation concerns and objectives have been an integral part of the mining and reclamation activities. In 1975, two years prior to the commencement of mining, Colowyo contracted with Colorado State University to conduct reclamation studies to develop methods to reestablish native plant species on disturbed lands, and in particular native shrubs. Also included in these studies were: runoff and sediment plots, mulch plots, fertilizer plots, seeding management practices individual species seedings, and species combination seedings. The initial and last progress reports on these studies are included in Exhibit 10, Vegetation Information.

The attainment of reclamation goals will be satisfied by implementation of the reclamation plan described below. Colowyo will combine information from existing baseline conditions with modern practices of reclamation technology to assure achievement of the reclamation objectives. The pre-mining condition of the permit area has been characterized through collection of baseline data. After identification of pre-mining conditions, mining and reclamation commenced in 1976 according to the following sequence:

(1) Removal of topsoil and vegetation
(2) Removal of overburden;
(3) Extraction of the coal resource;
(4) Backfilling, grading, and re-contouring of the surface to its approximate original contour;
(5) Reestablishment of surface drainage patterns;
(6) Topsoil Replacement; and
(7) Revegetation and restoration of the affected land to the pre-mining land use.

Such practices are expected to result in land use capabilities and productivity levels equal to or greater than those originally found.

At the outset, it is imperative to appreciate that the reclamation plan defined in this section is to be implemented in a permit area where there has been disturbance from surface coal mining and reclamation operations (since 1976) and prior (now abandoned) underground operations. There are certain areas which are now undergoing backfilling and regrading. Revegetation techniques have been applied to all previously mined or otherwise disturbed lands. The reclamation timetable for the various aspects of the mining operation are indicated in Section 2.03 on Table 1., Affected Areas For Mining and Reclamation. As indicated in Section 2.05.3, the east half of the coal lease will be mined from north to south. To meet the maximum coal recovery requirements of the U.S. Bureau of Land Management and to avoid disturbing the area twice, a strip of land 500 to 600 feet wide along the Streeter drainage will be left unreclaimed until the west half of the lease is mined (see Spoil Grading Map (Map 29)). The west half of the coal lease will be mined from north to south. The initial mining in section 15 and 16 will be "X" seam only. Mining will start on the east and west and progress toward the ridge in the middle of Section 16. Later, a portion of the west pit will progress into the northern portion of Section 16.

The estimate of the cost of reclamation of the proposed operations required to be covered by the performance bond is found under Rule 3.

As discussed in detail in Section 2.05.3, the mining method proposed by Colowyo is referred to as open-pit multiple seam/single seam dragline mining. The overburden material from the initial boxcut area was deposited in the Streeter Fill. As mining progresses to the south, overburden material from each successive cut will be backfilled into the previously mined out area. This cycle will be repeated for the entire mining area. Because an open-pit mining technique is employed, the regrading and backfilling of the spoil material will be as contemporaneous as possible behind the mined-out area to facilitate proper leveling of the overburden material. The mining techniques utilizing dragline and truck/shovel operation are shown in detail on Mining Range Diagram (Map 24), and show the approximate distance between topsoil removal and replacement.

The backfilled mining areas will be graded to establish the approximate original contour and to blend in with the undisturbed areas outside the mining limits. Colowyo will grade all final slopes so that overall grades do not exceed 33%. Additional information on the backfilling and regrading plan are discussed further in Section 2.05.3 and Section 4.14.

Where necessary, the spoil surface will be roughened by ripping or discing etc., to ensure a bond between the topsoil and spoil to reduce slippage. To date there is no evidence of topsoil slippage on reclaimed areas. A few small tension cracks resulting from settling of fill and topsoil have occurred in a few areas within a year or two after reclamation, but soon stabilize and begin to fill in.

The final surface as shown on the Post-mining Topography Map (Map 19) will approximate the overall pre-mining grades. Appropriate cross sections that show the anticipated final surface configuration of the proposed permit area, in conjunction with the existing pre-mining topography, are shown on the Pre-mining and Post-mining Cross Section (Map 20).

This final surface configuration also reflects an often neglected concept of providing topographic relief for wildlife habitat. The regrading plan reestablishes escape cover, south facing slopes for wintering big game populations and small drainages suitable as future location of stockponds necessary to achieve the post-mining land use.

Colowyo has prepared this reclamation plan with the understanding that some aspects of current reclamation practices are still in the development stages. Therefore, a degree of flexibility has been provided to allow changes and modification as techniques are refined or expanded. Colowyo will continue to evaluate the results of its reclamation plan each year in consultation with the Division and take advantage of each opportunity to try new plant species and materials and new methods for seeding and erosion control.

Supplemental Introduction (Responsive to Stipulation # 8 for PR-02)

Given the last statement above and responsive to Stipulation # 8 for PR-02, modified seed mixtures, revegetation metrics, and bond release protocols designed to target specific post-mining land use components are presented within the context of this section (2.05.4) as well as the revegetation requirements, Section 4.15. In effect, reclamation occurring at Colowyo during 2008 and beyond will focus on the replacement of the two primary subcomponents of the pre-mining rangeland land use: 1) grazingland (for domestic livestock), and 2) wildlife habitat (specifically targeting sage grouse brood-rearing habitat). The replacement of these two land use subcomponents will be effected by replacement of two primary revegetation communities: 1) grassland and 2) sagebrush steppe, respectively. Additional "incentive" for this new reclamation approach will be the validation (and modification as necessary) of said techniques necessary to address similar concerns related to greater acreages of potential impact on Colowyo lands located to the West of existing operations.

Reclamation beginning in 2008 will be responsive to a new revegetation philosophy utilizing a "prescribed ecological reclamation approach" (PERA) that has been adopted for the Colowyo operation to facilitate creation of a wildlife habitat favorable vegetation community (sagebrush steppe) among the more dominant grasslands necessary for livestock grazing and erosion control. Efforts resulting from this new approach will be subject to a new set of success criteria for bond release as detailed in Section 4.15. Beginning in 2008, revegetation will specifically target livestock grazing and sage grouse brood rearing habitat, both of which are the two primary components of the Post-mining Rangeland Land Use. Areas designed to target livestock grazing (and incidental / unavoidable grazing by elk) will comprise approximately 60% to 80% of the original (2008 and after) and South Taylor reclaimed landscapes. These areas will principally occupy more steeply sloping ground (>10% slope) where the grassland community is necessary to preclude excessive erosion, especially from snowmelt. Based on a detailed evaluation of the post-mining topography, the remaining 20% to 40% (estimated) of the reclaimed landscape will afford flat or gently sloping surfaces (<10% slope) with reduced exposure to erosion. It is on these less exposed more gentle slopes whereby development of wildlife favorable habitats (sagebrush steppe) can be attempted. In this regard, sagebrush communities targeting sage grouse brood-rearing habitat will be attempted in earnest on approximately 20% (or more) of the Post-2008 reclaimed landscape, with the goal of achieving success on at least one-half of this acreage or as otherwise agreed upon between Colowyo and CDRMS.

The principal basis of PERA is to rebuild the foundation conditions of target vegetation communities taking into account the appropriate aspects, slopes, and topographic features of the reclaimed landscape. In this manner, targeted communities, as opposed to more simple grasslands will be more strongly encouraged. Potential reclamation techniques to be applied to facilitate the targeting of sagebrush communities include, but are not limited to: 1) taking advantage of site-specific opportunities for development of convex and concave surfaces to encourage snow entrapment; 2) development of small berms along the contour and somewhat perpendicular to prevailing winds, also to encourage snow entrapment; 3) use of native species; 4) severe reduction of grasses in the seed mix; 5) use of only bunch grasses for those taxa planted with sagebrush; 6) sharp increases in the amount of sagebrush seed to be used; 7) extra care to obtain the correct subspecies of sagebrush (*vaseyana-pauciflora*) with a seed source as close as possible to the Axial Basin; 8) extra care to place seed at the ideal time of year (immediately prior to the first major snowfall event; 9) placement of thin layers of topsoil over overburden; 10) possible placement of zero topsoil; 11) possible placement of thin layers of overburden over topsoil; 12) use of specialized seed placement equipment to obtain correct planting depths; 13) use of seedbed preparation equipment and techniques to encourage sagebrush emergence; and 14) interseeding of additional grasses and/or forbs (only where necessary) following a period of 2 – 3 years of growth by shrubs. All of these possible techniques / metrics are designed to diminish the competitive advantage of grasses, at least in the early stages of establishment and growth. The primary "foundation-building" element for this approach is the ability to replace variable topsoil depths and/or quality of soil materials depending on site-specific needs, the discretion of the field construction supervisor, and the capabilities (or lack thereof) of available materials and equipment.

The following practices will not be promoted or practiced at Colowyo with respect to the topsoil resource: 1) Topsoil will not be "buried in place" within the footprints of existing stockpiles in order to reduce the amount of resource to be moved and placed on reclamation areas. 2) At no time will topsoil be placed without adequate metrics in place to accurately estimate volumes placed within each reclamation unit to ensure an accurate accounting of the topsoil balance. 3) Topsoil will not be placed indiscriminately within reclamation units in a manner that does not serve a specific defendable purpose regarding vegetation type establishment or location within the reclamation unit or localized watershed.

In summary, application of PERA on "shrub-favorable areas" would be based on the community development contributory factors of: 1) soil quantity, quality, and replacement depth; 2) aspect, slope, and landform; 3) documented and expected performance of various floral species; 4) revegetation metrics; and 5) the target post-mining land use. In this manner, reclamation and resultant developing communities will be encouraged to follow a more natural path to maturation and successional progression as opposed to more historically utilized grassland favorable approaches that should only be applied to the remaining 60% to 80% of reclaimed ground (sloping areas). However, there will likely be instances, if not an overall need, to incorporate managerial practices to encourage or protect positive recruitment to the shrub populations. Such management may include the following steps:

- Use of elevated quantities of sagebrush seed within the grassland target areas, and placement of that seed in a manner to encourage sagebrush emergence.
- Use of limited livestock (cattle) grazing to select against grasses and for shrubs and forbs.
- Use of elk-proof fencing to preclude access into large blocks of maturing shrub populations, especially core areas.
- Use of hunting pressure to reduce elk utilization of new reclamation where it can be incorporated in a safe manner given proximity to active mining. Develop special seasons in concert with CDOW for management of "refuge" elk. For obvious reasons, any

activity in this regard would have to be designed and approved for implementation in accordance with applicable statutes. Furthermore, approvals from appropriate agencies (CDOW, MSHA, etc.) will be obtained as necessary.

- Use of orchard grass (*Dactylis glomerata*) in key reclamation locations to encourage elk away from maturing shrub populations. It has been documented that this taxon is heavily utilized by foraging elk.
- Implement procedures for micro-habitat development whereby snow catchment is encouraged and shrub heavy mixes can be applied.
- Interseeding of shrubs (as necessary as a normal husbandry practice) within areas not exhibiting satisfactory establishment of shrubs, but still presenting opportunities (micro-niches) for shrubs. Such interseeding would be performed in accordance with Rule 4.15.7(5)(g), and documentation of any such efforts would be provided in the Annual Reclamation Report for that year.

Application of PERA includes management and revegetation specifications (e.g., shrub species in the seed mix) for use on the "grassland" targeted areas that will facilitate additional shrub establishment when climatic or other conditions are favorable. In this manner, small and/or scattered patches of additional shrubland may be established that will provide improved habitat diversity, especially for sage grouse. However, since this type of reclamation is entirely dependent on the vagaries of nature, dependence upon such techniques cannot be relied upon. Where shrublands evolve on reclaimed lands, they will be segregated into "core" areas and "ecotonal" areas (as is typically evident in nature), each with a separate woody plant density success criterion but both counting as "shrubland". Ecotonal areas are those areas that exhibit shrub-conducive habitat conditions (e.g., thin grass cover, skeletal soils, etc.), but have not as yet developed the more elevated densities of "core" areas. It has been noted repeatedly in the reclamation industry that the 10-year bond responsibility period is often insufficient for the adequate development of shrub populations unless an excellent "take" is achieved at the time of seeding. In this regard, flexibility has been built into the success evaluation process so that if a positive recruitment rate to the shrub population can be demonstrated on Colowyo revegetation, there would be no need to achieve elevated densities within a modest time-frame such as the 10-year responsibility period.

Colowyo makes the commitment to establish sagebrush steppe (comprised of both core and ecotonal areas) on approximately 450 acres (minimum of 225 acres core) of the post-2008 reclamation for the original and South Taylor permit areas, or as otherwise agreed upon between Colowyo and CDRMS. This acreage is based on the following rationale: 1) delineation of all post-2008 post-mining acreage exhibiting slopes 10% or flatter; 2) elimination of all small, isolated, or impractical areas for targeting this community; 3) implementing "banding" (alternating strips of grassland versus shrubland) procedures on large units with long slopes that might otherwise lead to excessive "snowmelt" erosion; and 4) assuming 50% shrub establishment success (i.e. sufficient density) on the acreage that actually receives shrub conducive metrics. Please refer to Map 44 for a visual representation of areas that are < 10% slope at Colowyo Mine according to the current PMT surface.

Critical to the adoption of this approach is the need for Colowyo to be allowed to deviate from the plan in instances where plan maps or specifications do not reflect "on-the-ground" reality, and to the contrary, when opportunities for adding unplanned supplementary areas targeting shrub establishment present themselves. By acceptance of this new approach, Colowyo will be granted the flexibility to take advantage of day-to-day opportunities to promote shrub establishment and be able to option out of planned areas if site conditions prove significantly different than anticipated. Such flexibility will in no way be allowed to circumvent the requirement to maintain a proper life-of-mine topsoil balance and overall plan objective to improve shrub establishment. All significant deviations from plan maps and expectations will be documented and submitted in the Annual Reclamation Report. In this manner, as well as documentation through bond release evaluations, CDRMS will maintain authority over any such deviations.

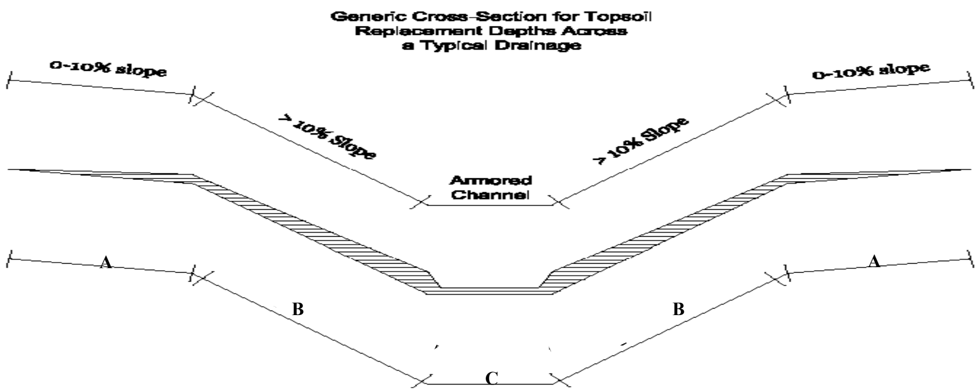
Related to this flexibility and as presented in revisions to Section 4.15, Colowyo commits to revised woody plant density success criteria for Phase III bond release for 2008 and later reclamation, that are somewhat less stringent than the original requirements, and are significantly less stringent for pre-2008 reclamation, but are ecologically defensible and appropriate. This commitment is in the interest of promoting the momentum of the bond release process and the pursuit of a "land-use" based reclamation program. Furthermore, this commitment on the part of Colowyo is based on the fact that the best reclamation science (30+ years ago), and significant financial expenditure went into implementation of the previous reclamation plan (and development of success criteria), and that recent experience and advancements in reclamation science now dictate less stringent requirements for a 10-year bond responsibility period. In other words, the original woody plant density success criterion was developed without sufficient experience, knowledge, or empirical evidence and as such was established at too high a level over too short a time period. In effect, this will amount to the waiving of the previous standards and the adoption of the new proposed standards.

Topsoil Redistribution Plan

Prior to any mining-related disturbances, all available topsoil will be removed from the site to be disturbed as discussed in Section 2.05.3, and will be redistributed or stockpiled as necessary to satisfy the needs of the reclamation timetable as described herein.

Final grading before topsoil placement will be conducted in a manner that minimizes erosion and provides a surface for the topsoil that minimizes slippage. If spoil compaction is a problem, the spoil will be ripped with a dozer to minimize compaction, assure stability and minimize slippage after topsoil replacement. Where possible, development of concave landforms (to encourage snow entrapment) will be developed on a case-by-case basis at the discretion of the field supervisor. Such landforms will still have positive drainage in accordance with overall permitted designs. Topsoil will then be redistributed and graded to a variable replacement depth following the general rule of thin topsoil (<6) inches on ridge tops to gradually thicker topsoil moving down the slopes to the drainage bottoms for the grazingland land use targeted areas (see representation below). Sagebrush Steppe areas will ideally receive an average of approximately 4 inches of topsoil that will likely be a more uniform application to encourage proper seeding depth and overall shrub establishment conditions (see representation below).

Colowyo will track the volume of topsoil applied to each reclamation unit and report it within the Annual Reclamation Report each year. Colowyo utilizes load counts and time card coding to differentiate and accurately assign costs/volumes for all other material movement on the mine site. As such, Colowyo will utilize these tools to ensure the planned and appropriate volume of topsoil is applied to each reclamation unit. A visual representation of Colowyo's drainage-wide topsoil replacement strategy is provided below:



A Generally defined as a "thin" zone of topsoil (0"-6") exclusively applicable to Sagebrush Steppe areas which will ideally average 4 inches. Areas seeded using the grassland mix will almost always be >10% slope and have > 6 inches of topsoil replaced.
B Generally defined as a "thicker" (>6") zone of topsoil in the transition zones between Sagebrush Steppe areas and Grazingland areas where topsoil thickness will likely begin around six inches at slope breaks >10% and gradually increase to approximately 10-14 inches to the base of slopes with armored channels in all reclamation areas except South Taylor. South Taylor topsoil replacement depths will begin with approximately 6 inches at the top of slope breaks >10% and gradually increase to approximately 12-18 inches mid-slope up to potentially 3 to 4 feet down-slope to the base of slopes with armored channels, depending on slope length and topsoil balance considerations.
C Generally defined as the area within armored channels that will receive minimal to no volume of topsoil due to the likelihood any topsoil placed within the structure would erode into terminal sediment control structures and be lost. On-site experience has demonstrated natural sedimentation processes will support vegetation early post construction, and these areas will be seeded via broadcast method to provide a seed source for beneficial species establishment.
NOTE: *Specific details regarding topsoil replacement depths on special planting areas will be included in the description provided for approval prior to the creation of those areas.*

The grazingland targeted reclamation blocks will by necessity have thicker layers of topsoil than recent reclamation areas due to reduced volume of topsoil that will be placed on sagebrush steppe areas. Unless Colowyo provides specific justification, the topsoil resource will be placed in a manner that is thin on the ridge tops and gradually increasing in depth to the base of coherent drainages. Large drainage bottom channels that will convey water on a consistent basis will receive little to no topsoil resource as any topsoil placed in these areas will likely be mobilized and washed down the drainage. The full application of seed will still be applied to these areas in order to minimize erosion and allow vegetation to establish in these special locations, adding an additional dimension of potential vegetation community diversity. Colowyo is moving away from applying topsoil in uniform layers and variability in depth will be applied in all practical locations to maximize plant community diversity in areas designated for grazingland. Because the volume of topsoil to be applied to sagebrush steppe targeted areas is much less, and the creation of a seedbed conducive for shrub establishment is of major importance, the variability of topsoil depths within these areas may be limited. However, wherever practical, Colowyo will also make attempts to vary topsoil depths in the Sagebrush Steppe areas as well. Colowyo will ensure proper topsoil resource management through annual analysis of the topsoil balance in stockpiles, the expected areas for the following year's reclamation focus, the total disturbance area, and the results of topsoil stripping activities each year. Because the topsoil resources from the "original" permit areas (East Pit, West Pit, Section 16, facilities, Gossard Loadout, etc.) are for the most part segregated by location from the topsoil generated from the South Taylor area, it will not be difficult to ensure that these resources are reapplied to the general areas from which they came. The same principles apply to both areas (original & South Taylor) regardless of targeted reclamation focus; < 6 inches on ridge tops with variably deeper application down slopes to the bottom of coherent drainages. The major difference between the two areas will be the thickness of reapplied topsoil from mid-slope to the bottom of drainages. Topsoil redistribution criteria specific to sagebrush steppe areas are defined further on in this section.

Prior to 2005, essentially all reclamation units were covered with an average of 18 inches of topsoil. One exception to this was the CSU/DMG Shrub study area, which received various treatments of replaced topsoil at 0", 6", and 18" as described in Section 4.15. From 2005 through 2009, reclamation areas received an approximate average of 8 inches of topsoil as a result of modifications related to TR-62. Reclamation areas from 2010 moving forward (including facilities and the Gossard Loadout area) will utilize variable topsoil depths as described in this section through modifications approved via TR-82, unless otherwise specified (sagebrush steppe and special planting areas).

Starting in 2005, Section 11 of the Annual Report presented a summary of topsoil stockpile volumes and a table showing the average topsoil replacement depth for each reclamation polygon, and information on overall topsoil balance. Beginning in reporting year 2010, Section 11 of the Annual Report will present topsoil balances for the original permit area and South Taylor area separately.

Topsoil will normally be reapplied by hauling, in trucks, from topsoil stockpiles or from areas where topsoil has been removed for mining advance, to the regraded spoil areas and then redistributed with dozers. Alternate methods may also include placing topsoil on slopes with a dragline followed by redistribution with dozer, or using a scraper to redistribute the topsoil.
It is anticipated that on slopes of < 10% it will be safe to strategically place rows of topsoil in a designated pattern with haul trucks to ensure the desired four to six inches of topsoil can be dozed into position. If a dozer operator doesn't do this properly, he won't have enough

material to cover the entire area and it will be obvious what has occurred. Depth control on the Sagebrush Steppe areas will be verified as the project progresses and any deviations from the plan will be rectified at that time. Depth readings will also be taken after the area has been completely topsoiled, sufficient to ensure that Colowyo can demonstrate compliance with the plan. Even if scrapers are used to initially lay topsoil down, it is anticipated that some dozer work will be needed to do the finish work. The required volume of material will be at/on the location. Verification work will lead to additional dozer/scraper work if necessary to ensure proper final placement. If depth control becomes an issue, staking will be initiated as an additional guide for operators.

On areas of > 10% slope it is anticipated that dozers will work together with scrapers to accomplish a gradually thicker application of topsoil on these slopes. As Colowyo has always done, depth stakes at regular intervals will provide guidance to the operators. Depth readings will be taken while the operations are progressing and any issues will be rectified at that time. Depth readings will also be taken after the area has been completely topsoiled, sufficient to ensure that Colowyo can demonstrate compliance with the plan. The allocated volume of topsoil for each area (total volume based on area multiplied by either 8 or 19.5 inches) will be hauled to the location, most likely with haul trucks and scrapers as close as safely possible to the final intended location, then dozed into place or placed via scrapers. Verification work will lead to additional dozer/scraper work if necessary to ensure proper final placement.

Beginning with 2010 reclamation activities, Colowyo will institute a topsoil depth verification program to document ecologically significant variations in topsoil where applicable (i.e. grazing land areas) and confirm more uniform topsoil reapplications (i.e. sagebrush steppe areas). It will consist of recording topsoil depths on five acre centers overlaid on each reclamation unit, similar to re-graded overburden suitability monitoring. Specific depth sampling point locations and results will be recorded and reported in the subsequent years Annual Reclamation Report within the Topsoil Volume Inventory section. The topsoil depth verification program is not intended nor should it be used as a topsoil volume verification method as the volume of topsoil will be planned, monitored and verified through load count, time card coding and engineering plan designation of placement of the material on a reclamation unit basis. Overall topsoil balance oversight is performed and reported annually in the Annual Reclamation Report. The overall goal of both the Division and Colowyo is to replace the entire resource in a manner that promotes the likelihood reclaimed areas will meet the success criteria for Phase III Bond Release after the required liability periods and thereby create reclaimed lands that reflect the desired post-mine land use (grazingland and sagebrush steppe).

Reapplied topsoil will be left in a rough condition to help control wind and water erosion prior to seeding. In the case of scraper-applied topsoil, dozers usually cross-rip along slope contours at intervals of about 50-75 feet to provide additional surface roughness. Also, contour furrows are almost always put in place when scrapers are utilized to minimize any sheet flow from the topsoil surface. Due to the specific equipment used for the Sagebrush Steppe areas, topsoil will be left in a more smooth condition to ensure proper seeding depth as described in the text. Any topsoil put into final position with a dozer will by practice be in a state of rough condition. Previous roughening efforts at Colowyo have been extreme, leading to difficulties in placing seed at biologically viable depths. The addition of more contour furrows will reduce sheet flow and moderating the roughness will allow a greater percentage of seed to germinate and provide ground cover that will also alleviate rilling and sediment control issues. As Coloywo transitions into areas of steeper slopes, density of cross ripping will be tightened to increase surface roughness and more contour furrows will be used to break up the slopes and minimize sheet flow conditions and reduce any concentration of flow from rain/snowmelt events. Seedbed preparation, other surface manipulation practices and seeding will be completed primarily during the fall months. Contour furrows, approximately 4-6 inches deep at the deepest point and 20-25 inches wide, which have been used on slope areas very successfully during the past several years, will be used to reduce erosion potential, conserve moisture, and maintain site stability until vegetation is sufficiently established. The size of the furrows may be increased if necessary to control erosion, and the distance between the furrows will vary, but will be approximately 10 to 75 feet along the slope. Small rock check dams may also be used where appropriate to aid in control of erosion both prior to seeding and if necessary, after an area has been seeded.

Given recent changes to Federal legislation (30 C.F.R. §816.22(d)(1)(i)) as published in the Federal Register (August 30, 2006, - pages 51683 - 51706), mine operators are now allowed to use "non-uniform redistribution of topsoil in their reclamation plan to encourage plant diversity…." Furthermore, the Colorado Division of Wildlife has requested Colowyo replace topsoil in a non-uniform manner as indicated by their statement: (see complete CDOW letter in Section 4.15.8) "DWM Wangnild discussed the possibility of changing reclamation efforts in the new [South Taylor] permit area. Specific changes would ideally be focused on dramatically varying topsoil depths in an effort to mimic natural depths and thus provide more suitable environments for woody species establishment. One example of this would be to create some sites with extremely shallow topsoil designed at reducing grass stand establishment and their resulting competition with shrubs for water and soil nutrients. Another example would be to create other sites with extremely deep topsoil depths. These sites would ideally benefit woody species like aspen and chokecherry."

In this regard, and depending on site-specific opportunities, Colowyo will utilize the planned post-mine topography (PMT) to help identify candidate (and prime candidate) areas for targeting Sagebrush Steppe post-mining communities. Key to this analysis will be considerations for the risk of erosion and for long-term stability. One such "threshold" value to be used for this analysis will be a slope break at 10% gradient. Slopes greater than 10% will be considered too risky to make attempts at targeting shrub communities, largely due to snowpack runoff scenarios that can often lead to serious erosion and stability failures. For example, snowmelt runoff in the early 1980s caused widespread and severe down-cutting of the natural drainages to the immediate west of Colowyo. Unless proven otherwise by hydraulic and/or erosion modeling, slopes less than 10% will be identified as candidate locations for shrub community establishment. Another "threshold" value to be used in the PMT analysis is the size of units that may exhibit slopes 10% or flatter. Areas small in aerial extent (e.g., less than about 5 acres) will not be identified to receive shrub-conducive metrics. Only those areas that are larger will be identified. The exact size cutoff will be at the discretion of the reclamation coordinator, however, a practical limitation must be defined given the complications realized by the change in revegetation targeting measures.

Where Sagebrush Steppe revegetation will be targeted, Colowyo would apply shallow lifts of topsoil (< 6 inches, ideally 4 inches). Where ideal spoil conditions are encountered, special effort will be made to place very minimal topsoil layers (nearly zero). The size of these areas must be small in order to ensure the potential erosion potential created by this activity does not negatively impact areas down slope. It is imperative for the Division to grant a substantial amount of latitude to Colowyo in the first several years of the implementation of the new reclamation plan as this will be a learning process for all parties involved. The Division will be informed of any instances of "nearly zero" topsoil laydown areas prior to or during topsoil laydown activities to ensure that the Division has the opportunity to verify Colowyo is adequately managing erosive potential. In most cases, due to the general rockiness of Colowyo's spoil, a layer of topsoil is desirable in order to limit damage to the preferred seeding equipment that will be utilized wherever possible in these areas, as proper seed depth placement is a major factor when establishing shrubs. To help maintain topsoil replacement balances, thicker lifts of topsoil (> 6 inches, occasionally up to 3-4 feet) can be placed along the groin of opposing slopes (drainage-ways). On long slopes steeper than 10%, topsoil distribution using pushdown techniques may be altered to facilitate thin layers near the upper shoulders of the slope, with thicker layers near the bottoms. In this manner, the lower elevation areas that tend to catch more snow will receive and store greater quantities of moisture with the hope that some of the mountain shrub seed within the seed mix will be presented with enhanced opportunities for growth and development, especially taxa such as snowberry. The shoulders of the slope, where soil thickness has been reduced will present greater opportunity for sagebrush to develop given reduced competition from cool-season grasses. In order to facilitate proper accounting of the topsoil resource, topsoil placement on specific areas will be tracked by load counts of the equipment involved. In cases where only Sagebrush Steppe acres are reclaimed in one season, replacement volumes may be less than the currently approved 8-inch average (in the original permit area, approximately 20 inches in the South Taylor area). This does not cause undue harm on the resource as the "left over" material will be utilized in the development of deeper soil areas elsewhere in the reclamation progression. All activities will be accurately and fully described within the confines of the Annual Reclamation Reports that include topsoil balance tracking.

Another directive with regard to topsoil distribution (at the discretion of the field supervisor) will be instruction to equipment operators to NOT engineer the final surface, but to the contrary leave it in a very roughened state, where there is the opportunity to diversify the potential plant communities within individual reclamation blocks and further reduce erosion potential. The primary directives in this regard will be to not leave preferential pathways for erosion and to avoid development of surface features that will overly compromise proper seed placement by seeding equipment (e.g., steep and narrow ridges). Sagebrush steppe areas will by necessity be predominately smooth prior to seeding in order to accommodate the special needs of the preferred seeding equipment to be utilized on those sites.

Another topsoil distribution technique that may be used in areas targeting Sagebrush Steppe would be the development of low berms using emplaced topsoil with the aid of equipment such as a road grader (see Figure 2.05-7). For ease of discussion, such berms could be termed "soil fences". These berms would act as natural snowfences trapping wind blown snow to aid sagebrush emergence and development. In this circumstance, a designed amount of topsoil (e.g.

9 inches) would be redistributed over a target area, however, berms would be developed utilizing only the topsoil resource. Where upper layers of topsoil have been pushed aside, a depth of remaining topsoil may be in the 2-4 inch range that should then help to encourage sagebrush emergence while discouraging vigorous grass growth. Where topsoil is bermed, a peak depth up to 30 inches may result. In these thicker topsoil areas, other taxa within the seed mix (or alternate mix) should provide additional competitive advantage. It is critical that berms be constructed on the contour to preclude development of preferential erosion pathways. It is also necessary that berms only be constructed where they will be approximately perpendicular to the prevailing winds, otherwise there is little benefit to be gained. Furthermore, berms would have to exhibit low and rounded shoulders to allow seeding equipment to operate properly. Implementation of techniques such as this must necessarily occur as a result of site-specific opportunity (as opposed to plan) given a variety of factors, not the least of which is availability of equipment and personnel.

As indicated on Figure 2.05-7, the dimensions (in cross-section) would need to be based on the width of seeding equipment to facilitate proper seeding operations, although the widths indicated may be changed in the field, especially given aspect differences. In this regard, sagebrush conducive seed mixes would be applied to the shallow soil areas as well as the uphill-facing side of the berm (west-facing slopes). This is the area that will receive maximum benefit from entrapped snow. The downhill-facing side of the berm would ideally receive the grassland conducive mix owing to the steeper slope (4:1). For easterly aspects, the grassland conducive mix would still need to be applied to the downhill 4:1 slope. As this technique is developed and "proven", modifications to seed mix placement can and should be made as necessary.
This additional level of complexity should not be problematic for maintaining an overall topsoil balance. It will simply add an additional layer of "bookkeeping" (Section 12 of the Annual Report) beyond that which has already occurred at Colowyo over the past three decades.

Revegetation Plan

Following the retopsoiling of an area, any necessary fertilization, surface preparation, berm development, construction of contour furrows, and seeding of the reclamation will take place.
The reclamation seed mixture for areas targeting grassland (grazingland land use and erosion control), as shown in Table 2.05-7, Reclamation Seed Mixture, contains sufficient diversity for ecological stability. The seed mixture contains a variety of grasses, forbs and shrub species well adapted to the soil and moisture conditions found at Colowyo. The diverse seed mixture is capable of self-selection for each reclaimed micro-habitat encountered in the reclaimed areas. The diverse seed mixture is required to ensure quick erosion control for the first few years of reclamation as well as obtaining the desired post-mining vegetative community with the same seasonal variety and lifeform of the pre-mined area.

The species and seeding rates indicated on this "grassland" mix resulted from in-depth analyses of past mixes and the resulting emergence and dominance within revegetated areas. A total of eleven different measurement events on Colowyo reclamation coupled with a performance evaluation for each taxon in the 2002 mix resulted in development of the mix indicated on Table 2.05-7 as well as Table 2.05-9. Examples of changes resulting from this analysis include: elimination of streambank wheatgrass (less palatable and redundant with thickspike), elimination of big bluegrass from the grassland mix for lack of performance, elimination of Sainfoin from both mixes for lack of performance, and substantial increases in the amount of sagebrush seed in both grassland and especially sagebrush steppe targeted mixes. These changes, including the planted amounts, have resulted in an increase in the number of seeds per square foot, from 29.2 / ft^2 to 75.1 / ft^2. Much of the increase is due to the substantial increase of sagebrush seed from 0.02 pounds PLS/acre to 0.5 pounds PLS/acre. Although inclusion of sagebrush seed is contrary to the intended vegetation community that targets the grazingland land use, this change has been adopted to increase the potential for development of shrub patches within the grassland community as well as to add structural diversity to the community and overall reclaimed area. If too much sage results from this mix for the intended land use, the amount of sagebrush seed can be reduced. If excess shrub numbers result from early revegetation efforts, then managerial techniques are readily available to reduce sage populations once the land surface has been transferred back to the landowner if Colowyo does not choose to reclassify the area as sagebrush steppe and apply for bond release under those criteria.

Table 2.05-8, List of Contingency Substitutions for Table 2.05-7 and Table 2.05-9, provides the approved list of contingency substitutions for the seed mixes should certain taxa be unavailable or unwarranted in any given year.

The reclamation seed mixture for areas targeting sagebrush steppe (wildlife habitat land use – sage grouse brood rearing habitat), as shown in Table 2.05-9, Reclamation Seed Mixture, also contains sufficient diversity for ecological stability. This mixture contains a variety of grasses, forbs and shrub species well adapted to the soil and moisture conditions found at Colowyo and should provide both the structural diversity and life form diversity necessary for habitat requisites of young sage grouse. The seed mixture is capable of self-selection for each reclaimed micro-habitat encountered in the reclaimed areas and contains sufficient sagebrush seed to hopefully encourage at least some emergence each year and substantial emergence occasionally.

There is potential, that too much sagebrush seed (115 seeds / ft^2) has been incorporated into this mix, and given recent experience with new planting techniques designed for use at Colowyo in and after 2008, the amount of seed may need to be adjusted at some future point[*]. However, present knowledge within the industry dictates that a significant amount of sagebrush seed is necessary to consistently obtain desired emergence. Present knowledge also dictates that special care must be taken to plant sagebrush seed at precisely the correct depth (~1/16[th] of an inch) and at precisely the correct time of year (immediately prior to the first major snowfall event of the Fall). The greater the attention given to such details, the greater the potential for successful emergence.

As with the reclamation seed mixture for grassland areas, the species and seeding rates indicated on this sagebrush steppe mix resulted from in-depth analyses of past mixes and the resulting emergence and dominance within revegetated areas. Furthermore, it is anticipated that the reduced competition from grasses, especially sod-formers like thickspike wheatgrass, will result in elevated diversity and better performance from certain poor producers such as big

[*] By example, as of 2007 the CSU shrub test plots exhibited an average sagebrush population of 3,500 plants per acre. This population resulted from an initial 0.25 pounds PLS of seed in the mix, following an excellent recruitment year.

bluegrass, Rocky Mountain Fescue, Louisiana sagewort, bitterbrush, and Wood's rose. If performance of any of these taxa remains poor after additional attempts, they would be candidates for removal from the mix.

Because the amount of grasses (and all sod-formers) has been substantially reduced for this sagebrush steppe mix, it is possible that on occasion, grass emergence may not be satisfactory for erosion control or life form diversity. In such circumstances a supplemental "inter-seeding" with the grassland mix may be necessary to "bolster" the grass and forb component of the community. This activity is allowed under Rule 4.15.7 (5)(g). Such an inter-seeding would only occur if adequate sagebrush or other shrub seedlings have emerged from the initial seeding, otherwise a "reseeding" or "augmented seeding" would be mandated. Furthermore, such an inter-seeding must occur within the first four years from the date of the initial seeding to avoid circumstances that would "reset the bond release clock". If "inter-seeding" is necessary on any units of land, CDRMS will be apprised in the Annual Reclamation Report.

The high rate of seeds per square foot in the sagebrush steppe mix is simply a result of the small seed size for several taxa in the mixture (e.g., sagebrush at 2,500,000 seeds / pound). The individual species have been selected for their habitat forming characteristics for sage grouse during their brooding period. None of the individual seeding rates are excessive given the current state of knowledge, nor is the seeding rate per acre excessive for combination drill / broadcast seeding. However, this mix has not been designed to ensure quick erosion control for immediate stabilization of the topsoil and therefore, should not be used on slopes that exceed 10%. Furthermore, it may need to be planted intermittently (banding) with the grassland mix on long, low-gradient slopes. For additional information regarding this planting technique, see the "Planting and Seeding Methods" section below.

The introduced taxon that is included in the seed mixtures above, (Cicer milkvetch), has been retained in the mix to provide forage for both wildlife (elk and sage grouse) and livestock. Furthermore, Cicer milkvetch is an excellent species for providing necessary habitat requisites for a variety of insects that in turn are especially important to sage grouse broods. It is a well-documented observation that insects comprise a very significant portion of young sage grouse diets.

Similarly, the introduced species, small burnett, has been retained in the contingency species list (Table 2.05.8) owing to its well documented value to wildlife.

Data on reclaimed areas at Colowyo, has indicated that orchard grass is an important grass species for controlling erosion and providing cover the first growing season, while decreasing subsequent growing seasons. Orchard grass comprised 0.13 plants per square foot the first growing season, while decreasing to less than 0.02 plants per square foot the second growing season. This indicates the effectiveness of orchard grass to provide erosion control early on revegetated areas, while not sustaining this vigor in later years due to increased competition and crowding by other species as well as targeted selection by elk (i.e. it has been repeatedly observed in Colowyo reclamation, that orchard grass plants have been selectively consumed by resident elk, and therefore, can be considered highly desirable forage).

Also, data from Exhibit 10 indicates that Kentucky bluegrass is the most important grass species contributing to the pre-mine vegetative diversity.

Given the aforementioned, it must be accepted that there is a place for certain introduced species in Colowyo reclamation. In 2008 and thereafter, occasional use of introduced species may occur, but will be limited (as indicated in the seed mixes) to specific circumstances. The only circumstances where limited use of introduced species will not be followed are instances where a unit of land is designed to target a post-mine land use of "pastureland" or a unique area is highly susceptible to erosion. Use of the more aggressive taxa: smooth brome, intermediate wheatgrass, and pubescent wheatgrass will be avoided, with the possible exception of "pastureland" development should such a land use be targeted at some future point of time. Prior to such land use designation or use of aggressive taxa to combat areas that are highly susceptible to erosion, an MR or TR (as appropriate) will be obtained from CDRMS to address such circumstances.

For the areas to be disturbed by mining, a timetable for reclamation has been established in order to allow for proper scheduling of reclamation activities. The acres to be reclaimed are shown in Section 2.03 on Table I, Affected Areas for Mining and Reclamation. The revegetation will be conducted during the first normal planting season following the application of topsoil and preparation of the site for seeding. The most favorable times for seeding in this area are in the early spring and late fall. Spring seeding is usually severely limited by high soil moisture conditions, which prohibit the use of seeding and seedbed preparation equipment at a time when conditions are best for germination and seedling establishment. For this reason seeding will be done during late fall months immediately prior to the average occurrence of the first significant snowfall event when the conditions for seeding are optimal. A modest amount of broadcast seeding may occur at other times including early spring, as detailed under <u>Planting and Seeding Methods</u> in this Section, but typically only for small "mop-up" circumstances.

With regard to road embankments, several methods have been used to stabilize the various cut and fill slopes. Where possible, road cut slopes were reduced from 1:1 to 3h:lv, retopsoiled, seeded, and mulched. Several other cut and fill slopes were left in a roughened condition during construction, and then topsoiled, mulched and seeded after construction. The seed mixture used for road cuts is the same as the mixture used for exploration sites as described in Section 2.02.

Upon the completion of all coal mining and reclamation operations by Colowyo, the office, shop, coal crushing facilities and other related surface facilities will be removed and the sites reclaimed according to the grading, topsoil and revegetation procedures set forth in this plan, providing there are no continuing beneficial uses for these structures.

Reclaimed areas will be appropriately fenced, if necessary, to manage grazing or browsing by livestock or wildlife. With regard to shrub establishment areas, the design is to provide sufficient seed for the development of more than adequate populations. If it is determined that marginal populations evolve and warrant protection, or excessive damage (severe hedging) to those populations is noted, those areas of sufficient size (e.g., 10 acres and larger) or sufficiently proximal to each other, may be fenced with elk-proof fencing at the discretion of Colowyo's reclamation coordinator. This practice would occur to ensure that reclamation would meet the established success criteria.

Planting and Seeding Methods

Planting and seeding methods will vary depending on degree of slopes, reapplied topsoil depth, new techniques, targeted community, etc.; however, the same planting sequence will be used in most cases. Seeding will occur during the Fall, immediately prior to the average first permanent snowfall event (typically mid to late October). If seeding cannot be completed prior to seasonally permanent snowfall, "mop-up" broadcast seeding may occur in the Spring as soon as ground conditions allow.

Following seedbed preparation, grassland targeted areas will be drill seeded with a heavy duty rangeland drill with depth bands using the perennial mixture as shown on Table 2.05-7, Reclamation Seed Mixture - Grassland. At times, broadcast seeding may be required on steeper areas, wet areas, very rocky areas, or simply on areas that were missed by the drill seeding equipment. Broadcasting will be used in conjunction with the drill seeding equipment to broadcast a portion of this mix as indicated on Table 2.05-7. A very light "tine harrow" or similar equipment may be dragged behind to facilitate a light cover of soil (~1/16 inch) over the broadcast seed. In this manner, the small seed for species such as fescue, yarrow, and sagebrush will be placed in a more optimal manner for emergence. This procedure (where the broadcaster is mounted on the seed drill) will facilitate a "one-pass" seeding procedure.

Following seedbed preparation, sagebrush steppe targeted areas will be seeded with one of three scenarios using the perennial mixture as shown on Table 2.05-9, Reclamation Seed Mixture – Sagebrush Steppe. The first scenario would be identical to grassland targeted areas whereby a heavy duty rangeland drill with depth bands would be used for taxa to be drill seeded along with a mounted broadcaster and light tine harrow (for those taxa indicated for broadcast seeding). This process would facilitate a "one-pass" seeding procedure. The second scenario would be separation of the drill seeding and broadcast equipment that would require a "two-pass" seeding procedure.

The third scenario (preferred) would involve use of equipment such as a "Trillion" cultipacker type broadcast seeder (or dribbler) to plant the entire mix indicated on Table 2.05-9 in a single pass. The trillion seeder has been developed specifically for "precision seed placement" by "combining the Truax seed box design with Brillion cultipacker rollers". Use of this equipment means obtaining the seed mix with the seed blended in three separate categories for use in the three separate seed hoppers: 1) small flowable seeds, 2) fluffy seeds, and 3) flowable large seed. (Filler material will also need to be added to these different hopper mixes, as appropriate, to facilitate the correct metering.) The trillion seeder firms the seedbed with the front row of cultipacker wheels, dribbles the seed immediately following, and then "imprints" the seed to the correct depth with the rear set of cultipacker wheels. Where the ground is uneven due to soil clods, rocks, or woody debris, proper seeding will require slower travel speeds. If the seedbed is too uneven or "cloddy", it will need to be broken and modestly smoothed by discing, harrowing, or chiseling to the point where equipment such as the trillion will work effectively.

Otherwise, most of the seed will not be imprinted to the proper depth and the risk of a seeding failure would be substantially elevated.

Research into the use of these techniques, especially with "brillion" style seeders in Wyoming and Idaho has indicated substantially elevated probabilities for success of sagebrush establishment at, or greater than, the desired densities. Other procedural recommendations based on recent successes in Wyoming and Idaho include: 1) proper seedbed preparation [standard agronomic practices]; 2) placement of sagebrush seed at a very shallow depth (≤5mm); 3) planting substantially elevated quantities of seed in comparison to past conventions [at least 80 - 100 seeds/ft^2 has been recommended by Agricultural Research Service studies in Wyoming]; 4) planting seeds into a firm seedbed with only a light covering of soil; 5) planting with direct-haul topsoil (as opposed to stockpiled) whenever possible; 6) planting into soils with textures of silty-loam to sandy-loam where possible; 7) use of few-flowered Mountain big sagebrush (*Artemisia tridentata* var. *pauciflora*) seed in the Colowyo environs; 8) use of sagebrush seed collected from as close to the Axial Basin circumstances as possible; 9) planting mixes that exhibit significantly reduced quantities of grass seed; 10) supplement with additional grass seed (if necessary) two to three years after sagebrush seedlings have emerged; and 11) placement of grass, forb, and shrub seed in differing rows to reduce interspecific competition when practical.
As previously indicated, sagebrush steppe revegetation will only be attempted on slopes exhibiting gradients of 10% or flatter. However, where large expanses of area suitable for this targeted community exist, there also exists potential for elevated erosion because of the length of slopes involved, and the dearth of expected grasses in the short-term. In these circumstances and at the discretion of the reclamation coordinator, the technique of "banding" may be implemented. Banding is defined as alternating "bands" of sagebrush steppe-targeted community with grassland-targeted community. Alternating bands of these two communities would occur along the contour so that erosional pathways that might begin in sagebrush steppe bands would then be intercepted by grassland bands down-gradient. Band width would be dependent on seeder equipment width and a defined number of passes to maintain field practicalities. For example, bands would need to be an even number of passes to facilitate travel in one direction, and then back. In such a manner, seeding equipment could be hooked and unhooked at one end of a reclamation unit without excessive travel. Similarly, field practicalities may dictate that 2, 4, or 6 passes are warranted with given seeding equipment before switching because of complications of attachment or other factors. If seeding equipment exhibits an 8-foot width, then alternating bands would be approximately 16, 32, or 48 feet wide for the example 2, 4, or 6 pass scenario. None of these widths, or even greater widths, would be problematic from an ecological perspective. In addition, such banding would maximize "edge effect" for sage grouse populations.

The aforementioned sagebrush steppe limitation to 10% or flatter slopes may be exceeded (up to 15% slope) at the discretion of the reclamation coordinator for given opportunities that may be presented. However, in any such circumstances where the 10% slope limitation is exceeded, the "banding" technique will necessarily become a standard (mandatory) procedure to preclude excessive erosion if no other methods of erosion control are implemented.

Mulching Techniques

During the initial permit review process, Colowyo proposed that on slopes flatter than 4h:lv that rather than utilize a hay mulch, a stubble mulch or no mulch be used on reclaimed areas. The use of mulch on these relatively flat slopes was of no value towards reclamation at the Colowyo site.

The application of mulch had become a very expensive, time consuming process which, in fact, produced additional problems on the reclaimed areas, rather than solving an assumed erosion problem that can be solved by other methods.

The added flexibility of eliminating the use of any mulch greatly enhances the germination of seeds earlier in the spring given the moisture and soil temperature conditions found at the Colowyo site. Mulches tend to shade the soil, thus slowing the rise in soil temperature needed for germination of seeds. At Colowyo, soil moisture is not usually a limiting factor. Soil moisture is usually very high during the spring, due to precipitation during the winter and early spring months. The summer months are generally dry, often with little additional precipitation. By eliminating the use of mulch, the soil temperature is increased earlier in the spring, thus enabling the seeds to germinate earlier when soil moisture conditions are optimum. When the seeds germinate earlier, they are able to utilize soil moisture earlier in the growing season. This results in further root development by the plants, aiding survival through the dry summer months. Only south-facing slopes would benefit from the use of mulch under the moisture conditions at the Colowyo Mine.

Without the use of a mulch, erosion control has been maintained with surface manipulation methods such as contour furrows, drainage benches and permanent drainage` channels. The initial reclamation at Colowyo that began in 1978 is indisputable evidence that the methods used at Colowyo have proven highly successful in controlling erosion on slopes as steep as 3h:lv until vegetative cover has established. Where deemed necessary by the reclamation coordinator (e.g., sagebrush steppe targeted areas, south-facing slopes, etc.), techniques such as mulching, chisel plowing, or discing on the contour will be reinstated as necessary.

Irrigation

No irrigation is planned for areas to be seeded.

Pest and Disease Control

Noxious plants, as defined in Section 1.04, will be managed in accordance with the following section – "Weed Management Plan". If insects become a problem to the point where they endanger the successful establishment of the seeded vegetation on the reclaimed area, they will also be controlled using methods suggested by the Colorado State University Extension Service. All herbicides and pesticides utilized will be those that are approved by the appropriate state and federal governmental agencies responsible for the approval and distribution of such agents.

Weed Management Plan

A listing of Colorado's noxious weeds (A, B, and C lists) as well as an indication of Rio Blanco and Moffat Counties' listed taxa are indicated on Table 2.05-10 along with an indication of those taxa that have been observed on or near the Colowyo mine. As indicated on this table, there are no "A" list taxa known from the area. "A" list taxa must be eradicated. To the contrary, there are seven (7) "B" list (must be managed) taxa known from the environs of the Colowyo mine as well as three (3) "C" list (management may be required by local governments) species. Of these 10 species, common mullein and poison hemlock from the "C" list, and Russian olive from the "B" list are not overly problematic and will normally not require attention. In fact the Russian olive was purposefully planted in the reclamation. If "infestations" of common mullein or poison hemlock evolve, they will be treated in the same manner as the more problematic species.

The remaining seven species: hoary cress, musk thistle, Canada thistle, bull thistle, houndstongue, black henbane, and downy brome (cheatgrass) will be the primary focus of the program and will likely receive attention as appropriate at the Colowyo mine. Of these seven species, the first six will be specifically targeted for remediation while the seventh, cheatgrass, will be carefully monitored to determine if it becomes problematic in older reclamation[*]. If it becomes problematic, it will receive similar attention as the other six species. In addition, continued monitoring of reclamation will focus on identification of any new noxious weeds.
For the most part, noxious weeds observed on or near Colowyo reclamation do not achieve "infestation" levels. By infestation, Colowyo means: 1) relative cover contribution of one noxious weed species or a combination of noxious weed species exceeding three percent in a revegetated stand; or 2) a "patch" of any listed species in which the noxious weed component exceeds 25% relative cover and occupies an area larger than 100 square feet on any disturbed area. Rather, noxious weeds tend to occur as scattered individuals or small pockets of individuals. This distribution suggests that spot control will be the only effective procedure that can be utilized.

To manage these six noxious weed specie populations, Colowyo will either perform itself, or contract out, annual weed control activities. Weed control will typically involve herbicide application at the appropriate rates and during the appropriate life stages (as possible) to effect control. Spot applications will be preferred over "blanket" applications to prevent loss of desirable reclaimed taxa such as seeded forbs and shrubs, however, blanket application may be necessary if any infestation areas are observed.

All Colowyo environmental staff, state inspectors, consultants, or contractors will be requested to remain vigilant for pockets of noxious weeds in the reclamation. If larger concentrations are observed, they will be mapped, recorded with GPS, or other means of identification to facilitate control by weed spraying crews. Both the weed spraying crew and the revegetation monitoring crews will be especially important in this regard.

[*] Although it cannot be discerned with 100% certainty, it appears that cheatgrass patches and populations in Colowyo reclamation, tend to succumb to successional pressure exhibited by the adapted perennials. In this regard, it appears that cheatgrass populations drop off to low levels in mature reclamation.

In addition to revegetated areas, vigilance will be maintained for other locations conducive to noxious weed populations. Such areas include: riparian areas, topsoil piles, major traffic areas, road cuts and fill slopes, ditches, pond embankments, non-use areas, etc.

Weed control measures may include mowing, discing (conventional cultivation), burning, grazing, or applying an approved herbicide. Weedy annual species (such as pennycress) with a single season life cycle provide initial site stabilization and moisture conservation in newly seeded reclamation sites; as such they will not be specifically targeted for control. Historically, seedings on reclaimed sites have greatly out competed annual weed infestations within three or four growing seasons.

Specific control measures will be selected by evaluating the location, growth characteristics and vulnerability of each weed. Management efforts will begin after proper planning and evaluation are performed. Proper use of chemicals applied during weed control is ensured by oversight of weed spraying activities by individual(s) certified by the State of Colorado to handle and apply herbicides.

Colowyo reserves the right to change and modify the practices and materials it utilizes within the weed management program to achieve compliance with all applicable state and federal rules and regulations. Colowyo will evaluate each infestation on an individual basis in order to ensure proper methods, timing, materials and manpower are utilized for maximum effectiveness.

Measures for Determining Success of Revegetation

The success of revegetation will be determined as explained in subsection 4.15.

Soil Testing Plan

From conception to the mid-1990's, Colowyo tested for topsoil fertility. In order to assure that the reapplied topsoil will support the proposed post-mining land use of rangeland, a soil sampling program will be implemented. Soil samples were taken randomly over each retopsoiled area and were analyzed for nitrate-nitrogen, phosphorus, and potassium. Historical results indicated adequate nutrient value to support post-mining revegetation.

Colowyo has demonstrated through numerous years of monitoring that topsoil fertility is not a concern at the mine; this is mainly due to the nutrient rich soil that is commonly present throughout the region. As a result, Colowyo has suspended the soil testing program requirements, until such time as Colowyo determines that the soil fertility adversely affects the reclamation and/or the post-mining land use.

As needed other soil amendments will be added to the reclaimed areas to support reclamation efforts.

Acid-Forming and Toxic-Forming Materials

No significant acid-forming materials exist within the overburden soil or coal seams to be mined. Therefore, Colowyo will not undertake special handling procedures as described in Section 2:05.3. A detailed description of the chemical characteristics of soils and overburden materials is presented under Sections 2.04.6 and 2.04.9.

For a detailed description of the special handling of spoil material and sampling programs, refer to the Production Methods and Equipment Segment of this section.

Flammable liquids, such as oil and fuel, will be protected from spilling into other areas by earthen, concrete or HDPE lined structures surrounding each storage facility. A spill containment control plan has been developed to protect against spills.

All major equipment on the mine site will be equipped with portable fire extinguishers or automatic fire suppression systems. The water truck used for dust suppression at the mine site could also be used to control most fires.

Sealing of Exploration and Mine Holes

Exploration and mine holes which remain open for use as a water supply well or for use as a groundwater monitoring well will be completed with casing or piezometers at sufficient height above the land surface to prevent drainage of surface water or entrance of foreign material into the well, and will be fitted with caps to prevent the introduction of objects other than monitoring and sampling equipment. When the groundwater monitoring wells are no longer needed or required for any purpose, each well will be eliminated by plugging with concrete to the surface and removal of the associated surface structure.

Plugging procedures utilized for exploration drill holes that will not be mined through during the current Permit term are as follows:

1. Drill holes drilled deeper than the stripping limit (450-500 feet) will be plugged by pumping cement or heavy solids bentonite Plug Gel or chips through the drill stem from the bottom up to within 3 feet of the ground surface.
2. Drill holes shallower than stripping limits (450-500 feet) may be plugged with the ready-mix concrete method instead the method in #1 to within 3 feet of the ground surface.
3. Drill holes with no water or coal zones may be plugged by backfilling with cuttings, and placing a plug ten feet below the ground surface to support a cement plug or bentonite chips to within 3 feet of the ground surface.

For safety considerations, exploration drill holes that will eventually be mined through during the present Permit term need only be covered with wood, plastic or other such material or otherwise bermed to prevent access.

Those holes completed in aquifers will be sealed entirely with cement or other suitable sealant to within 3 feet of the ground surface.

Where possible, the sealed holes will be marked. At times reclamation operations will cover up the sealed drill holes and marking of holes will not be possible.

Within 60 days of the abandonment of a drill hole, approved drilling program or when requested by the Division, the following information will be submitted:
a) Location of drill hole as plotted accurately on a topographic map.
b) Depth of drill hole.
c) Surface elevation of drill hole.
d) Intervals where water was encountered during drilling activities.
e) Diameter of drill hole
f) Type of amount of cement or other sealant used.
g) Name of drilling contractor and license number of rig.
h) How the hole was worked.

Exploration taking place inside and outside of the permit area will be handled through the Notice of Intent (NOI) procedures. See the appropriate NOI for details for each program.
With the approval of Technical revision 50, all exploration holes located within the permit boundary are transferred to NOI X-95-109-5 and are managed under Coal Exploration procedures.

Wells drilled as an integral part of water monitoring pland identified in the PAP (Permit C-81-019) and water supply wells (for mining purposes) are managed under this Permit C-81-019.

<u>Water and Air Quality Control Techniques</u>

Steps to be taken to comply with the Clean Water Act and other applicable water quality laws and regulations and health and safety standards include a comprehensive drainage and sediment control plan described in Section 2.05.3 and Sections 4.05.1 through 4.05.18. With respect to compliance with the Clean Water Act, Colowyo has a discharge permit from the Colorado State Department of Health under the National Pollutant and Discharge Elimination System (NPDES). Compliance with this permit will serve to effect compliance with the Clean Water Act and the Colorado Water Quality Control Act. A copy of this submittal is presented in Exhibit 7, Hydrology Information.

Colowyo, likewise, operates under several emission permits from the Colorado Department of Health, Air Pollution Control Division. Fugitive dust control measures will be employed as an integral part of the mining and reclamation operations.

Colowyo conducts air quality monitoring at the site in accordance with the requirements of emission permits approved by the Colorado Air Pollution Control Division. A copy of all applicable emission permits has been included in Exhibit 8 of the application.

2.05.4 (2)(a) Reclamation Timetable

The sequence for reclamation following the mining process is shown on Map 29 A. Final reclamation of the South Taylor pit will be delayed, due to the shape, size and depth of the pit;

which will result in leaving the majority of the spoil backfilling process until final pit closure. The majority of the spoil will be stacked in the initial boxcut area and associated valley fill areas, allowing adequate space to perform mining operations in a geotechnically safe environment. Colowyo is attempting to reduce the amount of mining related disturbance that is associated with the mining of the South Taylor pit; this also contributes to the situation of stacking spoil material and delaying reclamation, which minimizes the areas impacted by temporary spoil pile placement and concentrates the active mining activities to the existing disturbance boundary for South Taylor. Although the final reclamation of the South Taylor will be delayed due to the mining operations in the pit, Colowyo is committed to reclamation in accordance with Rule 4.13 and will perform reclamation activities as contemporaneously as practicable with the South Taylor mining operations. With the limitation of areas available for reclamation prior to final pit backfill, Colowyo is proposing to reclaim the out slopes of both valley fills as shown on Map 29 A, prior to final pit closure. It is anticipated that the South Taylor pit will reach a steady state operation in 2012; where as all spoil material produced in the advancing cut will be back-casted into previously mined areas. In general, it is anticipated that the vast majority of reclamation activities in the South Taylor pit area will begin in the lower elevation areas and progress upslope to the highest elevation areas. This is a matter of practical necessity due to the operational constraints encountered in the area which were also reflected in the hydrological modeling found in Exhibit 7, Item 20. Major departures from this premise will result in the need to revisit the adequacy of the sediment control structures designed and submitted as part of this permit revision.

2.05.4 (2)(b) Reclamation Costs

The estimate of the cost of reclamation of the operations required to be covered by the performance bond is found under Rule 3.

2.05.4 (2)(c) Backfilling Plan

As the mining progresses to the southeast, overburden material from each successive cut will be backfilled into the previously mined out area and the additional spoil will continue to buildup in previously mined areas, thus creating a large in-pit temporary spoil pile. This cycle will be repeated for the entire mining area. Due to shape, size and depth of the South Taylor pit, results in leaving the majority of the spoil backfilling process until final pit closure. As a result, Colowyo has officially requested a variance for a delay in contemporaneous reclamation based on Rule 4.14.1(1)(d) which states that "Rough backfilling and grading shall be completed within 180 days following coal removal and shall not be more than four spoil ridges behind the pit being worked..". The mining techniques utilizing dragline and truck/shovel operation are shown in detail on Mining Range Diagram (Map 24A), and show the approximate distance between topsoil removal and replacement. Premining topography is presented on Map 18A and the postmining topography is shown on Map 19B. Map 20B provides cross-sections of the premining and postmining topography. Map 28B presents the topsoil handling movements and the timing of stripping activities. Map 29A shows the spoil grading sequence timing of reclamation activities.

The backfilled mining areas will be graded to establish a stable post mine topography that blends into the undisturbed areas outside the mining limits (Map 19B). Colowyo will grade all final slopes so that overall grades do not exceed 33% (Map 20B). Additional information on the backfilling and regrading plan are discussed further in Volume 1, Section 2.05.4 and Section 4.14.

2.05.4 (2)(d) Topsoil Salvage

Prior to any mining-related disturbances, all available topsoil will be removed from the site to be disturbed as discussed in Section 2.05.3, and will be redistributed or stockpiled as necessary to satisfy the needs of the reclamation timetable.

Final grading before topsoil placement will be conducted in a manner that minimizes erosion and provides a surface for the topsoil that minimizes slippage. If spoil compaction is a problem, the spoil will be ripped with a dozer to minimize compaction, assure stability and minimize slippage after topsoil replacement. The average uniform topsoil replacement depth will be 19.8 inches as determined by the topsoil salvage calculations shown on Tables 2.04.9-6, 2.04.9-6A, and 2.04.9-7. Topsoil may be applied at depths that are lesser or greater than the specified depth in selected areas where plants, that may require a shallow or deep soil, will be established in conjunction with the proposed post-mining land use. Areas that require a variable topsoil depth replacement plan will be addressed through a Technical Revision to the permit after approval of PR-02. Topsoil will normally be reapplied by hauling, in trucks, from topsoil stockpiles or from areas where topsoil has been removed for mining advance, to the regraded spoil areas and then redistributed with dozers. Alternate methods may also include placing topsoil on slopes with a dragline followed by redistribution with dozer, or using a scraper to redistribute the topsoil. When necessary to ensure replacement to the required depths, replacement depths will be staked on the regraded spoil.

Reapplied topsoil will be left in a rough condition to control wind and water erosion prior to seeding. Seedbed preparation, other surface manipulation practices, and seeding will be completed primarily during the fall months. Contour furrows, approximately 4-12 inches deep at the deepest point and 20-36 inches wide, which have been used on slope areas very successfully during the past years, will be used on as needed to reduce erosion potential, conserve moisture, and maintain site stability until vegetation is sufficiently established. The size of the furrows may be increased if necessary to control erosion, and the distance between the furrows will vary, depending on each application. Small rock check dams may also be used where appropriate to aid in control of erosion both prior to seeding and if necessary, after an area has been seeded.

2.05.4 (2) (e)Reclamation Revegetation

Revegetation techniques described in Volume 1, Section 2.05.4 will be employed at the South Taylor mining area.

2.05.4(f-h) Disposal, Mine Openings, Water and Air Control

These topics are discussed in the original permit starting at page 2.05-57. There will be no substantive changes to the approaches already employed for these topics.

II. AIR POLLUTION CONTROL PLAN

Colowyo maintains fugitive dust control measures as an integral part of all mining and reclamation activities. Presently, Colowyo operates under numerous Emission Permits issued from the Colorado Department of Health, Air Pollution Control Division, as more particularly described in Section 2.03.10. Copies of all applicable emission permits issued by the Colorado Department of Health are contained in Exhibit 8, Air Quality Information. Colowyo conducts air quality monitoring at the site in accordance with the requirements of the emission permits. The principal fugitive dust control practices employed by Colowyo are as follows:

Roads

Colowyo employs a dust suppression program for in pit roads and other unpaved roads which primarily involves periodic watering. Mine water trucks run periodically as needed over the roads wetting down any dusty conditions. During the dryer months of the year, the water trucks will wet down the roads which are being utilized a minimum of two or three times per shift. If determined to be necessary as an addition to periodic watering, a chemical dust suppression agent may be used during the dry months on the primary in pit roads. To this date, however, chemical stabilization of the unpaved in pit roads has not been successful for more than a short period of time due to changing weather conditions and the use of heavy haulage trucks.

Colowyo has surfaced “in-pit” roads with gravel or crushed rock; however, no roads in the pit area will be paved with asphalt. Asphalt could not sustain the enormous weights of the haulage equipment currently in use. Likewise, crawler equipment would rip the asphalt surface causing an extremely hazardous condition for all equipment and personnel. All roads in the mining operation will be constantly maintained by a motor grader, scraper, or rubber tired dozer to remove any coal, rock, or any other debris. Smooth and clean road surfaces are essential for not only minimizing dust, but also for allowing efficient, safe and economic use of haulage equipment.

The haul roads have been paved with asphalt to provide for emission control. The paved roads include approximately five miles of road from State Highway 13/789 to the main office building, the road from the main office building to the Gossard coal loadout, and the road from the shop facility to the Gossard coal loadout.

A strict speed control will be implemented for all roads to control dust and to provide for safe operation of the equipment.

Most haul road embankment slopes and adjacent areas have been mechanically stabilized and seeded with a mixture shown in Table 7, Reclamation Seed Mixture. Mechanical stabilization has consisted of furrowing, chiseling, "cat tracking" and mulch, depending on accessibility to the slopes.

No travel of unauthorized vehicles will be allowed on anything other than established roads. All overburden haulage equipment will be restricted only to appropriate roads.

Colowyo does not plan to cover any of the haul trucks because the roundtrip between the coal crushing facility and the active mining area will be relatively short, and the loaded trucks will be moving slowly. Also, care will be taken by the front-end loader or shovel operators not to overfill any of the haul trucks so as to cause excessive fugitive dust.

Coal Crushing Facility

Coal will be hauled from the various mining areas in haulage trucks to the primary crusher facility as shown on the Existing Structures - South Map (Map 22). Following primary crushing, the coal is hauled to the Gossard Loadout facility, as shown on the Existing Structures - North Map (Map 21).

The coal crushing and conveying operations at the primary crusher and the Gossard Loadout have been equipped with a water spraying system at all coal transfer points. A four-sided enclosure-bas-been installed on the truck dump at the primary crusher to prevent excessive dust emissions. The secondary crusher at the Gossard Loadout has a bag house to control coal dust emissions. A stacking tube with metal doors is also used to minimize coal dust emissions at the 100,000 ton crushed coal stockpile. The air quality control measures at the coal crushing handling and loadout facilities have been approved by the Colorado Department of Health, Air Pollution Control Division.

Colowyo maintains several areas for coal storage near the shop facilities and also near the Gossard Loadout. Inactive storage piles have been sloped and compacted to prevent wind erosion and spontaneous combustion. If coal dust becomes troublesome in the active coal storage piles, a mobile water truck with a high pressure pump and nozzle is available for dust suppression.

No thermal dryers are used in the coal crushing and handling facilities.

Disturbance

Colowyo, in as much as practical, minimizes the area of land disturbed at any one time. Topsoil is removed only to the extent necessary to accommodate the mining operations. Through the mine plan, the rehandling of both topsoil and overburden is kept to a minimum. Reclamation of disturbed areas will commence as contemporaneously as possible.

As necessary, mobile water truck will be assigned to work in topsoil or overburden removal operations to keep any dusty conditions under control. Planting of special windbreak vegetation in the permit area is not planned.

Blasting

Sequential blasting is utilized as a standard practice to reduce the amount of unconfined particulate matter produced.

III. FISH AND WILDLIFE PLAN (TAKEN FROM VOLUME 1)

Prior to and during the early years of mining, Colowyo implemented wildlife management and range management programs to offset the potential impacts of mining on wildlife and to improve the rangeland in surrounding areas which had deteriorated after years of overgrazing. Other protection measures were also implemented to minimize any possible effects of the increased mining activity.

Also, during the early stages of pre-planning for the mining operation, Colowyo adopted a policy to return the land to a condition capable of supporting the diverse wildlife populations that the area currently supports. The assumption in the late 1970s was that shrub reestablishment would play a key role in wildlife habitat mitigation. These early efforts were unique in that revegetation with shrub species, especially native shrub species, had never been an integral part of pre-mine planning in the West. Virtually no information was available and very little was known about the growth requirements of native species. To reach these early objectives, Colowyo implemented revegetation and wildlife habitat use studies designed to determine the feasibility and techniques of revegetating disturbed areas with native shrub vegetation adapted to northwest Colorado. However, after decades of experience, it has become obvious that reestablishment of shrubs on the reclaimed area is not critical to encourage wildlife use such as by elk.

For example, in recent years it has been observed that elk herds of between 200 and 400 animals utilize the reclaimed grasslands of the mine as foraging habitat. These numbers increase to between 2000 and 4000 animals during the hunting season and then slowly drop off as the snow depths increase and the elk herds migrate to lower elevations. The animals return in the Spring for the early green-up. This occurs for at least three reasons: 1) elk are primarily grazers (grass consumers) by nature, 2) there is abundant, high quality grass on the reclaimed areas especially in comparison to surrounding country which exhibits very little if any grassland acreage and relatively low grass production in shrublands, and 3) elk have learned that harassments (such as hunting) are minimized on mining areas (refuge effect) which allows them to forage in relative peace. Likewise, mule deer populations have been observed on reclaimed grasslands at elevated densities (40-60 animals on a daily basis during the Spring, Summer, and Fall periods). Similarly, 15-20 pronghorn utilize the reclamation on a daily basis during the Spring and early Summer periods.

Following the winter, it has been observed in early spring that forage utilization on the reclamation often ranges between 70 and 90 percent, especially near water sources. In fact, utilization is often so elevated that both elk and mule deer turn to the few unfenced shrubs that have been established about the reclaimed area and cause extensive hedging damage. Over the years it has been observed that such hedging eventually leads to the death of most of these over-utilized shrubs.

Because of the dependence on these areas, and the shrub populations, efforts by Colowyo (as indicated in the previous portions of Section 2.05) have continued to improve reclamation techniques. As discussed in this revision, new and significant strides are being taken to re-establish sagebrush steppe communities as well as grassland areas. Many of these new measures will benefit not only the large game animal segment of the wildlife community, but also other components such as sage grouse and sharp-tailed grouse populations that are dependent on sagebrush and other woody species for forage and cover.

Impacts of Mining Operations on Wildlife Resources Within the Mine Plan Area

Several short term negative impacts to wildlife are to be expected in the permit area. Removal of vegetation communities and habitats will be the most direct impact, resulting in a reduction of forage and cover. Non-mobile species will be destroyed in localized areas as vegetation and topsoil are removed. Mobile species will be temporarily displaced until mined areas are reclaimed. As the mine progresses, some changes in topography will occur through the removing of vegetation, rock outcroppings, draws, etc. which form natural shelters.

Disturbance of soils will affect soil profiles, micro-climate, and other soil properties.

The backfilling and grading as required in Section 4.14.2 will assure that topographic features and drainage patterns will be returned to approximate original contour.

Wildlife species inhabiting the permit area that have the most potential for being affected include deer, elk, sage grouse, and raptors. However, experience to date has shown that all of these species have adapted to the presence of the Colowyo operation, resulting in minimal direct impact. Most of the mitigation measures, protection measures, and habitat improvement techniques are directed toward this wildlife group.

Range and Wildlife Management Programs

Data collected during pre-mine studies during 1974 - 1976 indicated overuse by cattle, deer, and elk. A majority of the browse species (serviceberry, oak, snowberry, bitterbrush, sage, chokecherry) showed overutilization to varying degrees. (It has been evident both past and present that many of the shrubs are in a decadent condition.)

The results of past poor range management practices and heavy browse use have been a reduction in growth with less available forage. In addition, species such as oak and serviceberry have grown taller, with palatable growth being limited to a height which can be reached only by the largest animals.

As oak and serviceberry have grown taller, large windbreaks have been created. In the winter, these areas hold the snow, which becomes deep enough to limit all access by deer and elk. Thirty years of observations on the permit area have shown that winter use of the mountain shrub type by elk and deer is highly dependent on snow depth and severity of winter weather conditions. The use of serviceberry has been limited to shrubs near the edges of the stands where less snow buildup occurs. Depending on snow depth, elk and deer populations tend to concentrate on south facing hill slope areas where snow depth is minimal.

Colowyo began fencing the boundaries of the Federal lease during the fall of 1976. The fencing was completed during the summer of 1977. At this time all cattle were removed from the lease area. The fencing was completed as part of an overall grazing management program to improve the rangeland after several years of over-grazing. In 1991, Colowyo constructed a similar fence to provide a boundary for the areas added to the Permit and to exclude grazing in this area.

Disturbed Areas

Disturbed acreage has been kept to a minimum in the permit area by proper planning for the location of mine support facilities, haul roads, and pit advance. The mining methods, as discussed in Section 2.05.3, allow for a minimum amount of disturbance on an annual basis (less than 100 acres per pit), when compared to strictly one or two seam mines with similar production levels which disturb several hundred acres annually per pit. Topsoil and vegetation are removed during the summer and fall months to allow for only enough disturbance to facilitate mining advance through June of the following year.

Habitat Improvement Program

Prior to start-up of mining, Colowyo initiated a big game habitat improvement program in January 1976. The purpose of this on-going program was to increase range carrying capacity by increasing available browse and increased access to herbaceous species. Another objective of the program was to provide increased forage on selected undisturbed areas on and adjacent to the mine site to draw wildlife away from newly reclaimed areas until the vegetation became established. A third benefit was to improve enough habitat prior to and during mining in order to offset the temporary loss of habitat from mining.

The technique for habitat improvement involved using a rubber tired or tracked dozer during the winter months, preferably when there was minimal snow cover and the ground was frozen, to shear off the dormant shrubs a few inches above ground level.

The shrubs tended to shear or break off easily when the ground was frozen leaving the root systems undisturbed. During the following spring, vigorous new growth from root sprouting occurred, and easy access was provided for deer and elk. This technique has had the additional effect of allowing grasses and forbs to establish stands that will compete with the shrubs, thus prolonging heights useable by wildlife. Approximately 30 acres of overmature decadent shrubs, i.e., serviceberry, oak, and chokecherry was “brushed” on an annual basis through 1986.

Although no specific data has been collected on these areas, general observations have shown that the areas are heavily utilized by both deer and elk. On all of the areas, any new shrub sprouting is kept down to a height of only a few inches. The one-acre plot that was cleared of vegetation and fenced in 1977 for testing by the Meeker Environmental Plant Center can be used as a good comparison of the differences between browsed and unbrowsed areas that have had similar treatments. Several of the unbrowsed shrubs that have grown up from root sprouting in the Plant Center plot have attained heights of up to four feet in just a few years. Over a five-year period, we feel the cumulative effects of improving 50-75 acres per year for deer and elk use has been increasingly successful in meeting the objectives of increasing available forage and drawing wildlife away from reclaimed areas.

This wildlife mitigation program is considered a success and was discontinued at permit renewal as reclaimed areas are now attracting a large population of local wildlife populations. Also, suitable areas within the permit for this mitigation had been increasingly difficult to find. Much of the habitat suitable for improvement had already received treatment.

Sagegrouse Mitigation

In a preliminary findings document dated December 11, 1981, the Division requested additional information on sagegrouse use of the Colowyo permit area and a description of habitat mitigation measures. Colowyo submitted the following response, dated May 25, 1982, which satisfied the remaining concerns of the Division.

Sagegrouse Mitigation

I. Ongoing Mitigation Offsetting Current Loss of Sagegrouse Habitat Due to Mining.

Prior to 1976 due to the prior landowners' grazing practices, the rangeland both within the permit area and surrounding areas was in an overgrazed condition.

After 1976 the following changes in the management of the land, then owned by Colowyo, took place which indirectly increased the sagegrouse nesting and brood rearing capacity of the overall area. This increased carrying capacity of the sagegrouse habitat provides the mitigation for any displaced sagegrouse population during mining.

I. From 1976 until 1979 all livestock grazing was stopped in order to allow the range to rest and to return to a more productive state. The immediate benefit to sagegrouse was the increased production of herbaceous vegetation which, along with insects, is an important component to the sagegrouse brood population diet. A secondary benefit was the end of any nest trampling and end of disturbance and heavy grazing around watering areas due to livestock grazing.

II. During 1976 a fence was constructed around the Federal coal lease which eliminated all further livestock grazing in this area. Since 1976 to the present, sagegrouse have continued to benefit as described as #1 above.

III. All other areas outside of the lease fence (approximately 6,000 acres) have been grazed since 1979 at 60% of carrying capacity. This rate would allow for an increased sagegrouse brood population over that which the area supported in an overgrazed condition.

4. Since 1976, numerous areas of thick, decadent stands of the mountain shrub vegetation within and adjacent to the lease area have been cleared of brush as part of the big game mitigation program. As a result of the brushing, the production of succulent herbaceous vegetation has increased, offering more forage for the sage grouse brood population.

The above changes in Management practices of the rangeland around the Colowyo mining area contribute to the increased capability of supporting any displaced sage grouse nesting and brooding population. No additional treatments to mitigate for a displaced sage grouse population are in effect, nor would other methods likely be as effective.

II. <u>Post-mining Mitigation for Sagegrouse</u>

As stated in the Permit Application, sage grouse use of the area to be mined is for nesting and brood rearing purposes.

According to information contained within the Bureau of Land Management Technical Note #330, "Habitat Requirements and Management Recommendations for Sage Grouse," the most important factor for nesting habitat in the sagebrush vegetation type is sagebrush. Within this vegetative community, the majority of sage grouse nests occur under sagebrush. It is assumed that within the mountain shrub vegetative community, sage grouse nest would be found under the mountain shrub components as well as sagebrush.

The most important factor for brooding habitat is the availability of the appropriate foods for the chicks. Also, during the later summer months of brood rearing, the availability of water becomes important.

Within the pre-mine vegetative community, the nesting cover component is assumed to be sagebrush as well as other elements of the mountain shrub community.

Within the post-mining vegetative community, seeded shrubs will supply the necessary requirements for nesting cover.

Within the literature no specific location of nests seem to be indicated other than a preference for less dense and shorter shrubs which seem to indicate a need for quick escape should the hen be flushed unexpectedly. The density and structures of the shrub component within the post-mine community should provide the diversity of cover and density suited to sagegrouse nesting.

Within the pre-mine vegetative community, insects and succulent vegetation provide the majority of the food for the developing chicks. As these food sources mature and dry, the grouse will move to areas still supporting succulent vegetation. These sites include springs, seeps, drainage bottoms and water impoundments. During the late summer and fall months, the important food plants dry up on the upland slopes and the grouse will tend to remain closer to available watering areas where some succulent vegetation is still available. Many of the grouse are then observed in the alfalfa and irrigated meadowlands on areas around the mining area.

Within the post-mine vegetative community, the food component for brood rearing will be provided by insects and succulent vegetation on reclaimed areas early in chick development. Later into the summer months, as food sources dry up on the upland slopes, food will be available near water impoundments and drainage bottoms being returned to the post-mining topography. The literature indicates no optimum distance between nesting sites and food sources. Evidently, the location of nesting sites are independent of food sources, rather, the nesting locations are based on available cover, and the grouse movements are tied to the availability of succulent vegetation.

For the most part, the mitigation measures indicated above had the desired impact of improving conditions for sage grouse on undisturbed areas under Colowyo control. To the contrary, original reclamation plan measures did not result in a sagebrush component consistent with the original projections in many areas of the mine, especially the old reclaimed units that were revegetated with "introduced" pasture grasses. Beginning in the late 1990s and as evident in revegetated units that have been seeded since then, the sagebrush component of reclamation has improved substantially, but is still not up to original expectations. Therefore, substantial changes to the reclamation plan have been introduced in this submittal to hopefully, make another quantum leap forward in the ability to establish sagebrush steppe communities. Many changes in techniques have been proffered including variable topsoil depths, significantly increased amounts of the appropriate sagebrush seed, proper planting techniques to encourage sagebrush, etc. Given success of these techniques elsewhere in the mining industry, the potential is strong that the original projections for sagebrush establishment at Colowyo will be realized from this point forward.

Additional Mitigation Measures

The pre-planning for a minimum amount of annual disturbance, the establishment of herbaceous species, the replacement of native shrub species, and habitat improvement techniques are the most important areas for minimizing impacts to wildlife, several other protection measures are in effect.
Electric power lines located in the permit area will be constructed in accordance with the requirements of Section 4.18 to minimize potential electrical hazards to large raptors.

Vehicle use within the permit area is limited to the active mining area and the various support facilities. Off-road vehicle use is kept to a minimum and is usually only authorized for surveying, environmental data collection and monitoring, security, etc. Travel by foot, which causes much more disturbance to wildlife than vehicle traffic, is highly unlikely outside active mining areas.
Hunting with firearms inside Colowyo's permit boundary is allowed and is strictly managed by Colowyo.

Speed limits in the mine area are limited to reduce the likelihood of collisions between vehicles and wildlife. Colowyo employees are fully aware of the possibility of encountering wildlife on and around the mine site and take special care to avoid these species.

In summary after several years of mining at Colowyo, the question is no longer whether coal mining at Colowyo has had an adverse impact on local wildlife populations. The population of deer and elk in the vicinity of Colowyo is reaching record levels. There is little doubt that wildlife populations are drawn to the reclaimed areas because of the availability of quality herbaceous vegetation. The immediate vicinity around Colowyo has become well known as a wildlife refuge, particularly during big game seasons.

The issue now is how can Colowyo assist the CDOW in efforts to control wildlife populations to a level that can be supported by adjacent ranges. To do so, in 1990 we have entered into a cooperative effort with the CDOW to establish a "Ranching For Wildlife" area located south of Hayden. Colowyo has also cooperated with the CDOW in allowing public hunters access to company properties in Axial Basin Ranch to increase harvest of local cow elk populations.

The concern for wildlife mitigation has clearly evolved from a concern for the impact of mining on the wildlife population to a concern for involving Colowyo in managing increasing populations especially for big game animals, particularly elk. As one of the large landowners in the region, Colowyo will continue to work with the CDOW to assist where possible to manage local big game populations.

With regard to sage grouse populations, Colowyo believes that the new revegetation metrics presented within this submittal will more completely address the concern for negative impacts to area populations and brooding habitat. As this new reclamation technology progresses and adapts into the future, it is anticipated that sage grouse use of reclaimed lands will return to pre-mining levels, or perhaps return to elevated levels as has been experienced at certain Wyoming mining operations.

Related to this mitigation and emphasis on wildlife populations, focus must be maintained on the fact that Colowyo is the landowner on the overwhelming majority of disturbed acreage. Were it not for the need for permitting of coal mining operations, and the desire to be a responsible steward of the land, the company could select to manage lands in a manner similar to other Western ranching operations that emphasize red meat production from livestock with little concern for the needs of wildlife.
Rule 4 Information

4.18 PROTECTION OF FISH, WILDLIFE, AND RELATED VALUES

As described in Section 2.04.11, no threatened or endangered species are known to rarely utilize the habitats present in the permit areas; however, it is unlikely that any impact will occur with respect to those threatened and endangered species which are known to occur in the region. No critical habitat for any species is known to exist in the South Taylor/Lower Wilson permit revision area. Golden Eagle nesting complexes, which are located within the permit area but outside the area to be mined, are described in Section 2.04.11 of the existing permit document.

Section 4.18 of the existing permit document discusses electric power line and transmission facility construction guidelines for retrofitting of existing power poles to project raptors. Colowyo has implemented these measures to protect raptors in the mine permit area.

As described in Section 2.05.6 and the existing permit document, all disturbed acreage, including roads, has been kept to a minimum by proper planning to reduce impacts to all environmental resources, including impacts on wildlife.

As part of the plan to return the post-mining land use to a rangeland condition capable of supporting the diverse wildlife populations identified in the permit areas, Colowyo initiated efforts to restore wildlife habitats during pre-mine planning and early mining. This was accomplished by conducting an extensive four year study to assist in determination of the best techniques for revegetating disturbed areas with native species to enhance wildlife habitat. In addition, Colowyo implemented a habitat improvement program in 1975 to offset temporary habitat loss during mining. The reestablishment of herbaceous species, topographic relief, impoundments and limited reestablishment of a shrub component form the integral elements of the reclamation plan. To date these efforts have proven successful. Herds of deer and elk are regularly seen grazing on the reclaimed areas. Rodent and small game populations have reestablished on the reclaimed areas providing a readily available food source for local raptor populations and other predators.

IV. PROTECTION OF THE HYDROLOGIC BALANCE

Surface Water

Surface water will be protected in the mining areas by stormwater management as described in Section 2.05.3(4) of this permit revision application and in the Stormwater Management Plan portion of the Stormwater Discharge Permit and as shown on Map 33B. Protection includes the use of diversion ditches to route surface water around the mining impact areas and stormwater impoundments downstream of the mining impact areas. Similar features will be included in the Lower Wilson mining area, with one or two impoundments likely to be used to catch surface water runoff from that impact area.

Current surface water rights will not be impacted by mining operations at Lower Wilson or South Taylor. There is no expected long-term measurable impact to the quantity of surface water in Wilson, Taylor, or Good Spring creeks or any of their tributaries. Surface water amounts that will be used in mining operations will be within the water rights owned by Colowyo.

Surface water quality of the three creeks is calculated to only be marginally impacted by mining activities. This marginal impact, described in the Probable Hydrologic Consequences section (Section 2.05.6 (3)(b)(iii) below), will be due to meteoric water being captured in and evaporated from the mine pit during operations, and meteoric water contacting an increased surface area of soil in the vadose zone and thereby theoretically increasing the mass of dissolved solids entering the groundwater. These dissolved solids in groundwater will eventually enter the surface water system, with a theoretical increase in dissolved solids in the surface water. This increase is calculated to be small enough to have no impact on the current or projected surface water uses in Wilson, Taylor, or Good Spring creek drainages.

Groundwater

Groundwater in the vicinity of the Lower Wilson and South Taylor mining areas is restricted to perched aquifers of limited extent within bedrock of the Williams Fork Formation, the Trout Creek aquifer (a bedrock aquifer of regional extent), and alluvial/colluvial aquifers as described in Section 2.04.7. The Williams Fork Formation aquifers have no beneficial use owing to their limited extent and minimal production. The Trout Creek Sandstone is a sandstone unit underlying most of the permit area and extending across much of northwestern Colorado. It contains water of useable quantity and quality as demonstrated by beneficial wells near the permit area. The Trout Creek Sandstone is beneath the mining impact areas and is separated from these impacts by clay and claystone layers within the Williams Fork Formation (see Section 2.04.5 and 2.04.6). A borehole intersecting the Trout Creek (84-B-TC - NW¼, NE¼, Sec. 19, T3N, R93W) was installed between the Lower Wilson and South Taylor mining areas. The Trout Creek formation was dry at this location, since the sandstone in this area outcrops to the west and is above any recharge source. With the dip of the strata to the north and east, the Trout Creek Sandstone, and overlying strata, do not become saturated until (1) the strata dips below the valley floor and (2) the elevation of the appropriate strata equals the elevation of surface water in Wilson and Good Spring Creek. Based on this information, mining is anticipated to have no impact on the Trout Creek aquifer. Groundwater in the shallow alluvial-aquifers of Good Spring Creek is calculated to be marginally impacted by surface mining activities at South Taylor as described in the Probable Hydrologic Consequences. There are no registered shallow alluvial aquifers, beneficial-use wells in the Colorado Division of Water Resources well database within several miles, down gradient of the mining impact areas (Map 11A).

2.05.6 (3)(b)(i & ii) Hydrologic Controls

Surface water and groundwater drainage from the mining areas will be controlled as described in Section 2.05.3(4) and Section 4.05 of this application and in the Stormwater Management Plan and stormwater discharge permit. Surface water flow will be diverted around the mining operations and into impoundments. Stormwater that enters the mining operations and water that occurs on the mining operations will be allowed to evaporate or infiltrate, or will be routed into these surface impoundments.

<u>RULE 4 INFORMATION</u>

4.05 HYDROLOGIC BALANCE

4.05.1 General Requirements

The surface mining activities at Colowyo have been planned and will be conducted to minimize changes in the prevailing hydrologic balance, in both the permit and adjacent areas, and to prevent long term adverse changes in the balance that might result from the activities.

As a preliminary step in minimizing adverse changes, hydrologic baseline information has been and is being collected, compiled and analyzed. The baseline monitoring programs are outlined in Section 2.04.7. This data provides detailed information on quality and quantity of surface water, drainage patterns, and geology. The description of the current hydrologic monitoring program is included in the following pages and results of the current monitoring program are included in the Annual Reports for 1983 through 1990. In addition, Section 2.05.4 and 2.05.5 details the specific mining and reclamation techniques which Colowyo will implement to minimize changes to the hydrologic balance.

The post-mining land use as described in Section 2.05.5 will be rangeland. Changes in the hydrologic balance will be minimized so that the post-mining land use will not be adversely affected.

Water quality standards and effluent limitations at the existing mining operation are regulated by the U. S. Environmental Protection Agency and the Colorado Department of Public Health and Environment under the terms of an NPDES Permit, (See Exhibit 7, Hydrological Information), and by the Coal Regulations of the Colorado Mined Land Reclamation Board. The applicable effluent limitations will be met by using treatment methods that will include prompt revegetation, minimizing disturbed areas, sediment retention, use of contour furrows, terraces, sediment ponds and, if necessary, strategically placed energy dissipaters, such as riprap, check dams, mulches, filters and dugouts. Water quality control measures are discussed in detail under Section 2.05.4 and 2.05.6.

Where practicable, diversion methods will be used to change the flow of water from undisturbed areas so as to bypass the disturbed areas rather than using treatment facilities. The principal technique to be used for this purpose will be diversion ditches. These diversion ditches are located on Maps 11 and 12 and discussed in detail under Section 2.05.6. Their design is specified in Exhibit 7, Hydrological Information.

No acid-forming materials are present in the area to be mined which would require selective placement and sealing of overburden (Exhibit 6). The chemical characteristics of the overburden is presented under Section 2.04.6. The overburden sampling program is presented under Section 2.05. Results of the current overburden sampling program are presented in the Annual Reclamation and Hydrology Reports beginning in 1983 to the present.

As discussed in Section 2.05.4, Colowyo will use various surface manipulation techniques on the topsoil after its redistribution as one method to prevent excessive wind or water erosion.
No special treatment of coal processing waste is necessary since none will be produced. See Section 4.10 and 4.11.

Colowyo plans to have all surface runoff from the disturbed areas pass through sedimentation ponds. Sedimentation ponds are discussed in detail under Section 4.05.6, and their locations are shown graphically on the mine plan map (Map 23A).

Colowyo employs various methods to manage water which periodically collects internal to the mining operation and does not reach sedimentation ponds. Various sumps, ditches, pumps, hoses and pipes, etc. will be employed to control water within pits and/or route water between pits. The ultimate destination of such water will be for operation's use (i.e. dust control), evaporation, or seepage into the backfilled spoil areas.

In addition to the mining, reclamation, and treatment methods described and referenced in this Section, further protection of the hydrologic balance will be established by an on-going plan for monitoring potential changes in surface water quality and quantity and groundwater quality. This monitoring plan is described under Section 4.05.13 and the monitoring locations are graphically shown on Map 10A. Excess spoil valley fill areas are located up-dip from mining and reclamation areas and periodic monitoring for seeps and springs and periodic monitoring of piezometer wells will detect the formation of spoil springs.

4.05.2 Water Quality Standards and Effluent Limitations

The plan for protection and control of drainage and sediment described in 2.05.6 provides that surface drainage from the disturbed area within the permit area will be passed through sedimentation control structures. All ponds will be constructed and maintained to contain or treat the volume design for a 10-year, 24-hour precipitation event. The accumulation of sediment in the ponds will be monitored quarterly. In addition, grab samples of water, as required, will be collected from pond discharges to measure the effectiveness in meeting the applicable Colorado and Federal water quality standards.

The proposed sedimentation ponds have been designed and will be constructed and maintained to effectively trap sediment from runoff resulting from precipitation events up to and including the 10-year, 24-hour precipitation event.

Drainage from the mining area, after treatment in sedimentation ponds, is not anticipated to exceed the effluent limitations of any federal or Colorado agency requirements. Baseline groundwater quality is discussed in Section 2.04.7. No acid mine drainage of pH equal to or less than 6.0 is expected. For further details relating to the sediment pond discharges, refer to the NPDES reports found in the 1983- through 1990 Annual Reports.

Historically, Colowyo has experienced no pH problems with water discharges sampled in the vicinity of the Colowyo operations. As reported in Section 2.04.7, all pH values of water samples taken in the vicinity of the Colowyo operations have ranged between 7.2 and 8.5; therefore, it is anticipated that no acid mine drainage will occur as the operations move to southward to South Taylor and west to Lower Wilson.

4.05.3 Diversions and Conveyance of a Watershed Less than One Square Mile

The drainage and sediment control measures described under Section 2.05.6 and presented in Erosion and Sediment Control Structures (Exhibit 7, Item 20) provides for temporary diversion of surface drainages within the permit area. A system of temporary ditches will be used to divert runoff from disturbed areas to sediment ponds. Temporary diversions will be constructed to pass at a minimum the runoff from the precipitation event with a two-year recurrence interval.

The temporary diversions drain watersheds less than one square mile in size and serve to reduce the contribution of suspended solids to runoff. The diversions will be constructed with a minimum gradient to pass the design flow and will be stabilized with grasses or riprap. If not removed by mining, upon completion of mining and at an appropriate point mandated in the Coal Regulations of the Colorado Mined Land Reclamation Board, the temporary diversions will be reclaimed as required in Section 4.05.17.

The only stream channels that will be impacted by the South Taylor pit are headwaters tributary to Taylor Creek and West Fork Good Spring Creek, which are intermittent and drain watersheds less than one square mile. There will be no upstream diversions of these streams since mining will extend to the top of the drainages. The headwaters systems will be restored to historic drainage patterns once temporary diversion ditches are removed; therefore, there will be no permanent diversions of these channels.

4.05.4 Stream Channel Diversions (Relocation of Streams)
No diversions of perennial streams or streams that drain watersheds that are greater than or equal to one square mile in size are planned or provided for at this time. The stream channels of Good Spring and Wilson Creeks will be maintained in their natural positions.

4.05.5 Sediment Control Measures
Sediment control measures to be implemented are shown in Erosion and Sediment Control Structures (Exhibit 7 Item 20). These facilities, consisting primarily of diversion ditches and sedimentation ponds, will be located, constructed and maintained to avoid erosion and increased contribution of sediment load to runoff.

Facilities to control sediment are typically installed in areas above and/or below the planned sites of disturbance. "Upstream" facilities, such as temporary diversion ditches and check dams upslope from the mining activities, serve to divert runoff away from the disturbed areas. Because South Taylor mining activities cover the top of the drainages, no upstream facilities are proposed. Temporary diversion ditches below the disturbed area will help collect runoff from disturbed areas and route it into the sedimentation ponds. During active mining, the mining areas will aid in retaining sediment within the disturbed areas by catching water in pits, small depressions and dozer basins, etc. This captured water and sediment will not leave the mining areas. Once reclaimed, the basins will drain as they did prior to mining activities (i.e., historic drainage patterns will be re-established).

All temporary diversions will be removed and reclaimed when no longer needed for sediment control in accordance with the Operations and Reclamation Plan described in 2.05.4.

Channel lining rock riprap and energy dissipaters will be used when necessary. As stated above, all temporary diversion structures will be seeded and revegetated. Colowyo does not anticipate that there will be any significant excess material resulting from the construction of diversion ditches.

None of the proposed diversions will drain into underground mines.

4.05.6 Sedimentation Ponds
The location, design parameters, and detailed sedimentation calculations of all planned sedimentation ponds are presented in Erosion and Sediment Control Structures (Exhibit 7, Item 20). The design plans and specifications for the sedimentation ponds are described in this section. All sedimentation ponds will be located as close as practical to the areas to be disturbed. Steep terrain in the upper basins precludes location of the ponds at the disturbance boundaries, necessitating down-valley locations. Other methods of sediment control will be located on the reclaimed areas; these methods include the use of contour furrowing, contour drainage ditches, chisel plowing, and revegetation.

This application contains calculations used to determine runoff volumes and flow rates for the theoretical 10-year, 25-year, and 100-year, 24-hour precipitation events and 50 percent of the probable maximum precipitation (PMP), as well as subsequent sediment volumes. PMP information is required for State Engineer's Office (SEO) requirements for Class II, small to moderate hazard dams. The precipitation data were obtained from the NOAA Atlas 2, Volume 3 for Colorado; soil types were obtained from the Soil Conservation Service, and are shown on the Soils – South Taylor (Map 5C).

The ongoing mining activities within each watershed of the permit area will create constantly changing hydrologic conditions. The design models are generally based on a static, theoretical scenario, utilizing SEDCAD 4, which considers the worst-case scenario wherein mine phasing has caused impacts to the entire disturbance area and reclamation has not yet been attained for any areas. Refer to Map 41A for a delineation of the areas used for these modeling purposes as well as the individual maps associated with each SEDCAD run. The dates indicated on Map 41A are for development of the worst-case scenario for hydrologic modeling and are not a definitive schedule for mining and reclamation activities.

It is Colowyo's contention that the proposed models represent nothing more than our best hydrologic estimates for a described worst-case condition. The intent of the modeling is to aid in the design of sedimentation ponds to predict compliance with applicable effluent standards. A primary limitation of the modeling and subsequent designs is the available existing topography, which is very coarse at a 25-ft interval. Colowyo believes it would be an inappropriate use of the SEDCAD models to use them as an enforcement tool for such operations as topsoil stripping; backfilling, grading, reclamation, etc. Furthermore, more detailed topography must be obtained to verify results prior to implementation.

The scenario used for the sedimentation ponds corresponds to an active, disturbed operation. In terms of groundwater, Colowyo's pits have remained essentially dry. Pumping of pit water (precipitation induced surface runoff) into sedimentation ponds is not anticipated. Discharges from the ponds will remain in compliance with Colowyo's CDPS Discharge Permit. The use of flocculants in sedimentation ponds may also be used in accordance with the provisions of the CDPS Permit.

Sediment will be removed from all sedimentation ponds on an as needed basis or when the sediment level will not allow effective treatment of the runoff resulting from the 10-year, 24-hour precipitation event in accordance with Rule 4.05.2. Quarterly inspections will note the level of sediment in each pond. Ponds will typically be cleaned of sediment when water levels are lowest, and the least amount of precipitation is expected. The removed sediment will be used as topsoil or subsoil if it meets the suitability criteria discussed under Section 2.04.9. The Division will be notified of this determination if the material is selected as overburden material that can be substituted for or as a supplement to topsoil.

All sedimentation ponds will be designed so that the minimum elevation at the top of the settled embankment is at least one foot above the elevation of the water surface in the pond with the emergency spillway flowing at design depth.

Colowyo will design, construct, and maintain the sedimentation ponds to prevent short-circuiting to the extent possible. As a general rule, the inflow to the ponds will be at the opposite end from the outflow area. The constructed height of the sedimentation pond embankment will be designed to allow for settling. During construction, a registered professional engineer will ensure that the appropriate embankment height is accomplished. For all sedimentation ponds, the entire embankment, including the surrounding areas disturbed by construction, will be seeded after the embankment is completed, using the Topsoil Stockpile/Pond Embankment seed mix described below. The active upstream side of the embankment where water will be impounded will be riprapped or otherwise stabilized, where necessary. Areas in which revegetation is not successful or, where rills and gullies develop, will be repaired and revegetated.

Colowyo will inspect the condition of each sediment pond, sediment trap, orfuture postmining stock reservoir on a quarterly basis. All of these types of structures meet the requirements of an impoundment, and the inspection procedures will meet the requirements under Rule 4.05.9 (17). Previously, Colowyo has received a waiver from quarterly inspections for several existing stock reservoirs within the current permit area as described under Section 4.05.9. This waiver changed the inspection frequency to annual. Following construction of any future postmining stock reservoir proposed in the South Taylor area, Colowyo may request a similar waiver but until that is approved, the quarterly frequency would apply. Results of all impoundment inspections will be submitted annually.

Topsoil Stockpile/Pond Embankment Seed Mix*

Western wheatgrass @ 4 Lbs PLS/Acre

Thickspike wheatgrass** @ 4 Lbs PLS/Acre

Yarrow*** @ 0.15 Lbs Pls/Acre

*mix will be modified as a result of an updated Reclamation Plan submitted after PR-02 approval.

Colowyo existing permit Section 4.06.3 must be modified to reference the updated seed mix in this location at that time.

**option to replace Thickspike wheatgrass with Beardless bluebunch wheatgrass or Sheep fescue

***option to replace Yarrow with Cicer milkvetch

4.05.7 Discharge Structures

The sedimentation ponds at Colowyo are designed to treat the theoretical 10year, 24-hour storm event in accordance with Rule 4.05.6(3)(a). As such, the general operation of the ponds will be a passive discharge system where water is allowed to discharge automatically as necessary. Colowyo will sample discharges as appropriate to remain in compliance with applicable CDPS Permit requirements. Pond dewatering through a manual headgate may be performed as necessary to lower the water level depending on operational requirements. Manual dewatering of ponds will meet applicable CDPS Permit standards. Discharge from sedimentation ponds will be controlled by energy dissipaters and flow check devices where necessary. All ponds utilize separate principal and emergency spillways with the emergency spillway located at a minimum of 1 foot above the elevation of the maximum water surface during the discharge of the 10-year 24-hour storm event through the principal spillway. The principal spillways are designed for the 10-year, 24-hour storm event and the emergency spillways are designed to pass the 25-year, 24-hour storm event in accordance with Rule 4.05.6(5). The design requirements can be found on each of the pond as-built drawings or in Exhibit 7, Item 15 of the existing permit document. All sedimentation ponds will provide a non-clogging dewatering device or conduit spillway to remove water storage from inflow.

4.05.9 Post-Mining Impoundments
Colowyo constructs small impoundments on reclaimed areas in accordance with Section 4.05.9 of the CMLRD regulations for Coal Mining, 3/21/01. These small impoundments are essential and basic to the management of the rangeland post-mining land use of livestock grazing and wildlife habitat. The design of post-mining impoundments provides for structures having a vertical height less than five feet from the bottom of the channel to the bottom of the spillway and impound less than two acre-feet of water. As such they are exempt from Division of Water Resources, Office of State Engineer requirements. Water harvesting ditches may also be used to enhance the function of the impoundments, which is consistent with practices employed on adjacent rangelands.

The impoundments collect surface runoff from precipitation events and snowmelt from reclaimed areas. The impoundments do not result in the diminution of the quality or quantity of water for downstream water users. Colowyo is the holder of water rights immediately downstream. During periods of low precipitation, the impoundments may be dry, which is consistent with regional practices on similar rangelands. Since the source of water is surface runoff from revegetated areas the quality of the water will meet the requirements of the intended use.

The post-mining impoundments have slopes of 4h:1v or less to provide easy access to both livestock and wildlife. These impoundments and any associated ditches, while intended to be permanent, will be classified as temporary until the requirements of Rule 4.05.9 are met. Prior to construction, all designs are submitted to the Division. A copy of the as-built design information will be submitted after construction for inclusion into Exhibit 7, Item 20. In addition, sedimentation ponds that are subsequently approved as part of the post-mining land use, as shown on the hydrology - South Map (Map 12), will remain as permanent impoundments after the requirements of Rule 4.05.9 have been met.

All embankments, impoundments, and associated structures will be revegetated if construction materials are conducive to plant growth. If not, rock or gravel will be used on the embankments. The quarterly routine inspections of these structures will be conducted as required by Rule 4.05.9(17).

The Division granted Colowyo a waiver to the requirements of 4.05.9(17) for small impoundments. The waiver applies only to impoundments which are not the primary sediment control structure for a particular area; are constructed in reclaimed areas of the mine to enhance the approved postmining land use; are completely incised, or have a storage capacity no greater than two-acre feet and an embankment no greater than five feet in height. The small impoundments will be inspected on a yearly schedule until removal of the structure or release of the performance bond as directed in rule 4.05.9(14). The inspections will be performed by a qualified registered professional engineer, or other qualified professional specialist under the direction of a professional engineer, or a qualified person other than, and not under the direction of, a professional engineer.

Colowyo successfully demonstrated that failure of the small impoundments would not create a threat to public health and safety or threaten significant environmental harm. A written safety demonstration completed by a professional engineer is located in Exhibit 7, Item 11 of the existing permit document in accordance with rule 4.05.9(18)(b). None of the small post-mining impoundments act as primary sediment control structure for a particular area; they are all constructed in reclaimed areas of the mine to enhance the approved postmining land use; they are all under two-acre feet.

All impoundments will be maintained according to the specifications set forth in this part. Maintenance for impoundments may include mowing and cutting of excess vegetative growth for the purpose of facilitating inspections and repairs and will include keeping ditches, culverts, spillways, and other outflow structures free of debris. All combustible material, other than mulch or other material needed for erosion control and surface stability will be removed.

Plans for any modification of any sedimentation impoundments or dams will be submitted to the Division, and no modification will begin until approval of the plans have been granted unless such modification is necessary on an emergency basis for public health, safety or the environment would be endangered.

Colowyo will inspect the condition of each pond annually with the reports submitted annually. None of Colowyo's post-mining impoundments will meet the size criteria of 30 CFR 77.216(a)(1989).

4.05.13 Surface and Groundwater Monitoring

The proposed monitoring program will replace the existing monitoring program in its entirety. This section replaces Section 4.05.13 of Volume 1. Colowyo proposes monitoring the following sites:

<u>Sedimentation Ponds</u> - The proposed surface water monitoring plan includes monitoring required under the NPDES Permit Number CO-0045161 issued by the Colorado Department of Public Health and Environment. Colowyo will measure the quantity and quality of any discharges from the permit area in compliance with the NPDES Permit in accordance with permit requirements. Please refer to Colowyo's discharge permit for a list of monitored parameters.

Colowyo will report the discharge in accordance with the Clean Water Act of 1977 under the NPDES Permit on a quarterly basis; therefore, Colowyo will plan to use the NPDES report for filing with the Division. All monitoring data is submitted in an annual report. Annual Hydrologic Reports for the period of January 1st through December 31st will be submitted by April 1st of the following year.

At various times, due to unforeseen circumstances, Colowyo will obtain and discharge water under a CDPS minimal discharge permit. In the event that water is discharged under a minimal discharge permit, Colowyo will report the discharge in the corresponding Annual Hydrologic Report.

Surface Water - Six surface water sites will be monitored to some degree. These points include five locations along Good Spring Creek and one location along Taylor Creek.

Monitoring Type	Monitoring Location	Monitoring Frequency	Monthly Parameters	Quarterly Parameters
Surface Water	Lower Taylor Creek (LTC)[1]	Monthly/ Quarterly	Flow from Parshall Flume. See List Below	Flow from Parshall Flume. See List Below
Surface Water	Lower West Fork Good Spring Creek (LWFGSC)[2]	Monthly/ Quarterly	Flow Only taken from Parshall Flume. Volume added to EFGSC measurement to apply to actual flow for NUGSC.	Flow Only taken from Parshall Flume. Volume added to EFGSC measurement to apply to actual flow for NUGSC.
Surface Water	East Fork Good Spring Creek (EFGSC)[3]	Monthly/ Quarterly	Flow Only taken from Parshall Flume. Volume added to LWFGSC measurement to apply to actual flow for NUGSC.	Flow Only taken from Parshall Flume. Volume added to LWFGSC measurement to apply to actual flow for NUGSC.
Surface Water	Upper West Fork Good Spring Creek (UWFGSC)[4]	Monthly/ Quarterly	Flow from Parshall Flume. See List Below	Flow from Parshall Flume. See List Below
Surface Water	New Upper Good Spring Creek (NUGSC)[5]	Monthly/ Quarterly	See List Below. Flow estimated by combining measurements taken from LWFGSC & EFGSC.	See List Below. Flow estimated by combining measurements taken from LWFGSC & EFGSC.
Surface Water	Lower Good Spring Creek (LGSC)[6]	Monthly/ Quarterly	Flow from Parshall Flume. See List Below	Flow from Parshall Flume.See List Below

1. Lower Taylor Creek (LTC) represents the water quality conditions of Taylor Creek directly downstream of the South Taylor mining area and immediately prior to the confluence with Wilson Creek and immediately downstream of the Gossard Loadout.
2. Lower West Fork Good Spring Creek (LWFGSC) represents this tributary after potential impacts caused by South Taylor mining.
3. East Fork Good Spring Creek (EFGSC) represents the upstream, undisturbed background condition of the East Fork Good Spring Creek.
4. Upper West Fork Good Spring Creek (UWFGSC) represents the upstream, undisturbed background condition of the West Fork Good Spring Creek.

5. New Upper Good Spring Creek (NUGSC) represents the water quality of Good Spring Creek downstream of the confluence of the east and west forks of the creek and downstream of the South Taylor mining area.
6. Lower Good Spring Creek (LGSC) represents the water quality downstream of the South Taylor and existing mining areas.

Monthly Surface Water Parameters

pH	Conductivity	Temperature	Total Suspended Solids	Flow

Quarterly Surface Water Parameters

Flow	pH	Conductivity	Total Dissolved Solids	Total Suspended Solids
Bicarbonate (HCO_3^-)	Calcium (Ca^{+2})	Magnesium (Mg^{+2})	Ammonia (NH_3)	Nitrate-Nitrite
Phosphate (PO_4^{-3} as P)	Sodium (Na^+)	Sulfate (SO_4^-)	Arsenic (As)	Iron - Total
Lead (Pb)	Mercury (Hg)	Manganese (Mn)	Selenium (Se)	Zinc (Zn)

Prior to mining at Lower Wilson, the following three surface water monitoring sites will be added to the sampling schedule:

1. Upper Wilson Creek (UWC) represents water quality upstream of all mining impacts.
2. Upper Middle Wilson Creek (UMWC) represents water quality downstream of the proposed Lower Wilson mining area.
3. Lower Wilson Creek (LWC) represents water quality immediately upstream of the confluence with Taylor Creek.

It is reasonable to expect potential future monitoring activities for the Lower Wilson locations to mirror those for the existing operation as it pertains to frequency and specific parameters.

Groundwater – Four alluvial groundwater sites will be monitored.

Monitoring Type	**Monitoring Location**	**Monitoring Frequency**	**Quarterly Parameters**
Alluvial Ground Water	Gossard Well[1]	Quarterly	See Below
Alluvial Ground Water	A-6 Well[2]	Quarterly	See Below
Alluvial Ground Water	North Good Spring Well[3]	Quarterly	See Below
Alluvial Ground Water	MT-95-02[4]	Quarterly	See Below

1. Gossard Well – Located within alluvium beneath the rail loop, this site represents the condition of the alluvial aquifer in the vicinity of the Gossard Coal Loadout Facility.
2. A-6 Well – Located in the Good Spring Creek alluvium, this site represents the condition up-gradient of proposed and current mining activities.
3. North Good Spring Well – Located in the Good Spring Creek alluvium, this site represents the down-dip condition below existing and proposed mining activities.

4. MT-95-02 – Located in the Taylor Creek alluvium, this site represents the down-dip condition below current and proposed mining activities.

Quarterly Alluvial Ground Water Parameters

pH	Conductivity at 25°C	Total Dissolved Solids	Bicarbonate (HCO_3^-)	Calcium (Ca^{+2})
Magnesium (Mg^{+2})	Ammonia (NH_3)	Nitrate	Phosphate (PO_4^{-3} as P)	Sodium (Na^+)
Sulfate (SO_4^{-2})	Arsenic (As)	Iron (Fe)	Lead (Pb)	Manganese (Mn)
Mercury (Hg)	Selenium (Se)	Zinc (Zn)	Water Level	

Prior to mining at Lower Wilson, the following three groundwater monitoring sites will be added to the sampling schedule:

1. MW-95-01 – Located in the Wilson Creek alluvium, this site represents the upstream, undisturbed background conditions of the alluvial aquifer.
2. MW-05-03 – Located in the Wilson Creek and unnamed drainage alluvium, this site represents alluvial groundwater quality immediately downgradient from Lower Wilson.
3. MW-95-02 – Located in the Wilson Creek alluvium, this site represents the downgradient conditions below Lower Wilson and the proposed haul road.
4.

It is reasonable to expect potential future monitoring activities for the Lower Wilson locations to mirror those for the existing operation as it pertains to frequency and specific parameters.

Groundwater, Fill Piezometers - The Streeter Draw piezometer and the Section 16 Fill piezometer will be monitored annually for water levels. The West Pit Fill piezometer will be monitored quarterly for water levels. After mining, two additional piezometers will be installed into the toes of East Taylor Fill and West Taylor Fill as described in Exhibit 21 Item 1. These piezometers will be added to the monitoring program.

V. OPERATIONS

RULE 4 INFORMATION

4.09 DISPOSAL OF EXCESS SPOIL

Spoil removed from the South Taylor pit will be stockpiled in valley fill area as shown on Map 23A. Colowyo expects a 20% swell of excavated materials; therefore, part of the material stockpiled in the East and West Taylor Fills and the temporary fill will remain at the conclusion of the project as shown on Map 19B. Placement will occur as described in previous sections of this permit revision application and in the original permit document.

Design of the two (East Taylor and West Taylor) fills associated with the South Taylor Mine plan are provided in Exhibit 21, Item 1. The East Taylor Fill will contain approximately 50 million yards of permanent out-of-pit spoil and the West Taylor Fill will contain approximately

10 million yards of out-of-pit spoil. Both fills will be regraded in accordance with the approved Post Mine Topography shown on Map 19B. The final configuration of the fills is designed to minimize erosion. This takes into account a number of the components of the other fill piles at the mine which have proven successful. The final outslope will not exceed 3h:1v.

Drainage benches with designed terrace ditches will be constructed at approximately 100 foot vertical increments. Benches will be backsloped to direct runoff against the face to prevent flows from overflowing the edge of the bench. These drainage benches will direct surface runoff perpendicular to the face into a permanent drainage channel designed to pass safely the runoff from a 100 year, 24 hour precipitation event. Terrace ditches are shown on Map 41A and design information is provided in Exhibit 7, Item 20, Part G.

Reclamation, specifically topsoil replacement, seeding etc. will be implemented consistent with the Section 2.05 of the permit.

CONSTRUCTION PLAN

All available topsoil will be removed and either stockpiled for later use or direct haul replaced to a reclaimed area.

Due to the fact that the valley fill locations are in close proximity to the initial boxcut area means the entire footprint of these fills must be stripped of topsoil immediately after the approval of PR-2. As described in further detail in this submittal under Section 2.05.3(1); "The entire seam sequence from the top overburden through to the bottom G8 seam, which resides in the area of the initial boxcut, will be placed in the valley fill locations; this will allow Colowyo enough spoil room to reach the desired mining depth."

It is anticipated the valley fill drains and associated lateral drains will be constructed as one project during the first two years of operation in the South Taylor operation for practical purposes and as a necessary step in preparation of the area for full scale mining.

Channels constructed along the outside of the valley fills (perimeter relief drains) will be built immediately after the logical completion of each terrace ditch across the faces of the fills, which obviously cannot be completed until such a time as the fills themselves develop and are constructed to meet PMT compliance. This activity will be logically sequential in that they will be developed from the bottom up.

Colowyo will follow the Shannon & Wilson recommendation for excavation as described in Exhibit 21, Item 1.

A controlled underdrain in accordance with the Shannon & Wilson recommendations will be placed in the natural drainage bottom from the head to the top of the fill, The harder, available sandstones obtained from the mining operation will be selectively handled and placed in at least a 24 foot wide by 8 foot high configuration to serve as the underdrain before covered by spoil material. The natural spoil sorting which will occur by utilizing the thicker lifts recommended by

Shannon & Wilson will be sufficient to protect the drain from clogging above the geotextile fabric.

Lift thicknesses up to 100 feet thick is acceptable and will be utilized to construct the fill. This method of spoil placement also enhances the construction of a free—draining layer of spoil material at the base of the fill. Experience at Colowyo provides evidence that the natural sorting process which occurs while dumping in higher lifts is sufficient to create this drain. Inspection and documentation of this natural sorting is recommended and will be conducted by Colowyo. See the Inspection Plan section for additional details.

INSPECTION PLAN

During construction of the East Taylor and West Taylor Fills, Colowyo will provide the following information in certified reports as required by Rule 4.09.1(11).

1. Inspections will be conducted at least quarterly during the construction period and during the following specific construction periods.
    a. removal of topsoil and organic material
    b. placement of underdrain system
    c, installation of surface drain system
    d. placement of fill material to insure that the largest rocks are reaching the bottom of the dump face and that the formation of voids that adversely affect mass stability are prevented and
    e. revegetation

The purpose of the inspections is two fold. First, these inspections will document and certify that the construction plan is being followed. Secondly, during the above phases of the construction, a key emphasis of all inspections will be to implement routine contingencies as situations warrant. For example, perhaps a section of underdrain should be reworked, or the spoil dump raised to provide optimum gravity spoil sorting. Inspections and implementation of contingencies during these critical phases of fill construction will be a routine but very important component of fill inspections.

2. Each certified inspection report will be provided to the Division within two weeks after each required inspection. Each report will certify that the fill has been constructed as specified in the minimum design approved by the Division. The reports will include a description of any appearances of instability, structural weakness and other hazardous conditions observed during the inspection.

3. Certified reports addressing the underdrain system will include color photographs taken during and after construction, but before the underdrain is covered with spoil.

After construction, the South Taylor fills will be monitored quarterly for the following items and reports will be submitted in the Annual Reclamation Reports. Monitoring will continue until such time that DRMS staff approve a revision to this plan.

1. The groundwater piezometer well will be established in the valley bottom and will be monitored quarterly for water level and the other parameters consistent with the present Colowyo groundwater monitor plan.

2. On a quarterly basis, a certified report by a registered engineer will be completed taking into consideration any changes and will note any evidence of surficial slope failure or the formation of springs or seeps on the face of the fill.

4.14 BACKFILLING AND GRADING

4.14.1 General Requirements

The mining operations of Colowyo will not employ the use of contour mining methods.
The original permit demonstrates that Colowyo does not have thin or thick overburden as defined in Subsection 4.14.4 or Subsection 4.14.5. There is always more than enough overburden to reestablish the original elevation.

The mining plan, as described in Section 2.05.3, maximizes coal conservation and recovery while minimizing adverse environmental impacts. Because of the multi-seam mining configuration planned by Colowyo, an exemption from the 180 day or four spoil ridge limitations has been formally requested at the date of this submittal. The mining plan has been designed as a continuously-moving open pit operation with the mine advancing approximately parallel to the dip of the numerous coal seams. The mining operation is an extension of the existing Section 16 mine operation, and will progress in a southward direction with shovels/trucks/ proceeding along the entire length of the mining area (Map 23A). With the numerous benches used in an open pit operation, the mine area will be opened for some time until the equipment comes back to initiate another pass on a designated bench.

As the mining operations remove coal seams, the mining area must be left open until such time as the lower-most coal seam can be recovered. With the mining configuration, the time differences between mining the upper-most seam versus the lower-most seam will be greater than 180 days. As the operation advances, backfilling will be as contemporaneous as practical but not so as to interfere with removal of the lower-most coal seam. Colowyo will rough backfill and grade as shown on the Map 29A. All disturbed areas will be returned to the appropriate final contour by grading and backfilling with the use of a dragline, trucks, dozers, and scrapers. Additional detail of the backfilling and grading for the mining operation is set forth in the discussion under Sections 2.05.3 and 2.05.4.

The area to be mined will be restored to a topography approximating pre-mining grades. The slopes of backfilled areas, as necessary, will utilize terraces and/or contour furrows for erosion control and stability. These terraces and contour furrows will be constructed according to the requirements outlined in Section 2.06.2. Where applicable, Colowyo will retain all overburden and spoil on the solid portion of existing benches. The final graded slopes will not exceed the approximate original pre-mining slope grade as shown on the Map 19B. Post-mining surface drainage channels will be located to minimize erosion and to minimize slippage.

4.14.2 General Grading Requirements

The final graded slopes at the mining operation will not exceed the approximate original pre-mining slope grade as shown on Map 19B. Colowyo will retain all overburden and spoil material on solid portions of existing or new benches. The final highwall at the operation will be eliminated by backfilling overburden into the final pit area.

Small depressions of a holding capacity slightly greater than one cubic yard of water may be used to create a moist micro climate to aid in shrub establishment. See Section 2.05.4, Planting and Seeding Methods for further information regarding these small depressions. Also, several stock watering ponds will be constructed to compliment the post-mining land use. Providing a supply of water is an integral part of the grazing post-mining land use. Colowyo will not be mining on any slopes above 20° as shown on Map 18A.

Final grading before topsoil placement will be conducted in a manner that minimizes erosion and provides a surface for the topsoil that minimizes slippage. Final grading will be accomplished so that overall grades will not exceed lv:3h. The plan for backfilling and grading is shown graphically on the Map 29A.

4.27 OPERATIONS ON STEEP SLOPES

Over 18% of the South Taylor pit area is greater than 20 degree slopes, and over 30% of the pit area is greater than 15 degree slopes (Figure 2.06.4-1). These areas are around most of the perimeter and scattered isolated locations within the pit. Therefore, the application for a variance from approximate original contour for steep slope mining is appropriate for the South Taylor pit. Colowyo has requested this variance in the cover letter to this permit revision.

Norwest Corporation prepared the Post Mine Topography (PMT) for the South Taylor mining area based on the Operations on Steep Slopes section of the regulations. The design was based on the mine plan prepared by Marston Mining Engineers & Consultants and the following methodologies were followed:

1. Ridgelines from the original topography will be used to maintain each drainage area.
2. Drainage channels from the original topography will be used to tie into the undisturbed area surrounding the mine.
3. Waste materials will not be placed back into the pit under Approximate Original Contour (AOC); alternatively, the pit will be backfilled and the external waste dumps will be re-contoured.
4. The final PMT was designed with SurvCADD Natural Regrade software to create a more stable land form and drainage system.

The configuration of the mining plan will not allow the pit to be backfilled until the end of the mine life. An initial PMT design was based upon conventional methods to generate a PMT surface to maintain the drainage basins using ridgelines from the original topographic map. The final PMT was developed using SurvCADD Natural Regrade. The area was subdivided into eight areas, different drainages, and sub-drainages. The geofluvial design of the channels and drainage basins will control the surface water to minimize the effects of erosion and assist in reestablishing vegetation. Cut and fill volumes were modified to reduce the material by lowering the fills and raising the cuts. The final material movement for the South Taylor mining area is approximately 114.3 million cubic yards of cut and 115.4 million cubic yards of fill.

All requirements set forth in Section 4.27 of the Regulations will be followed during operation and reclamation. Drainage plans are shown in Exhibit 7, Item 20, Erosion and Sediment Control Structures. The post-mining topography is shown on Map 19B. The watersheds tributary to Taylor Creek and Good Spring Creek will be improved by having a lower gradient on reclaimed streams and slopes leading into those streams, thereby reducing erosion and total suspended sediment. The lower slopes will also allow greater infiltration of precipitation, which will tend to attenuate surface water flows. The post-mining watershed drainage areas will be the same as the pre-mining drainage areas.

Highwalls will be completely backfilled with spoil material in a manner which results in a static safety factor of at least 1.3. No land above the highwalls will be disturbed except as shown on Map 23A**,** *Mine Plan*. The highwall will be blended into the backfilled material to result in a natural and gradual slope change.

As discussed in Section 4.14.2, final grading will be accomplished such that overall grades will not exceed 1v:3h. Rule 4.27 requires that a showing be made which demonstrates a minimum static factor of safety of 1.3 for all portions of the reclaimed land.

The following analysis is provided for that demonstration:

As a general observation, such a demonstration can easily by made when postmining grades do not exceed 1v:3h (approximately equivalent to 18.4 degrees). For example, assuming a cohesionless dumped spoil slope with a 3H:1V slope composed of 125 lbs/sq. ft. in-place density and an internal friction angle (phi) of 35 degrees, the safety factor F for this "infinite slope" problem simplifies to:
F = tan (35 degrees) / tan (18.4 degrees) = 2.1

This factor is well above the required safety factor of 1.3. This analysis assumes that no phreatic surface has developed, i.e. no groundwater is present. For the purposes of this analysis, this is a valid assumption. According to the U.S. Army Corp. of Engineers Manual entitled "Engineering Design, Slope Stability, October, 2003" (EM 1110-2-1902), in the case of cohesionless soils, "the critical mechanism is shallow sliding, which can be analyzed as the infinite slope failure mechanism." In this case, a graphical solution from the manual can be used to verify the equation above.

The calculated factor of safety shown above is for a shallow surface failure, and that surface is controlling. A deeper-seated, larger failure surface would have an even higher factor of safety. It is also generally recognized that such a 2-dimensional analysis is conservative. This is because it does not account for additional soil strength that occurs when 3-dimensional effects are considered.

In addition, each of the spoil pile designs (Streeter Fill, West Pit Fill, and Section 16 Fill) contain further information regarding other stability analyses that have been performed. These include additional information regarding material properties, hydrologic assumptions, and laboratory testing results that have been performed as components of the stability analyses. See Section 2.05.3 and Exhibit 19 for more information.

V. SMCRA PERMIT STIPULATIONS

The following stipulations were added as part of the previous PR-02 revision process.

STIPULATION 2

PRIOR TO DISTURBING ANY LANDS IN THE LOWER WILSON AREA THE COLOWYO COAL COMPANY SHALL PROVIDE THE DIVISION WITH A PERMIT REVISION CONTAINING A MINE PLAN AND A RECLAMATION PLAN AND ANY ADDITIONAL BASELINE MONITORING INFORMATION (SURFACE WATER, GROUND WATER, SOILS, VEGETATION, ETC) REQUESTED BY THE DIVISION. THE APPROVAL OF PERMIT REVISION 02 IS ONLY AN APPROVAL FOR DISTURBANCE IN THE SOUTH TAYLOR PIT (SOUTH TAYLOR PIT, WEST VALLEY FILL, EAST VALLEY FILL, AND ASSOCIATED STRUCTURES). NO DISTURBANCE IS APPROVED FOR THE LOWER WILSON AREA WITH THE APPROVAL OF PERMIT REVISION 02.

STIPULATION 3

PRIOR TO DISTURBING THE LOWER WILSON AREA THE COLOW YO COAL COMPANY SHALL PERFORM FURTHER ARCHAEOLOGICAL INVESTIGATIONS ON SEVEN AREAS IDENTIFIED AS REQUIRING MORE DETAILED STUDY IN THE OCTOBER 1984 REPORT TITLED “CULTURAL RESOURCES INVESTIGATIONS IN THE DANFORTH HILLS PROPOSED COAL LEASE AREA; MOFFAT AND RIO BLANCO COUNTIES, COLORADO; CONSOLIDATION COAL COMPANY.” THESE AREAS ARE AS FOLLOWS: 5MF1652, 5MF1935, 5MF1937, 5MF4003, 5MF4010, 5MF4011, AND THE BISON BONE IN THE CUT BANK. THE ADDITIONAL STUDY DATA WLL BE FORWARDED TO THE COLORADO HISTORIC SOCIETY FOR THEIR EVALUATION AND A DETERMINATION OF THE PROPER COURSE OF ACTION REQUIRED.

STIPULATION 4

PRIOR TO DISTURBING THE LOWER WILSON AREA THE COLOWYOCOAL COMPANY SHALL PERFORM FURTHER ARCHAEOLOGICAL INVESTIGATIONS ON THE SIX AREAS IDENTIFIED ON MAP 16A AS “UNSURVEYED AREAS.” ADDITIONALLY, COLOWYO WILL BE REQUIRED TO SURVEY ANY OTHER AREAS THAT ARE DETERMINED TO HAVE NO SURVEY OR INADEQUATE SURVEY DATA. THE SIX UNSURVEYED AREAS SHOWN ON MAP 16A ARE ALL WITHIN TOWNSHIP 4 NORTH RANGE 93 EAST AND ARE BASICALLY DESCRIBED AS FOLLOWS:

SW1/4 SW1/4 SECTION 15
SW1/4 SW1/4 SECTION 22
SE1/4 NE1/4 SECTION 28
SW1/4 SE1/4 SECTION 28
E1/2 NW1/4 SECTION 33
W 1/2 SW1/4 SECTION 33

THE ADDITIONAL STUDY DATA WILL BE FORWARDED TO THE COLORADO HISTORIC SOCIETY FOR THEIR EVALUATION AND A DETERMINATION OF THE PROPER COURSE OF ACTION REQUIRED.

STIPULATION 5
WITHIN 30 DAYS AFTER THE APPROVAL OF PERMIT REVISION 02 THE COLOWYO COAL COMPANY WILL SUBMIT A MINOR REVISION TO THE PERMIT TO INCLUDE TWO ADDITIONAL GROUND WATER MONITORING SITES. THE SITES TO BE INCLUDED ARE A7 AND A8 BOTH ALONG THE WEST FORK OF GOODSPRING CREEK.

STIPULATION 6
WITHIN 30 DAYS AFTER THE APPROVAL OF PERMIT REVISION 02 THE COLOWYO COAL COMPANY WILL SUBMIT A MINOR REVISION TO THE PERMIT TO INCLUDE ONE ADDITIONAL SURFACE WATER MONITORING SITE. THE SITE TO BE INCLUDED IS THE UPPER WEST FORK OF GOODSPRING CREEK

STIPULATION 7
THE COLOWYO COAL COMPANY SHALL SUBMIT A TECHNICAL REVISION TO THE DIVISION WHICH PROVIDES AN ANALYSIS OF GROUNDWATER POINTS OF COMPLIANCE AT THE COLOWYO MINE PURSUANT TO RULE 4.05.13(1). THIS ANALYSIS WILL BE DONE IN CONSULTATION WITH THE DIVISION AND WILL INCLUDE A WRITTEN DETERMINATION OF THE NEED FOR GROUNDWATER POINTS OF COMPLIANCE AT THE MINE. IF DEEMED APPROPRIATE, BASED ON THIS ANALYSIS, COLOWYO SHALL ESTABLISH ONE OR MORE POINTS OF COMPLIANCE FOR THE COLOWYO MINE.

STIPULATION 8
NO LATER THAN 15 MARCH 2008 THE COLOWYO COAL COMPANY SHALL SUBMIT A TECHNICAL REVISION TO THE DIVISION CONTAINING A COMPREHENSIVE RECLAMATION PLAN FOR THE EAST PIT, WEST PIT, SECTION 16 PIT, SOUTH TAYLOR PIT, FACILITIES AREA, GOSSARD LOADOUT, AND ALL REMAINING DISTURBANCES AT THE COLOWYO MINE. THE REVISION WILL ELIMINATE OUTDATED METHODS OF RECLAMATION THAT ARE CURRENTLY USED AT THE COLOWYO MINE. FURTHER, THE REVISION WILL ADDRESS DIVISION CONCERNS REGARDING REVEGETATION, SOILS HANDLING, AND SPECIES DIVERSITY SUCCESS STANDARDS, ETC. TO MEET THE CURRENT POST-MINE LAND-USE. CONSULTATION WITH THE DIVISION, THE COLORADO DIVISION OF WILDLIFE, THE BUREAU OF LAND MANAGEMENT AND OTHER APPROPRIATE AGENCIES WILL BE NECESSARY.

STIPULATION 9

PRIOR TO CONDUCTING ANY HIGHWALL MINING IN THE SOUTH TAYLOR PIT, THE COLOWYO COAL COMPANY SHALL SUBMIT A TECHNICAL REVISION TO THE DIVISION INCLUDING A MINING PLAN AND SEQUENCE, A STABILITY ANALYSIS AND A ZERO SUBSIDENCE ANALYSIS AND PLAN. HIGHWALL MINING MAY NOT BEGIN IN THE SOUTH TAYLOR PIT UNTIL THE AFOREMENTIONED REVISION HAS BEEN APPROVED BY THE DIVISION.

STIPULATION 10

PRIOR TO DISTURBING ANY LANDS ALONG THE WILSON CREEK, THE COLOWYO COAL COMPANY SHALL PROVIDE THE DIVISION WITH A DETAILED ANALYSIS AND DISCUSSION OF THE ALLUVIAL VALLEY FLOOR (AVF) THAT HAS BEEN DOCUMENTED IN THE AREA. COLOWYO MUST ALSO PROVIDE A DETAILED PLAN FOR THE RESTORATION OF THE AVF IF AND WHEN IT IS DISTURBED. THIS ANALYSIS MAY BE IN THE FORM OF A STAND-ALONE REVISION OR IT MAY BE CONTAINED IN THE REVISION REQUIRED IN STIPULATION 3. ANY REVISION SUBMITTED MUST BE APPROVED BY THE DIVISION PRIOR TO ANY DISTURBANCE.

OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix C

Air Data Tables

Table 1. Mean Monthly Temperature °F

Monitor	Station Name	Elevation (feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Craig Airport[1]	24046	6191	13.9	20.4	32.5	41.8	50.9	60.5	68.6	65.9	56.5	43.8	32.4	17.4
Meeker Airport[1]	28801	6365	18.9	23.9	30.8	42.4	51.4	61.2	68.7	66.1	57.3	44.6	34.2	20.3
Onsite Gossard[2]	-	-	9.4	19.3	32.1	40.1	49.2	60.0	66.9	64.7	56.3	44.1	32.3	16.5
Onsite North[3]	-	-	20.3	23.1	36.1	41.0	52.0	61.4	69.2	67.6	59.2	46.4	36.1	22.3

1. Data was gathered from the National Climate Data Center from Jan 2005-Dec 2013, www.ncdc.noaa.gov/cdo-wed/datasets
2. Data is onsite from the Gossard Met station from April 2011-April 2013.
3. Data is onsite from the North Met station from July 2008-April 2013.

Table 2. Mean Monthly Precipitation (inches)

Monitor	Station Name	Elevation (feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Craig Airport[1]	24046	6191	0.8	0.6	1.0	1.5	1.4	1.1	0.9	1.0	1.9	1.5	0.9	1.2
Meeker Airport[1]	28801	6365	1.0	0.9	1.1	1.8	1.5	1.1	1.3	1.4	2.2	1.9	1.0	1.0

1. Data was gathered from the National Climate Data Center from Jan 2005-Dec 2013, www.ncdc.noaa.gov/cdo-wed/datasets

Table 3. Mean Monthly Windspeed (m/s)

Monitor	Station Name	Elevation (feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Craig Airport[1]	24046	6191	3.6	3.6	4.0	4.5	4.4	4.3	3.7	4.0	3.8	3.9	3.7	3.5
Meeker Airport[1]	28801	6365	3.0	4.2	4.6	5.0	4.9	4.9	4.4	4.2	4.2	4.4	4.1	3.7
Onsite Gossard[2]	-	-	1.45	2.34	2.95	3.34	3.56	3.00	2.56	2.52	2.16	2.59	2.78	2.16
Onsite North[3]	-	-	4.2	4.5	4.9	5.3	4.8	4.9	4.1	4.4	4.0	4.7	4.6	4.1

1. Data was gathered from the University of Utah MesoWest site from Jan 2009-Dec 2013, www.mesowest.utah.edu
2. Data is onsite from the Gossard Met station from April 2011-April 2013.
3. Data is onsite from the North Met station from July 2008-April 2013.

Table 4. Mean Monthly Wind Direct (degrees)

Monitor	Station Name	Elevation (feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Craig Airport[1]	24046	6191	212.5	203.7	208.8	223.5	211.1	203.4	171.8	181.9	207.5	221.7	216.6	211.7
Meeker Airport[1]	28801	6365	163.3	168.4	171.8	191.8	165.7	163.2	146.3	149.1	152.9	172.3	170.1	166.6
Onsite Gossard[2]	-	-	187.6	188.7	188.6	206.3	200.4	202.2	171.9	184.4	201.0	203.3	200.0	197.1
Onsite North[3]	-	-	222.4	228.8	221.6	191.1	220.8	219.4	212.5	218.3	234.2	232.0	219.8	224.1

1. Data was gathered from the University of Utah MesoWest site from Jan 2009-Dec 2013, www.mesowest.utah.edu
2. Data is onsite from the Gossard Met station from April 2011-April 2013.
3. Data is onsite from the North Met station from July 2008-April 2013.

Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine

	Facility Name	$PM_{2.5}$ (tpy)	PM_{10} (tpy)	CO (tpy)	NOx (tpy)	SO_2 (tpy)	VOC (tpy)	Lead (tpy) Not Repo	Distance from Colowyo (km)
1	3B ENTERPRISES, LLC - DEAKINS PIT	1.353	4.6						42.3
2	4B LAND & LIVESTOCK- BREEZE BASIN S&G PI	4.088	13.9						45.6
3	AXIA ENERGY - BAR NONE (20-12H-892)	0.187	0.187	12.173	4.018		27.696		46.9
4	AXIA ENERGY - MCINTYRE COMPRESSOR STAT.	1.582	1.582	49.998	29.515		35.226		41.4
5	AXIA ENERGY - RIDGELINE PAD (26-34H-894)			6.6			38.975		43.8
6	BARGATH LLC - GREASEWOOD CS	1.96	1.96	28.383	96.276	0.118	35.093		46.1
7	BASIN OPERATING - GOVT TRINITY 1-27	0.089	0.089	6.57	6.57	0.006	0.15		31.4
8	BASIN OPERATING COMPANY	0.117	0.113	0.5	6.57	0.002	1.95		32.6
9	BASIN OPERATING COMPANY	0.113	0.117	6.57	8.06	0.008	0.15		32
10	BKEP CRUDE - ILES GROVE						78.77		17
11	BOPCO - YELLOW CREEK FEDERAL #35-12-1	0.02	0.02	3.606	0.523		16.756		49
12	BOPCO, L.P. - YELLOW CREEK #1-35-1	0.02	0.02	3.606	0.523		6.187		48.4
13	BOPCO LP - YELLOW CREEK FEDERAL #1-41-1						91.136		47.5
14	BOPCO, L.P. - YELLOW CREEK FED #27-32-11	0.02	0.02	3.606	0.523		22.038		49.2
15	BOPCO, L.P. - YELLOW CREEK XOM 2-35-1	0.01	0.01	5.29	3.143		5.369		49.5
16	BOPCO, L.P.- YELLOW CREEK #2-42-1	0.02	0.02	3.606	0.523		11.261		48.7
17	BOPCO, L.P.- YELLOW CREEK FED #35-33-1	0.02	0.02	3.606	0.523		18.165		48.5
18	BOPCO, L.P. -YELLOW CREEK FEDERAL 2-22-1	0.01	0.01	5.29	3.143		38.272		49.4
19	BOPCO, LP - YELLOW CREEK BRIDGE PLT.	0.45	0.45	8.702	26.287		20.562		47.8
20	CHEVRON USA - WILSON CREEK GAS PLT	0.007	0.007	10.32	4.94	1	78.392		6
21	CHEVRON USA - WILSON CREEK UNIT 69 TANK						8.1		9.3
22	COLORADO INTERSTATE GAS CO GREASEWOOD	1.92	1.92	24.427	37.048	0.98			45.6
23	CONNELL RESOURCES - WHITE RIVER CITY PIT	7.235	24.598				1.05		34.7
24	CONNELL RESOURCES- LYSTER PIT	0.226	1.749						41.9
25	CUSTOM ENERGY CONST. - BUCK PEAK PLANT	0.008	0.008	1.924	4.733	0.001	3.475		42.1
26	ELAM CONSTRUCTION - GEHRMAN PIT	0.124	0.958						42.8
27	ELAM CONSTRUCTION INC-CRAIG HMA PLT	1.008	4.3	55.6	5.5	5.8	3.2		42
28	ENCANA - ANT HILL UNIT WYATT 25-43						4.279		33.8

Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine

	Facility Name	$PM_{2.5}$ (tpy)	PM_{10} (tpy)	CO (tpy)	NOx (tpy)	SO_2 (tpy)	VOC (tpy)	Lead (tpy) Not Repo	Distance from Colowyo (km)
29	ENCANA - WHITE RIVER FED M-17	0.024	0.024	0.72	8.5	0.001	0.03		30.5
30	ENCANA - WRD FEDERAL 19-13 N BOOSTER ST.						3.363		31.3
31	ENCANA - WRD FEDERAL 31-13			1.337	1.783		0.527		32.5
32	ENCANA - WRD FEE A-29	0.018	0.018	1.3	1.7	0.001	0.5		30.1
33	ENCANA - WRD NORTH BOOSTER STATION						8.9		31.3
34	ENTERPRISE CRUDE - ILES GROVE						3.175		16.9
35	ENTERPRISE GAS PROC - MEEKER GAS PLANT	26.4	26.4	254.063	138.728	205.272	317.662		48.9
36	ETC CANYON PIPELINE - GREASEWOOD	0.11	0.11	14.854	7.008	0.1	17.58		45.8
37	EXXON MOBIL CORPORATION	1.092	3.713						46
38	EXXON MOBIL CORP - WELL #33-29						9		42.1
39	EXXONMOBIL - PCU T35X-11G						1		49.5
40	FEY FAMILY INVESTMENTS DBA GOFER FOODS						0.491		21
41	FLEISCHI OIL CO.						10.15		40.7
42	GREAT DIVIDE DISPOSAL, LLC			9.734	4.636		54.23		49.7
43	Gulfport Energy Corp. - State 33-15			0.968	6.736		7.175		36.2
44	HALLIBURTON ENERGY SVCS		1.872				0.85		35.8
45	HRM RESOURCES, LLC - NOLAND #1-15			1.274	1.699		0.661		42.6
46	JETTA OPERATING CO., INC. - CRAIG 1-7	0.021	0.021	1.468	10.818	0.001	54.91		41
47	KINDER MORGAN - BASS YELLOW CREEK GP			12.26	14.59				47.8
48	KN GAS GATHERING PICEANCE - SEE 103/0037						16.7		40.3
49	KOCH - ANT HILL UNIT 13-43						19		33.3
50	KOCH - ANT HILL UNIT 18-23						2.34		31
51	KOCH - ANT HILL UNIT 18-43						2.215		31
52	KOCH - ANT HILL UNIT 19-44			3.693	2.2		0.096		31.3
53	KOCH - ANT HILL UNIT 8-12						0.609		29.3
54	KOCH - ANT HILL UNIT 8-32						3.11		29.3
55	KOCH - ANT HILL UNIT COUNTY 25-22						2.23		33.9
56	KOCH - ANT HILL UNIT FED 16-22						2.455		28.4

	Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine								
	Facility Name	**$PM_{2.5}$ (tpy)**	**PM_{10} (tpy)**	**CO (tpy)**	**NOx (tpy)**	**SO_2 (tpy)**	**VOC (tpy)**	**Lead (tpy) Not Repo**	**Distance from Colowyo (km)**
57	KOCH - LOVE 17-42			2.33	1.16		0.28		30
58	KOCH - LOVE FEDERAL 17-42						2.4		30
59	KOCH - WRD DOW 20-11						2.84		30.7
60	KOCH - WRD DOW 20-13						3.39		29.8
61	KOCH - WRD FEDERAL 01	0.019	0.019	0.8	2.1	0.001	0.5		32.5
62	KOCH - WRD FEDERAL 19-11			1	2.5		3.135		32
63	KOCH - WRD FEDERAL 29-32			3.693	2.2		0.096		31
64	KOCH - WRD UNIT 29-23			3.659	2.18		0.095		30.5
65	KOCH - WRD UNIT 29-33						24.539		30.7
66	KOCH - WRD UNIT 32-12						3.165		31.3
67	KOCH EXPLORATION - ANT HILL 30-42			3.659	2.18		0.095		32.6
68	KOCH EXPLORATION - ANT HILL UNIT 18-42			1.337	1.783		0.527		31.6
69	KOCH EXPLORATION - ANT HILL UNIT 24-43			3.088	1.834		0.025		33.2
70	KOCH EXPLORATION - MEEKER GAS PLANT	3.052	3.052	53.01	61.76	0.221	68.208		31.5
71	KOCH EXPLORATION - WRD FED B-25			1.337	1.783		0.527		33.3
72	KOCH EXPLORATION - WRD FEDERAL 2-23						0.3		34.6
73	KOCH EXPLORATION - WRD FEDERAL 4-23						6.295		34.4
74	KOCH EXPLORATION - WRD FEDERAL 6-26	0.062	0.062	1.467	14.486		8.19		35
75	KOCH EXPLORATION - WRD FEDERAL 8-26						1.575		34.6
76	KOCH EXPLORATION - WRD FEE A-29-2N-96W			1.286	1.715		0.507		30.1
77	KOCH EXPLORATION - WRD UNIT 20-33			3.659	2.18		0.095		30.2
78	KOCH EXPLORATION - WRD WYATT 25-44						3.857		33.4
79	KOCH EXPOLORATION - WRD WYATT 36-23			1.337	1.783		0.527		34
80	KUM & GO						3.784		42.2
81	KUM & GO						3.505		42.4
82	KUM & GO						3.415		40.9
83	KUM & GO, LC- # 2925						6.313		23.5
84	LAFARGE WEST, INC. - BLAIR MESA MINE	0.55	1.87						43.9

Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine									
	Facility Name	**$PM_{2.5}$ (tpy)**	**PM_{10} (tpy)**	**CO (tpy)**	**NOx (tpy)**	**SO_2 (tpy)**	**VOC (tpy)**	**Lead (tpy) Not Repo**	**Distance from Colowyo (km)**
85	LAFARGE WEST, INC. - BUNN RANCH PIT	6.968	19.848						42.2
86	LOAF N JUG # 869						3.163		40.4
87	MAYBELL ENTERPRISES-JUNIPER MTN LIMESTON	1.114	3.153	2.575	3.919				32.8
88	MEEKER SAND & GRAVEL INC	1.051	8.054						23.1
89	MOFFAT CO LANDFILL		3.15				1.94		36.9
90	MONUMENT OIL CO GO FER FOODS OF CRAIG						2.682		42.4
91	OLDCASTLE SW GROUP - BERRY PIT	1.256	4.27						19.8
92	OVERLAND PASS - DAVIS METER						3.5		45.8
93	OVERLAND PASS - DAVIS/PICEANCE JUNCTION						0.76		46.3
94	OWEN A. GRANT DBA GRANT MORTUARY	0.085	0.1	0.07	0.01	0.002	0.15		41.9
95	PETERSON ENERGY - KNOWLTON BATTERY						32.325		24.3
96	PUBLIC SERVICE CO GREASEWOOD STATION	0.05	0.05	21.5	24.4	0.003	0.17		45.7
97	PUBLIC SERVICE COMPANY INDIAN VALLEY STA	0.664	0.664	11.2	25.04	0.023	10.99		35.7
98	QUESTAR PIPELINE CO - DARK CANYON			0.27	0.13		17.08		45.9
99	QUESTAR PIPELINE CO - GREASEWOOD GULCH	1.413	0.403	1.596	8.943	0.023	3.903		45.6
100	QUICKSILVER - BRET GRANDBOUCHE 24-02H			46.473	9.998		77.137		33.6
101	QUICKSILVER RES. - ANTIETAM 11-12D						3		40.4
102	QUICKSILVER RES. - GAMMA STATE 14-15D			0.784	3.638		3.289		37.2
103	QUICKSILVER RES. - NORTH FORK 43-12						3		39.8
104	QUICKSILVER RESOURCES - ROUNDUP 22-24D			6.406	2.445		11.586		36.7
105	QUICKSILVER RESOURCES - SIMOES 12-30			1.321	1.761		0.52		36.8
106	QUICKSILVER RESOURCES - STODDARD 33-30	0.05	0.08	19.576	5.102		84.728		37.1
107	QUICKSILVER RESOURCES - STODDARD CTB			5.55	1.02		30.302		37.3
108	QUICKSILVER RESOURCES - WEBER 32-04			8.026	2.94		25.559		33.3
109	RIO BLANCO CNTY RD & BRIDGE- BACHMANN PI	0.002	0.019						23.1
110	RIO BLANCO CNTY RD & BRIDGE- SLEEPY CAT	0	0						32.4
111	RIO BLANCO CNTY RD& BRIDGE- PICEANCE PIT	0.003	0.01						36.5
112	RIO BLANCO CNTY ROAD & BRIDGE DEPT		8.2				1.337		34.3

Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine

	Facility Name	$PM_{2.5}$ (tpy)	PM_{10} (tpy)	CO (tpy)	NOx (tpy)	SO_2 (tpy)	VOC (tpy)	Lead (tpy) Not Repo	Distance from Colowyo (km)
113	RIO BLANCO COUNTY ROAD & BRIDGE	1.063	3.615						30.7
114	RN INDUSTRIES - PICEANCE CREEK, RANGELY	0.372	0.372	6.26	5.921	1.879	12.592		29.6
115	ROBERT L. BAYLESS- MOFFAT FIELD BATTERY						10.115		24.4
116	ROBERT L. BAYLESS- YENOM 1 FIELD BATTERY						2.83		25.5
117	ROCKY MNTN PIPELINE SYS- ILES STATION						31.692		17
118	ROCKY MOUNTAIN NAT GAS - PICEANCE	0.92	0.92	36.014	28.292	0.02	40.431		40.3
119	SAM F. LOVE - P&S GRAVEL PIT	3.949	13.425						33.6
120	SAMSON RESOURCES - ALLEN 44-8 #1						2.889		35.6
121	SAMSON RESOURCES - WEST DANFORTH 5A	0.02	0.02	0.32	6.6		0.652		18.5
122	SIMONS PETROLEUM, INC						60.147		41.1
123	SWEPI - DURHAM 7-32 PRODUCTION FACILITY			0.547	1.974		14		31.5
124	SWEPI - HERRING DRAW PRODUCTION FACILITY	0.202	0.202	9.077	5.306		16.92		31.5
125	SWEPI - WT DURHAM 4			0.396	0.528		0.016		30.1
126	SWEPI LP - DEAL GULCH						30.338		35.3
127	SWEPI LP - HARPER HILL PRODUCTION FACIL.						88.927		31.8
128	SWEPI, LP - BEAVER DURHAM						10.996		30.5
129	SWEPI, LP - DURHAM PRODUCTION FACILITY			87.646	2.361		44.996		29.8
130	TRANSCOLORADO GAS TRANS - GREASEWOOD				0.02				46
131	TRAPPER MINING INC	251	852.4	452.25	114.75				35.3
132	TRI STATE GENERATION CRAIG	132.24	190.701	1978.3	13498.5	3961	59.29		35
133	TRUE OIL - BREEZE UNIT 34-8	0.01	0.01		6.53		5.34		48.4
134	WAGNER ROCK, LLC - WAGNER PIT	0.5	1.7						49.3
135	WEST TEXAS - PICEANCE CREEK GP	1.02	1.02	12.04	9.41	0.006	45.403		45.7
136	WESTERN GRAVEL, LLC - WRC GRAVEL PIT	3.221	10.951						33.1
137	WESTON OIL CO						5		41.3
138	WILLIAMS FORK CO	0.84	6.172						34.5
139	WR AGGREGATES - MEEKER PIT	0.603	2.05						20.2
140	WR AGGREGATES - RUSSELL RANCH PIT	0.323	5.388						23.1

	Table 5. 2015 APEN Reporting Sources Within 50 km of the Colowyo Coal Mine								
	Facility Name	**$PM_{2.5}$ (tpy)**	**PM_{10} (tpy)**	**CO (tpy)**	**NOx (tpy)**	**SO_2 (tpy)**	**VOC (tpy)**	**Lead (tpy) Not Repo**	**Distance from Colowyo (km)**
141	WRR SAND & GRAVEL - BLAIR MESA PIT	3.82	3.82						42.8
142	WPX ENERGY - BCU 23-22-198						4.79		49
143	XTO ENERGY - CENTRAL TANK BATTERY						31.826		45.3
144	XTO ENERGY - FEDERAL 1-96-23-12						15.462		37.9
145	XTO ENERGY - FEDERAL 1S-95-20-23						12.692		35.3
146	XTO ENERGY - FEDERAL 1S-96-9-11						11.367		37.5
147	XTO ENERGY - FEDERAL 2S-95-15-22			5.6	17.368		16.631		41.2
148	XTO ENERGY - FEDERAL 2S-95-16-22CP			5.657	2.833		40.731		42.1
149	XTO ENERGY - FEDERAL 2S-95-15-42						28.647		40.9
150	XTO ENERGY - FEDERAL 2S-95-16-33			5.657	2.913		32.322		42.2
151	XTO ENERGY - HATCH GULCH						2.56		48.7
152	XTO ENERGY - NPU 196-19B						11.6		41.6
153	XTO ENERGY - NPU 197-3A (WILD HORSE)						10.796		43.5
154	XTO ENERGY - PICEANCE CREEK UNIT 25X-25G						23.515		45.2
155	XTO ENERGY - PICEANCE CREEK UNIT F23-18G						1.78		48.6
156	XTO ENERGY - PICEANCE CREEK UNIT T22X-8G						1.719		46.2
157	XTO ENERGY - PICEANCE CREEK UNIT T64W-8G						4.537		46.2
158	XTO ENERGY - PINTO GULCH T68-18G						2.315		43.5
159	XTO ENERGY- PICEANCE CREEK UNIT T23X-26G						3.795		47.7
160	XTO ENERGY- PICEANCE CREEK UNIT T33X-29G						17.331		42
161	XTO ENERGY, INC. - PICEANCE CREEK	6.79	7.115	90.02	89.96	7.849	91.711		46.3
162	XTO ENERGY, INC. - PICEANCE CREEK AMINE	0.63	0.63	20.653	9.47	0.05	13.322		46
163	XTO ENERGY, INC. - SHULTS GRAVEL PIT	3.014	9.31	3.29	6.19	1.32	0.65		31.4
	TOTALS	**475.13**	**1251.64**	**3462.78**	**14434.73**	**4185.69**	**2413.19**		

Table 6. Colowyo Coal Company L.P. Customers

COLOWYO COAL COMPANY, LP
HISTORICAL SALES SUMMARY

CUSTOMER	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
	287.9	1,024.4	1,459.4	2,481.7	3,563.9	3,168.2	2,824.8	3,041.6	3,170.6	3,239.5	3,507.6	3,985.6	4,199.8	3,945.9	4,298.8	4,654.8	4,729.7	4,527.5	4,457.8	5,713.5	5,556.1	5,823.4	5,569.5	5,171.2	5,767.6	5,348.4	4,998.6	0.0	106,517.7
AEP(Central Power & Light Co.)			33.1	982.5	1,406.6	1,650.0	1,427.3	1,356.3	1,357.1	1,509.8	1,506.2	1,509.3	1,505.4	1,210.3	1,204.5	1,207.1	1,208.9	1,059.7	640.3	1,621.8	1,502.5	1,325.2	1,050.8	1,052.6	995.2	1,202.4	1,236.7		30,761.6
City of Colorado Springs	219.3	217.0	597.0	416.6	489.2	593.6	567.6	580.7	637.4	538.1	557.3	566.7	540.8	588.2	608.5	600.0	592.3	520.9	650.2	560.7	590.3	579.1	585.8	616.4	610.0	605.1	590.6		14,819.5
Craig Station								603.1	921.9	977.3	1,020.3	1,293.7	1,306.1	1,483.9	1,815.8	2,137.7	2,159.2	2,186.6	2,249.9	2,091.6	2,299.1	2,238.3	2,217.3	2,253.8	2,257.8	2,299.6	2,207.5		36,020.5
Abitibi																								49.4			11.4		60.7
Alliant																								12.6	139.4	200.9	277.1		630.0
American Coal Sales							0.9	1.4	1.3	2.7	3.6	11.3	11.6	17.2	11.7	3.6	1.3	0.8	0.6	0.4	0.3	0.4							69.1
Anaconda Minerals							0.1																						0.1
Arizona Electric Power Co-op																								24.5	408.6	91.4	38.4		562.9
Arizona Public Service																							210.9		148.9	168.9			528.8
Blue Sky Flower Farms								2.1	0.1																				2.2
Calco							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1												0.1
Carbon Energies								0.2																					0.2
Cedar Falls																				1.5									1.5
Celanese																						20.1	209.5	554.3	555.0	558.0	556.8		2,453.6
Central Illinois Public Service																			427.8	22.1									449.9
Central Power & Light Co.					369.3	382.7	525.0												332.5	170.7			83.6						1,863.8
Cerame Coal																										0.1	0.1		0.2
Champion International									81.8	93.9	63.8																		239.5
City of Alliance		0.6																											0.6
City of Ames Iowa		64.6	69.6	51.2	33.7											4.5													223.6
City of Colorado Springs				187.5	228.0								37.9	313.6	294.9	296.0	276.2	308.0			135.2	137.5	120.9	25.6	21.0				2,382.3
City of Colorado Springs (Tuco)																						13.4							13.4
City of Springfield																	79.1												79.1
City Public Service San Antonio																			21.6	10.5		59.1							91.2
Clinton Corn		18.1																											18.1
Coastal States Energy					8.4																								8.4
Colorado-Ute											20.1	253.4	424.1																697.6
Coors Energy														326.5	344.8	391.5	378.0	410.7	51.1										1,902.6
Coors Energy	2.9		4.8	14.5			98.6	50.1	59.3	69.7	325.1	342.1	314.3																1,281.4
Cyprus Amax																				37.3									37.3
Dept. of Public Inst.			0.6																										0.6
Eastern Coal & Coke					56.9																								56.9
Exxon Coal USA																				45.2	21.9								67.1
Farmer's Coop Grain									0.1																				0.1
Fremont Nebraska Utilities						1.6	6.8																						8.4
Great Western Sugar	65.7	77.1	98.9	82.9	3.6	10.0																							338.2
Hughes, L. Coal Corporation									0.1	0.1	0.1				8.0														8.3
Hyland Enterprises																													0.0
Illinois Power		49.5	52.3														20.4												122.2
Intermoutain Power Assoc.																					184.9								184.9
Iowa Public Service		74.9																											74.9
Iowa State University		60.3	85.6	9.8																									155.7
LeHigh Portland Cement			3.8																										3.8
LouBend Coal Yard								0.6	1.0	0.8	0.9	1.3	1.3	1.4	1.6	1.4	1.3	1.1	1.0	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.4		19.4
Martin Marietta				1.6		80.0	54.6	69.5																					205.7
Marubeni				60.7	89.2																								149.9
McDonald																											0.1		0.1
Meeker Sand & Gravel										0.9	1.1	0.8	0.8	0.9	1.1	0.6	0.6	0.8	0.4	0.6	0.4	0.5	0.4	0.2	0.2				10.2
Metro Stevedores					64.8																								64.8
MidAmerican Energy																									25.2				25.2
Minnesota Corn Processors																	7.8	23.0	5.4										36.2
Missouri Public Service																9.0													9.0
MJK Sales & Feed																										0.2	0.1		0.3
Nebraska Public Power		72.4	29.7																										102.1
Nebraska State Penitentiary			0.3				1.5	1.6	7.0	4.5	3.7	7.0	4.9	3.9	7.9	3.4	4.5	6.8	5.8	5.2	5.2	5.9	3.5	6.4	5.5	6.5	5.3		106.3
Nippon Oil																				0.0									0.0
Norit																								0.5					0.5
Northern Coal			3.5	1.2																									4.7
NW States Portland Cement			97.5	189.2	88.4	127.5	35.0	27.5																					565.1
Oxbow																											0.1		0.1
P&M (shipped to CCS)						21.0																							21.0
Pacific Basin										2.2	5.4																		7.6
PacifiCorp																			7.4	135.6						55.8	18.6		217.4
Peabody Energy & Trade																									50.8				50.8
Platte River Power Authority																								21.4	41.6	95.7			158.6
Public Service of Colorado		290.2	378.5	110.3	441.1	234.0		62.8											63.7	98.5	281.9	204.3	494.9	21.7					2,681.9
Salt River Project																				116.8	105.0	58.1				63.4	24.9		368.2
South Dakota State University		8.6		7.5	7.6																								23.7
Sprague Coal & Coke				29.5																									29.5
Ssangyung (USA), Inc.				80.0	248.2																								328.2
St. Regis Paper		0.3	4.2		20.9	67.8	85.2	81.1																					259.5
SW Portland Cement									103.5	39.5																			143.0

H:123data/sales/historicalsalesdatabase (2)

COLOWYO COAL COMPANY, LP
HISTORICAL SALES SUMMARY

CUSTOMER	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	287.9	1,024.4	1,459.4	2,481.7	3,563.9	3,168.2	2,824.8	3,041.6	3,170.6	3,239.5	3,507.6	3,985.6	4,199.8	3,945.9
Tennessee Valley Authority														
Texas Eastman							22.2							
Tristate														
Tuco														
Tucson Electric														
Union Electric		90.8		256.7				201.1					52.6	
Warren Air Force Base								3.5						
Western Coal Sales														

CUSTOMER	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
	4,298.8	4,654.8	4,729.7	4,527.5	4,457.8	5,713.5	5,556.1	5,823.4	5,569.5	5,171.2	5,767.6	5,348.4	4,998.6	0.0	106,517.7
Tennessee Valley Authority						33.1									33.1
Texas Eastman															22.2
Tristate													30.5		30.5
Tuco							20.6	1,180.8	588.7						1,790.2
Tucson Electric				9.1		223.5									232.6
Union Electric															601.2
Warren Air Force Base															3.5
Western Coal Sales					0.1	0.6									0.7

H:123data/sales/historicalsalesdatabase (2)

COLOWYO COAL COMPANY

Coal Sold Year 2004 - 2014

CUSTOMER	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
Alliant	222	138	144	108								252
AEPCO	771	804	804	1,010	808	105						2,727
Buckeye Industrial	9											-
ADA-ES - test		1										-
Celanese	623	520	569	583	537							1,689
Coleto Creek	1,094	1,105	1,166									1,166
Colorado Springs	336			27	27							390
Coors Energy			54	52								106
Entergy		227	606	500	247	53						1,633
Georgia Pacific			10									10
APS Cholla				48	22	26						96
City of Holland, MI				23								23
Peabody - Hayden	72	151										223
Tri State - Craig	2,251	2,260	2,271	2,287	2,212	2,330	2,306	2,316	2,296	2,171	2,375	25,075
Tri State - Spot	891	129	297	303	698	824	277	47				3,466
Tri State - Escalante									23			23
PRPA - Spot				28								28
Salt River Project - Coronado											58	58
Tucson Electric				353	353	151						857
Xcel	107	509	410	295								1,321
Virginia Power - test		20										20
NRG					11							11
												-
Sold	6,376	5,864	6,331	5,617	4,915	3,489	2,583	2,363	2,319	2,171	2,433	44,461

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OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix D

2006, 2007, and 2015 Biological Opinions

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
445 West Gunnison, Suite 240
Grand Junction, Colorado 81501-5711

IN REPLY REFER TO:
ES/GJ-6-CO-15-F-006
TAILS 06E24100-2015-F-0189

August 27, 2015

Memorandum

To: Supervisor, Program Support Division, Field Operations Branch, Office of Surface Mining Reclamation and Enforcement, Denver, Colorado

From: Acting Colorado Supervisor, Colorado Ecological Services Field Office, Lakewood, Colorado

Subject: Biological Opinion on the Approval of a Mining Plan Modification for the South Taylor/Lower Wilson Area at the Colowyo Coal Mine

This memorandum and the attached Biological Opinion (BO) responds to the Office of Surface Mining Reclamation and Enforcement (OSMRE) request for reinitiation of consultation with the Fish and Wildlife Service (Service) on effects of the subject project to species and habitats listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; [Act]). OSMRE's request dated August 5, 2015, and received electronically on August 7, 2015, included a biological assessment (BA) entitled *Reinitiation of Consultation for the Colowyo Coal Company, L.P. "Colowyo" Mine, Permit C-81-019 – South Taylor/Lower Wilson Mining Area, Permit Revision PR-02*, dated August 5, 2015. The BA was subsequently amended with additional information and transmitted to us electronically on August 13, 2015. After revision of the project description, a new BA (OSMRE 2015a) and consultation request was delivered on August 26, 2015. OSMRE analyzed the effects from the subject project to a number of listed species in the BA; the final determinations of OSMRE are presented below.

Species	Listing status	Determination
Colorado pikeminnow (*Ptychocheilus lucius*)	endangered, critical habitat	likely to adversely affect
razorback sucker (*Xyrauchen texanus*)	endangered, critical habitat	likely to adversely affect
humpback chub (*Gila cypha*)	endangered, critical habitat	likely to adversely affect
bonytail (*Gila elegans*)	endangered, critical habitat	likely to adversely affect
western yellow-billed cuckoo (*Coccyzus americanus*)	threatened	not likely to adversely affect
western yellow-billed cuckoo (*Coccyzus americanus*)	proposed critical habitat	not likely to destroy or adversely modify
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	threatened	no effect

In addition to the species listed above, effects to other listed species were analyzed in the original consultations, as described in the Consultation History section below and in the BA. OSMRE determined none of the other species would be adversely affected or affected any differently by the subject project. Therefore, reinitiation of consultation was not requested and is not necessary for these species.

The Service has prepared a BO with a finding that the proposed project is not likely to jeopardize the four endangered fish, nor is it likely to destroy or adversely modify their critical habitats (attached). We also concur (below) with OSMRE's determinations for the western yellow-billed cuckoo (cuckoo) and its proposed critical habitat.

For the Ute ladies'-tresses orchid, we acknowledge your determination of no effect, but neither 7(a)(3) of the Act, nor implementing regulations under section 7(a)(2) of the Act require the Service to review or concur with this determination; therefore the Service will not address this species further. However, we do appreciate you informing us of your analysis for this species even if not required to do so under the Act

Concurrence for western yellow-billed cuckoo and its proposed critical habitat

No cuckoos have been found at or near the Colowyo Mine or the Craig Generating Station. Cuckoo habitat is not present at or near these facilities. Critical habitat has been proposed for the western yellow-billed cuckoo (79 FR 48547), including a unit along the Yampa River near Craig. Cuckoos and their proposed critical habitat are found within the airshed analyzed for mercury deposition from the Craig Generating Station, as outlined in the BA and discussed in our BO below.

We have records of only four cuckoos from the Yampa proposed critical habitat unit. The most recent observation was from 2008. We do not know whether any of these cuckoos were nesting or not. There is potential for contamination of cuckoo insect prey items and habitats from mercury emissions from the Craig Generating Station. However, we have no data on mercury levels from cuckoos or their prey in this area. Aquatic insects are more likely to accumulate mercury from the environment than terrestrial insects due to the mercury methylation process which takes place in the presence of anoxic lentic environments (Sandheinrich and Wiener 2011). Aquatic insects (e.g., dragonflies, caddisflies) are only a minor component of a cuckoo's diet (79 FR 48587).

Although the boundary of the Yampa proposed critical habitat unit has been identified and mapped, additional information on the spatial arrangement of the primary constituent elements (PCEs) within the unit would improve conservation planning for the cuckoo. As described in the BA, Colowyo will fund an effort to delineate which portions of proposed critical habitat along the Yampa River contain these different habitat features. This mapping effort will refine our knowledge of the habitat composition of the unit and improve targeting of future occupancy surveys. Colowyo will have a habitat mapping methodology developed and implemented in coordination with the Service. The relevant scientific literature will be reviewed to determine the vegetation component, distance to water, and patch size requirements for the western yellow-billed cuckoo. Data used would come from existing data sets already developed and available including the latest aerial imagery (of primary importance), Southwest Regional Gap

Analysis habitat data, The Nature Conservatory, Colorado Parks and Wildlife (CPW) habitat suitability data, and any other currently available agency data, as needed. A ground-truth effort on publically accessible land would be conducted to facilitate the assessment of vertical integration of the mid-story vegetation layers that are difficult to detect remotely. The mapping effort would produce a report on established methods, results, and GIS mapping classification of the proposed critical habitat into areas of "good," "moderate," and "unsuitable" habitats. Colowyo will fund the mapping effort at a cost not to exceed $10,000.00. A preliminary habitat map of the Yampa unit will be prepared by June 15th, 2016, prior to the start of cuckoo survey season. The final project would be completed by mid-summer, 2016, but no later than August 31, 2016.

You have determined that your proposed action may affect, but is not likely to adversely affect the cuckoo. You have also determined that your proposed action is not likely to destroy or adversely modify proposed critical habitat for the cuckoo. We concur with your determinations. We base our concurrence on the rationale provided in the BA and additional Service review and analysis. We would like to point out, however, that many questions remain regarding the cuckoo's status and the potential contaminant levels in the action area; new information could lead to different conclusions in the future. We conclude informal consultation under section 7 of the Act for the cuckoo and its proposed critical habitat. Further consultation pursuant to section 7(a) (2) of the Act is not required at this time. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the BO; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action.

In accordance with section 7 of the Act and its implementing regulations, this BO incorporates the best scientific and commercial information available on the effects of the proposed action to federally listed species and their critical habitats, including from the mining and combustion of coal resulting in mercury and selenium emissions and subsequent deposition and accumulation in listed species within the Yampa and White River Basins. A complete record of this consultation is on file at the Service's Western Colorado Ecological Services Field Office, in Grand Junction, Colorado.

If you have questions regarding this consultation, please contact Creed Clayton at (970) 628-7187.

BIOLOGICAL OPINION
On effects to the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail
from
Permit Revisions for the Colowyo Coal Company, L.P. "Colowyo" Mine– South Taylor/Lower Wilson Mining Area

TAILS No. 06E24100-2015-F-0189

Colorado pikeminnow (*Ptychocheilus lucius*)

FISH AND WILDLIFE SERVICE
Mountain Prairie Region
Grand Junction, Colorado

Acting Colorado Supervisor, Ecological Services ____________________

Date 8/27/15

Purpose of this Document

In 1973, Congress passed the Endangered Species Act (ESA) in order to "*...provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved...*" (ESA section 2). Included in section 7 of that Act, is the requirement that every federal agency must insure that any action "*…authorized, funded, or carried out… is not likely to jeopardize the continued existence of any endangered or threatened species…*". To meet this requirement, Congress required that the action agencies request assistance from the U. S. Fish and Wildlife Service (Service) and seek their biological opinion (BO) regarding whether the proposed action is likely to jeopardize the continued existence of a listed species.

This document, is that required examination of the OSMRE's proposed action (approval of a mining plan) and the Service's BO on the proposed action's effects to the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail (four endangered fish). This BO also determines whether the proposed action would destroy or adversely modify critical habitats for the four endangered fish.

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02; instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat (Service 2004). This consultation analyzes the effects of the action and the relationship of those effects to the function and conservation role of critical habitat for the four endangered fish to determine whether the current proposal destroys or adversely modifies critical habitats for these species.

Background

As a result of a legal challenge (*WildEarth Guardians v. U.S. Office of Surface Mining et al.*, Case 1:13-cv-00518-RBJ (D. Colo. 2015)), the District Court of Colorado required OSMRE to review their action (including any effects from that action) and complete additional analysis under the National Environmental Policy Act (NEPA). OSMRE was given 120 days (until September 5, 2015) to complete that analysis. The court's findings also indicated that the indirect effect of combustion at the Craig Generating Station, from coal mined under the plan should be considered as "reasonably foreseeable" under NEPA and should be included in the NEPA analysis. The Court's direction to explore those indirect effects under NEPA has the unintended consequence of leading to a potential examination of these effects under section 7 of the Act.

Indirect effects under regulations implementing section 7 of the Act are defined as "...those that are caused by the proposed action and are later in time, but still are reasonably certain to occur." (Emphasis added.) This definition differs from the NEPA phrase "reasonably foreseeable." This difference may reflect a distinction between the procedural nature of NEPA vs. the substantive nature of section 7 and is touched on briefly in the Federal Register notice finalizing the 1986 regulations on conducting section 7 consultation (FR June 3, 1986, Volume 51, No. 106, p. 19933).

OSMRE does not have discretion or authority over determining where the Colowyo mined coal is taken to be combusted. It also does not have discretion or authority regarding the manner in which the coal will be combusted. In the past, the Tri-State Generation and Transmission Association, Inc. (Tri-State), has made the decision to purchase this coal (along with coal from other sources) and combust it at the Craig Generating Station to produce power. This decision space in between OSMRE's plan approval and the combustion of the coal at the Craig Generating Station may make the causal connection somewhat less than reasonably certain. However, OSMRE has assumed (for analysis) the causal connection for indirect effects. The Service therefore, will base our analysis on that assumption.

Consultation History

By statute and regulation, formal consultation and delivery of a BO must be completed in 135 days (CFR 50 402.14(e)). To meet the needs of OSMRE resulting from the Court's direction regarding the NEPA analysis, this BO needed to be expedited and completed before September 5, 2015.

A first draft biological assessment (BA) was delivered to the Service on July 23, 2015. The Service returned comments the next day on July 24, 2015. Another draft was delivered to the Service on July 31, 2015. The Service returned comments on August 3, 2015. The final BA and request for formal consultation was received on August 6, 2015. The Service pointed out a few additional needs for correction; as a result a revised request for consultation was received on August 7, 2015, and the revised final BA was received in our office on August 13, 2015 (BA still dated August 5, 2015).

On August 21, 2015, OSMRE determined that it was appropriate to revise the project description and consultation request, removing consideration of the Collom expansion area. The original August 6 consultation request was for two mining areas at the Colowyo Mine, which included the Collom Expansion area. The new consultation request received on August 26, 2015, is only for coal mined at the South Taylor/Lower Wilson mining area.

This section 7 consultation is a reinitiation of a past consultation involving the South Taylor/Lower Wilson coal at the Colowyo Mine. Section 7 consultation was initiated in 2006 on the impacts associated with mining and reclamation operations at the South Taylor/Lower Wilson Permit Expansion area (Permit Revision [PR]-02) by Colowyo, the project applicant. The Service produced a final BO on March 9, 2007, (Service 2007) with the determination that the proposed action was not likely to jeopardize the continued existence of the four endangered fish and was not likely to destroy or adversely modify their critical habitats. The four endangered fish and their critical habitats would be adversely affected by a total water depletion of 554.48 acre-feet/year from the upper Colorado River system for use at the mine. This consultation summed up all previous water depletions that had taken place, starting back in 1988, for which a depletion payment had been made for recovery projects administered by the Upper Colorado River Endangered Fish Recovery Program (Recovery Program). No other threatened or endangered species were determined to be adversely affected.

The water depletions analyzed in the 2007 BOs have not changed with the expanded project description that is the subject of this consultation. Given that the amount of water to be depleted has not changed, and the effects of those water depletions has not changed, water depletions are not addressed further in this BO. We reexamined the information and our conclusions contained in the 2007 BO and find that they remain valid.

As further discussed below, this BO addresses the effects to the four endangered fish and their critical habitats from contaminants released from coal combustion and mine discharge, which were not previously addressed.

In the current BA, OSMRE analyzed effects of the action to the Ute ladies'-tresses orchid (*Spiranthes diluvialis*) and has determined that mining at the South Taylor/Lower Wilson area would have no effect on this species. Therefore, no consultation or reinitiation of consultation for this species is required.

OSMRE did not address the western yellow-billed cuckoo in their consultation request or BA for the South Taylor/Lower Wilson mining area in 2006. However, given that the western yellow-billed cuckoo was listed as threatened under the ESA in 2013 (78 FR 61621), and critical habitat was proposed for the cuckoo along the Yampa River near Craig in 2014 (79 FR 48547), the cuckoo and its proposed critical habitat were addressed for this consultation in the BA. Effects to the cuckoo are not evaluated in this BO, however, as OSMRE determined that they would not be adversely affected. Our concurrence with this determination is provided in the associated memorandum above.

Past consultations involving water depletions and their effects on endangered fish from operation of the Craig Generating Station were also conducted with the Rural Electrification Administration (REA) within the United States Department of Agriculture (USDA). On March 13, 1980, the Service issued a BO on the depletion of 6,400 acre-feet/year of water from the Yampa River for operation of the Craig Station Unit 3 Power Plant. To satisfy requirements of the 1980 BO, a water management plan was developed, including limited water diversions during baseflow conditions. The final water management plan was approved on April 15, 1992, and the Service stated that, with implementation of the water management plan, operation of the Craig Station Unit 3 power plant was not likely to jeopardize the continued existence of the endangered fishes. Section 7 consultation for Units 1 and 2 was carried out in 1973-1974.

1.0 PROPOSED ACTION

The Proposed Action includes future mining at the South Taylor/Lower Wilson Permit Area, and the interrelated activity of burning the mined coal at the Craig Generating Station. The Court in *WildEarth Guardians* determined that coal combustion at the Craig Generating Station was a reasonably foreseeable indirect effect under NEPA of the South Taylor/Lower Wilson mine plan authorization. OSMRE does not have discretion or authority over determining where the mined coal is taken to be combusted. It also does not have discretion or authority regarding the manner in which the coal will be combusted. In the past, the coal has been combusted at the Craig Generating Station. This decision space in between the OSMRE plan approval and the combustion of the coal in Craig Generating Station makes the causal connection less than reasonably certain. However, for this section 7 consultation, OSMRE is assuming that the approval of the Colowyo mining plans would logically lead to mining and local combustion of the coal, therefore those potential impacts of burning the coal mined from the South Taylor/Lower Wilson area at the Craig Generating Station are included in this consultation.

Reinitiation of consultation with the Service for the coal mining project at the Colowyo Mine was requested by OSRME because the effects to listed species stemming from coal combustion, as an indirect effect of mining, were not previously analyzed. In the BA OSMRE finds that combustion of the coal mined at the Colowyo Mine is a reasonably foreseeable future action. However, the Colowyo Mine and the Craig Generating Station are independent operations with independent utility; Colowyo could sell coal to a different power plant, and the Craig Generating Station could and does purchase coal from different mines.

The Colowyo Mine, located approximately 10 miles south of the Yampa River, is not located near suitable habitat for the endangered fish. The Craig Generating Station is located approximately 1.1 miles south of the Yampa River just downstream from the town of Craig.

1.1 Action Area

The description of action area is informed by the following definitions.

Action – "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies….. or (d) actions directly or indirectly causing modifications to the land, water, or air." (50 C.F.R. § 402.02)

Action Area – "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." (50 C.F.R. § 402.02)

Effects of the action – *" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline….* **Indirect effects** *are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.* **Interrelated actions** *are those that are part of a larger action and depend on the larger action for their justification.* **Interdependent actions** *are those that have no independent utility apart from the action under consideration."* (50 C.F.R. § 401.02) [Emphasis added]

Based on the area where "modifications to the land, water, or air" (directly or indirectly) from this proposed action occur and can be perceived, the action area for this BO covers: 1) the Colowyo Mine, 2) the topographic mercury deposition airshed (airshed) (Figure 9 in BA), and 3) the Colorado River Fish Analysis Area (Figure 9 in BA), which includes the Yampa and White Rivers adjacent to, and downriver from, the airshed. This includes the critical habitats designated for all four endangered fish species found along the Yampa and White Rivers down to where each meets the Green River. The airshed encompasses the Colowyo Mine and Craig Generating Station and was delineated using topographic features. It extends out approximately 25-50 miles from the Craig Generating Station, and generally encompasses the area from

Steamboat Springs west nearly to Dinosaur National Monument, and from the town of Meeker north to the Elkhead Mountains. The airshed includes portions of Moffat, Rio Blanco, Routt, and Garfield Counties. Defining the air quality region of impact through a topographic airshed methodology allows for an assessment that utilizes the theoretical motion of the atmosphere, the blocking features of local topography and the location of emissions sources.

1.2 Mining

Coal has been mined on a commercial scale in the Colowyo Coal Mine area for over 100 years. Coal was mined by underground mining techniques continuously until 1974 when the underground mines closed. In 1977, Colowyo initiated its first surface mining operation at the Colowyo Coal Mine, to access thinner coal seams located closer to the surface than the seams historically developed through underground mining (OSMRE 2015b).

According to the BA, mining in the South Taylor/Lower Wilson Permit Expansion area (PR-02) commenced in 2008 and has continued uninterrupted since then. The remaining life of the mine in this area involves operations from 2015-2019. Under the proposed action, nearly all ground-disturbing activities have occurred and all of the facilities have been constructed. All disturbance related to the actual mining of coal has already occurred (789 acres), however, approximately 20 acres of disturbance will occur during future reclamation activities in order to match the pit to the contour of the surrounding landscape. Mining coal here involves one open pit--the South Taylor pit, spoil stockpiles, roads, a power line, a building, fueling station, diversion ditches, and sediment ponds. The South Taylor pit has produced approximately 10.3 million tons of coal at an average rate of 1.47 million tons per year (mtpy). There are approximately 12.7 million tons of coal remaining to be mined in this area.

1.3 Coal Combustion

The destination of the coal, once mined, is not under the jurisdiction of OSMRE. However, much of the coal produced at the Colowyo Mine (South Taylor and West pits) since 2008 has been sent to the Craig Generating Station in Craig, Colorado. The Craig Generating Station is a coal burning power plant that was constructed between 1974 and 1984 (Units 1, 2, and 3 were completed in 1980, 1979, and 1984 respectively). It generates approximately 1,303 megawatts at peak capacity.

Combustion of coal releases the following pollutants: sulfur dioxide, particulate matter, nitrogen oxides (NOx), mercury (Hg), selenium, and carbon dioxide. The Craig Generating Station, along with all coal fired power plants, has measures in place that reduce mercury and other emissions. Environmental control equipment at the station includes:

- Wet limestone scrubbers on Units 1& 2 to remove sulfur dioxide.
- Fabric filter "baghouse" on all Units to control particulate matter.
- Dry limestone scrubber on Unit 3 to remove sulfur dioxide.
- Low nitrogen oxide burners with over fire air on all three Units.
- Mercury emission control on Unit 3, installed in 2014/2015. (Units 1 and 2 do not require mercury controls as they qualify as low emitters under the Environmental

Protection Agency's (EPA) Mercury and Air Toxics Standards (MATS) rule for power plants.)

Selective Catalytic Reduction (SCR) emission controls are also planned to be constructed on Units 1 and 2 for NOx reduction by 2018. While not specific to mercury, the SCRs will provide the additional benefit of capturing some mercury before it is emitted. However, the amount captured is not known. Selective Non-Catalytic Reduction is also planned to be installed on Unit 3 for NOx reduction by 2018.

As stated in the BA, emissions of sulfur dioxide, nitrogen oxides, and particulates are not expected to affect listed species in the action area. We agree. Of the contaminants listed above, mercury is of greatest concern for endangered fish, which is discussed further in the Effects of the Action section along with Selenium. The emissions information that follows here therefore pertains to mercury and selenium.

1.3.1 Mercury

Coal produced at the Colowyo Mine has been sampled for heat content as well as mercury content. As stated in the BA, the coal generally has a heat content of 10,275 British thermal units per pound (btu/lb) and a mercury emission factor of 2.31 lb/10^6 btu. Therefore, in an uncontrolled setting (i.e. burned without environmental control equipment) and under a combustion rate of 4 mtpy, approximately 188 lbs (85.2 kg) of mercury would be produced in one year from Colowyo coal. As noted above, the Craig Generating Station has mercury emissions controls on Unit 3. In Unit 3 at the Craig Generating Station, there is an emission factor of 1.08 lb/10^9 btu after all controls are included. This indicates that the environmental controls in place at Craig Generating Station remove a large amount of the potential mercury contained in the coal. Because mercury deposition and concentration quantities are measured in metric units, all further emissions in this BO are reported in kg. Based on data from the EPA, the Craig Generating Station has emitted between 14 and 59 kg of mercury annually between 2007 and 2013 with 19.2 kg emitted in 2013 (the last year data is available) (NAPD 2015, as cited in BA). Between the 2008 and 2009 reports, the amount of mercury emitted dropped significantly due to actual data being recorded at the station rather than reporting estimates made through modeling efforts. Actual data from emissions testing shows that the previously used EPA emission factors overestimated the amount of mercury emissions being reported (BA, p. 9).

Not all of the coal combusted at the Craig Generating Station comes from Colowyo or the South Taylor/Lower Wilson Project. Assuming a 4 mtpy maximum of coal combusted at the Craig Generating Station from Colowyo and with the latest emission factors at Craig Station, 16.3 kg of mercury would be emitted annually from coal mined at Colowyo from the South Taylor/Lower Wilson area. The Environmental Assessment (EA) in progress for the South Taylor/Lower Wilson project contains detailed descriptions of how these emissions were calculated (OSMRE 2015b).

As stated in the BA, it is not clear that mercury emissions from the Craig Generating Station would be affected if the South Taylor/Lower Wilson Project did not go forward. The Craig Generating Station can access other sources of coal and has done so in the past (BA p.10). The

BA states that 16.3 kg/year of mercury would be emitted by burning South Taylor/Lower Wilson area coal (2015-2019). However, it is possible that emissions of mercury and other contaminants from the Craig Generating Station would not change over this time period even if the South Taylor/Lower Wilson Project did not go forward, due to the possibility of burning other coal instead. Nevertheless, the court determined that the combustion of coal at the Craig Generating Station is a reasonably foreseeable indirect effect (under NEPA) of OSMRE's approval of the mine plan modification for the South Taylor/Lower Wilson Permit Expansion Area, proposed by Colowyo, and thus, coal combustion is analyzed in the BA and is considered by OSMRE to be part of the action for which OSMRE has requested section 7 consultation.

1.3.2 Selenium

In addition to mercury deposition from the combustion of coal, another element known to be emitted is selenium. Selenium, a trace element, is a natural component of coal and soils in the region. While it may be released during combustion, it is not monitored at coal combustion stations to the same degree as mercury. No estimate as to the amount of selenium emitted annually and potentially deposited into the area was made in the BA. However, according to the BA, when Colowyo coal was last tested, it contained below 1 microgram of selenium per gram of coal (µg/g), which is the detection limit. Thus, selenium amounts in the coal, if any, were smaller than could be measured with the equipment used. It was last tested for selenium in March 2015.

1.4 Applicant Committed Conservation Measures

Conservation measures are actions that will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review. As part of the proposed action, Colowyo has committed to the conservation measures below that are intended to advance the scientific information on the potential effects of coal combustion to the affected species. Also included are measures intended to improve the status of the four endangered fish by supporting the recovery program established for the conservation of these species

"These broad conservation measures are not project specific, but provide a programmatic approach to address the potential harm related to combustion emissions. These conservation measures will provide a basis for better understanding the nature of the threats to the species from combustion emissions and are intended to provide conservation measures applicable to impacts from current and future projects proposed by Colowyo, for which OSMRE has initiated or completed review, at the existing, state-permitted Colowyo Mine."

The following conservation measures will be implemented for the direct benefit and ultimate conservation of the endangered Colorado River fish in the Yampa and White River basins. By being included in the proposed action these conservation measures are now mandatory commitments of the project proponent. As described in the BA, the applicant has committed to the following conservation measures:

1) ***Species Preservation and Recovery Actions Funding.*** Colowyo will contribute $50,000 to the National Fish & Wildlife Foundation (NFWF) to implement recovery actions overseen by

the Recovery Program. This measure would directly benefit the endangered Colorado River fish species in the two rivers impacted by mining and combustion of coal mined at the Colowyo Mine. Funding will be provided within 30 days of receipt of the South Taylor/Lower Wilson mining plan approval from OSMRE. The funds are to be directed toward the control of nonnative fish species in both the Yampa and White River's designated critical habitat for the Colorado Pike Minnow, or to support other recovery activities that directly benefit the endangered fish in the action area such as habitat improvement.

2) ***Mercury Deposition Modeling.*** Due to the uncertainty of understanding about where all of the mercury that is being deposited into the Yampa and White River Basins originates from, Colowyo and their parent organization Tri-State, have committed to funding a study to further develop the knowledge of mercury source attribution for future decision making. The overall goal of this effort is to improve the amount of information available to researchers and policy makers regarding mercury in the Yampa and White River basins.

   The Electric Power Research Institute (EPRI) will conduct an air quality deposition modeling analysis to determine the sources of mercury being deposited in the Yampa and White River basins in northwest Colorado. Mercury is a global pollutant and may undergo atmospheric transport over both short and very long (intercontinental) distances depending on its chemical form. The attribution of sources contributing to mercury deposition in the Yampa and White River Basins will be determined from modeling conducted at multiple geographic scales: global, regional and local. As done by EPRI in the San Juan River Basin (EPRI 2014), a global mercury model, GEOS-Chem (Goddard Earth Observing System Chemistry), will be applied to provide concentrations of mercury in the United States due to distant sources. The CMAQ model (Congestion Mitigation and Air Quality) and CMAQ-APT (CMAQ with Advanced Plume Treatment) model will be used by EPRI to simulate emissions and deposition at a finer scale. At the local level individual sources will be modeled to determine their contribution to loading in the analysis area. The atmospheric models keep track of which sources or source categories contribute to eventual deposition by "tagging" or labeling each unit of mercury by where it originated. Tags are carried along with the calculations for deposition so that the analysis of deposited mercury into the local analysis area can show how much and from which sources. Deposition receptors will be identified in the local scale modeling.

   The deposition modeling and source attribution analysis for the Yampa and White River basins will be conducted similar to the deposition modeling and source attribution analysis performed for the San Juan River Basin Project in the Four Corners region. The analysis will consider anthropogenic and natural sources of mercury deposition and will model the transport, chemical transformation and deposition of mercury under both wet and dry conditions. Colowyo will fund the deposition modeling analysis to an amount not to exceed $224,000.00. The modeling effort will be initiated within 30 days of the approval of the mining permit and will be completed within 24 months. Information gathered from this modeling effort will fill an obvious gap in the information available for the protection of the endangered Colorado River fish species from contaminants. Results of the study will aid in planning for the recovery of endangered fish and other listed species potentially affected by mercury contamination in the Yampa and White River Basins.

2.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

The purpose of this section is to summarize the best available information regarding the current range wide status of the listed fish species. Additional information regarding listed species may be obtained from the sources of information cited for these species. The latest recovery goals for all four endangered fish, which provide information on species background, life history, and threats, can be found on the internet at: http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-goals.html.

2.1 Colorado Pikeminnow

2.1.1 Species description

The Colorado pikeminnow is the largest cyprinid fish (minnow family) native to North America and evolved as the main predator in the Colorado River system. Individuals begin consuming other fish for food at an early age and rarely eat anything else. It is a long, slender, cylindrical fish with silvery sides, greenish back, and creamy white belly (Sigler and Sigler 1996). Historically, individuals may have grown as large as 6 ft long and weighed up to 100 pounds (estimates based on skeletal remains) (Sigler and Miller 1963), but today individuals rarely exceed 3 ft or weigh more than 18 lbs (Osmundson et al. 1997).

The species is endemic to the Colorado River Basin, where it was once widespread and abundant in warm-water rivers and tributaries from Wyoming, Utah, New Mexico, and Colorado downstream to Arizona, Nevada, and California. Currently, wild populations of pikeminnow occur only in the Upper Colorado River Basin (above Lake Powell) and the species occupies only 25 percent of its historic range-wide habitat (Service 2002b). Colorado pikeminnow are long distance migrators, moving hundreds of miles to and from spawning areas, and requiring long sections of river with unimpeded passage. They are adapted to desert river hydrology characterized by large spring peaks of snow-melt runoff and low, relatively stable base flows.

The Office of Endangered Species first included the Colorado pikeminnow (as the Colorado squawfish) in the List of Endangered Species on March 11, 1967 (32 FR 4001). It is currently protected under the ESA as an endangered species throughout its range, except the Salt and Verde River drainages in Arizona. The Service finalized the latest recovery plan for the species in 2002 (Service 2002b), but is currently drafting an updated revision.

The Service designated six reaches of the Colorado River System as critical habitat for the Colorado pikeminnow on March 21, 1994 (59 FR 13374). These reaches total 1,148 miles (mi) as measured along the center line of each reach. Designated critical habitat makes up about 29 percent of the species' historic range and occurs exclusively in the Upper Colorado River Basin. Portions of the Colorado, Gunnison, Green, Yampa, White, and San Juan Rivers are designated critical habitat. The primary constituent elements of the critical habitat are water, physical habitat, and the biological environment (59 FR 13374).

Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. This includes oxbows, backwaters, and other areas in the 100-year floodplain that provide access to spawning, nursery, feeding, and rearing habitats when inundated. The biological environment includes food supply, predation, and competition from other species.

Recovery of Colorado pikeminnow in the Colorado River Basin is considered necessary only in the Upper Colorado River Basin (above Glen Canyon Dam, including the San Juan, and Green River subbasins) because of the present status of populations and because existing information on Colorado pikeminnow biology support application of the metapopulation concept to extant populations (Service 2002b). As a result, this BO will focus on the status of the Colorado pikeminnow in that unit.

2.1.2 Life history

The Colorado pikeminnow requires relatively warm waters for spawning, egg incubation, and survival of young. Males become sexually mature at approximately 6 years of age, which corresponds to a length of about 400 millimeters (mm) (17 inches (in.)), and females mature 1 year later (Sigler and Sigler 1996).

Mature adults migrate to established spawning areas in late spring as water temperatures begin to warm, with migration events up to 745 river kilometers round-trip on record (463 mi) (Bestgen et al. 2005). Spawning typically begins after peak flows have subsided and water temperatures are above 16° Celsius (°C) (60.8° Fahrenheit (°F)). Mature adults deposit eggs over gravel substrate through broadcast spawning and eggs generally hatch within 4 to 6 days (multiple references in Bestgen et al. 2005). River flows then carry emerging larval fish (6.0 to 7.5 mm long (0.2 to 0.3 in.)) downstream 40 to 200 km to nursery backwaters (25 to 125 mi), where they remain for the first year of life (Service 2002b).

Colorado pikeminnow reach lengths of approximately 70 mm by age 1 (juveniles) (2.8 in.), 230 mm by age 3 (subadults) (9 in.), and 420 mm by age 6 (adults) (16.5 in.), with mean annual growth rates of adult and subadult fish slowing as fish become older (Osmundson et al. 1997). The largest fish reach lengths between 900 and 1000 mm (35 to 39 in.); these fish are quite old, likely being 47 to 55 years old with a minimum of 34 years (Osmundson et al. 1997).

Reproductive success and recruitment of Colorado pikeminnow is pulsed, with certain years having highly successful productivity and other years marked by failed or low success (Service 2002b). The most successful years produce a large cohort of individuals that is apparent in the population over time. Once individuals reach adulthood, approximately 80 to 90 percent of adults greater than 500 mm (20 in.) survive each year (Osmundson et al. 1997; Osmundson and White 2009). Strong cohorts, high adult survivorship, and extreme longevity are likely life history strategies that allow the species to survive in highly variable ecological conditions of desert rivers.

2.1.3 Population Dynamics

The Colorado pikeminnow is endemic to the Colorado River basin, where it was once widespread and abundant in warm-water rivers and tributaries. Wild populations of Colorado pikeminnow are found only in the upper basin of the Colorado River (above Lake Powell). Three wild populations of Colorado pikeminnow are found in about 1,090 miles of riverine habitat in the Green River, upper Colorado River, and San Juan River subbasins (Service 2011a).

We measure population dynamics of Colorado pikeminnow separately in the Green, upper Colorado, and San Juan River basins because distinct recovery criteria are delineated for each of these three basins. In the 2002 recovery plan, preliminary abundance estimates for wild adults in the basins were: upper Colorado River, 600 to 900; Green River, 6000 to 8000; and San Juan River, 19 to 50 (Service 2002b).

UPPER COLORADO RIVER

To monitor recovery of the Colorado pikeminnow, the Recovery Program conducts multiple-pass, capture-recapture sampling on two stretches of the upper Colorado River which are roughly above and below Westwater Canyon (Osmundson and White 2009). In their most recent summary of those data (Osmundson and White 2013, in draft) the principal investigators conclude that during the 19-year study period [1992-2010], the population remained self-sustaining. The current downlisting demographic criteria for Colorado pikeminnow (USFWS 2002b) in the Upper Colorado River Subbasin is a self-sustaining population of at least 700 adults maintained over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-6 (400–449 mm TL), naturally produced fish must equal or exceed mean adult annual mortality (estimated to be about 20 percent). The average of all adult estimates (1992 – 2010) is 644. The average of the five most recent annual adult population estimates is 658. Osmundson and White (2013) determined that recruitment rates were less than annual adult mortality in six years and exceeded adult mortality in the other six years when sampling occurred (Figure 2). The estimated net gain for the 12 years studied was 32 fish ≥ 450 mm TL. Whereas the Colorado River population may meet the trend or 'self-sustainability' criterion, it has not met the abundance criteria of 'at least 700 adults' during the most recent five year period. Updated graphs of Colorado pikeminnow abundance in the Colorado River are shown in Figure 1 (adults) and Figure 2 (subadults) (Service 2015a).

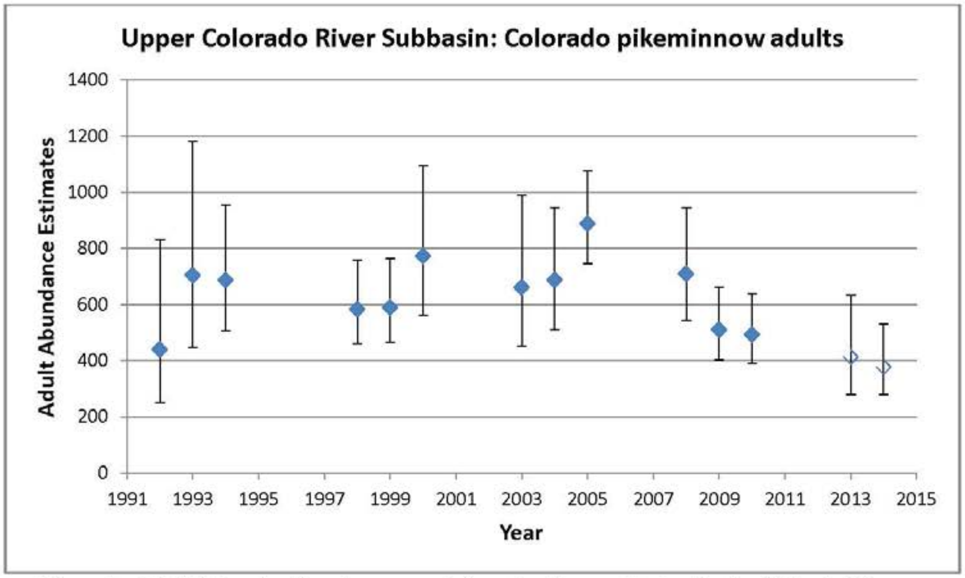

Figure 1. Adult Colorado pikeminnow population abundance estimates for the Colorado River (Osmundson and Burnham 1998; Osmundson and White 2009; 2014). Error bars represent the 95 percent confidence intervals. The 2013 and 2014 data are preliminary and represented by hollow data points.

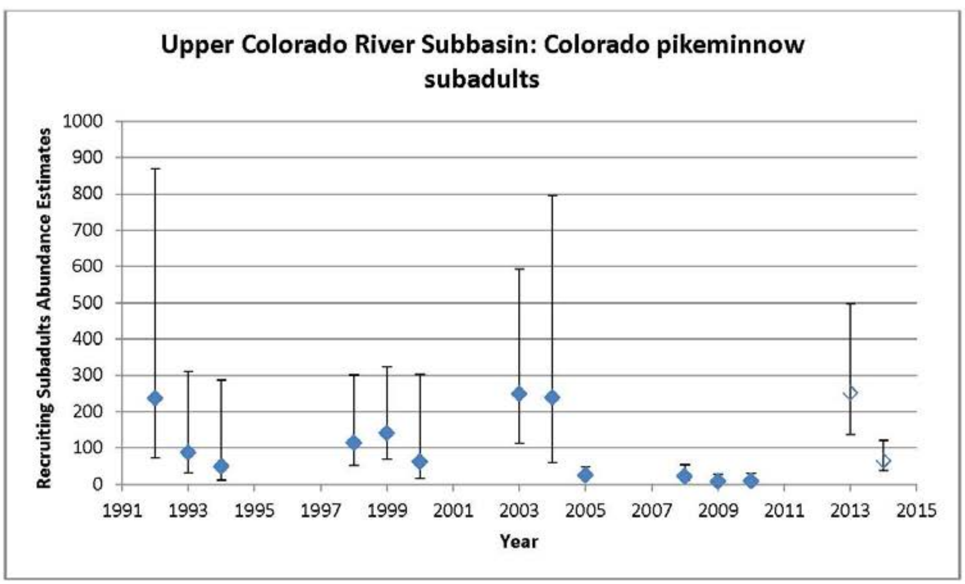

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Figure 2. Colorado pikeminnow recruitment abundance estimates (calculated using the same mark recapture methodology as for the adults) for the Colorado River (Osmundson and White 2009; 2014). Recruits are age-6 (400-449mm TL). Error bars represent the 95 percent confidence intervals. The 2013 and 2014 are preliminary and represented by hollow data points.

To summarize, in the Upper Colorado River Subbasin, the Colorado pikeminnow subpopulation may be self-sustaining, but the number of adults is below the level needed for recovery. Recruitment is quite variable over time, but has exceeded adult mortality in approximately half of the years when measured over the past two decades. The number of age-0 (young of year) Colorado pikeminnow is also quite variable over time, but appears to be less, on average, since the year 2000 than prior to 2000 (Figure 5). Colorado pikeminnow are also generally distributed throughout the Colorado River now to the same extent that they were when they became listed.

GREEN RIVER

Population estimates for adult Colorado pikeminnow in the Green River subbasin began in 2000. Sampling occurs on the mainstem Green River from the Yampa confluence to the confluence with the Colorado River and includes the Yampa and White Rivers. The initial year of sampling did not include the lower Green River (near the confluence of the White River to the confluence with the Colorado River). Beginning in 2001, the sampling regime has consisted of three years of estimates followed by two years of no estimates (Bestgen et al. 2005). The first set of estimates showed a declining trend; however, estimates collected in 2006–2008 showed an increasing trend approaching the level of the estimate made in 2000 (Figure 3) (Bestgen et al. 2010). Data from the third round (2011–2013) of population estimates for the Green River subbasin are still being analyzed (thus no confidence intervals are shown for the 2011–2013 estimates in Figure 3) (Bestgen et al. 2013). Preliminary results from Bestgen (2013) analysis indicate adults and sub-adults are decreasing throughout the entire Green River subbasin (Service 2014).

The downlisting demographic criteria for Colorado pikeminnow in the Green River subbasin require that separate adult point estimates for the middle Green River and lower Green River do not show a statistically significant decline over a 5-year period, and each estimate for the Green River subbasin exceeds 2,600 adults (estimated minimum viable population [MVP] number) (Service 2002b). The average of the first two sets of adult estimates was 3,020 (between 2000 – 2008). The preliminary estimates for 2011-2013 are below 2,600 adults in each year.

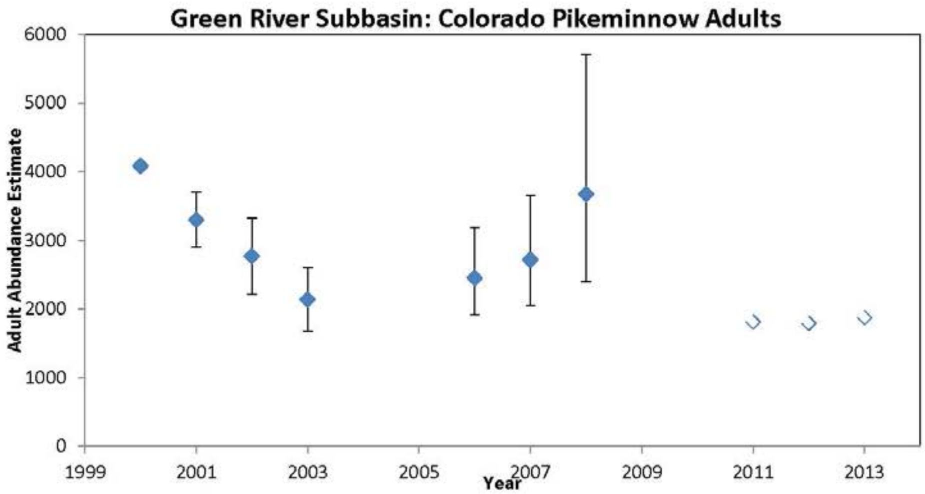

Figure 3. Adult Colorado pikeminnow population abundance estimates for the Green River (2000-2008 estimates from Bestgen et al. 2010; preliminary estimates for 2011-2013 from Bestgen et al. 2013). Error bars represent the 95 percent confidence intervals. In 2000, the lower Green River was not sampled. The data depicted for 2000 incorporates an extrapolated lower Green River contribution to the overall population estimate and therefore lacks a confidence interval.

Another demographic requirement in the 2002 Recovery Goals is that recruitment of age-6, naturally produced fish must equal or exceed mean annual adult mortality. Estimates of recruitment age fish have averaged 1,455 since 2001, but have varied widely (Figure 4). Recruitment has exceeded annual adult mortality in some years, but not others, which falls short of meeting the recruitment recovery goal for the Green River subbasin (Service 2011a; Service 2015a). However, this criterion is currently being revised to allow for a longer tracking period to accommodate natural population fluctuations observed in the Green River population (Service 2011a).

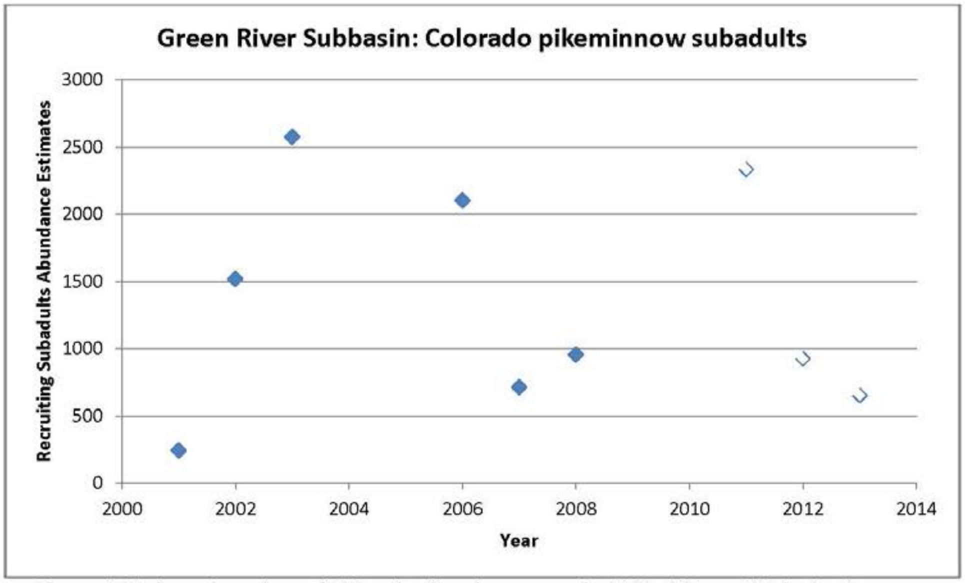

Figure 4. Estimated numbers of Colorado pikeminnow recruits (400–449 mm TL) in the Green River subbasin (Yampa, White, Middle Green, Desolation-Gray Canyons, and Lower Green) for 2001–2013. Data from Bestgen et al. (2010). Estimates of recruitment for the most recent 2011-2013 sampling period are preliminary.

Bestgen et al. (2010) recognized that the mechanism driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats. Osmundson and White (2014) saw a similar relationship between a strong age-0 cohort in 1986 and subsequent recruitment of late juveniles five years later, but that relationship was more tenuous in later years. Researchers are particularly concerned with what appears to be very weak age-0 representation in the Middle Green reach (1999 thru 2008) and in the lower Colorado River (2001 thru 2008) (Figure 5). In some years, the Bureau of Reclamation has released higher summer base flows in the Green River for a few years based on the understanding that this may improve survival of young Colorado pikeminnow and disadvantage smallmouth bass.

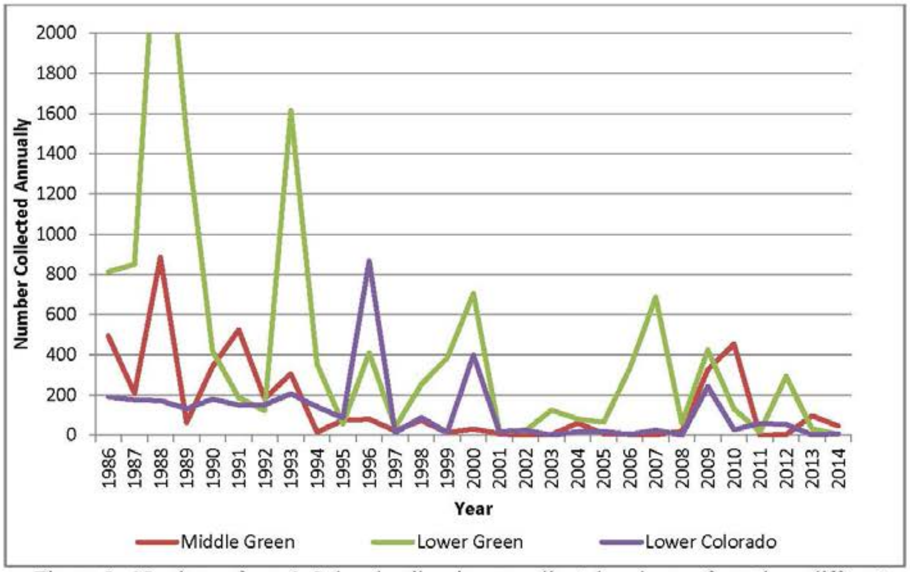

Figure 5. Numbers of age-0 Colorado pikeminnow collected each year from three different habitat reaches of river. A total of 2,892 Age-0 were collected in the lower Green River in 1988; the significance of strong Age-0 cohorts collected in the late 1980's was discussed in Bestgen et al. 2010. Data from Breen et al. 2014.

To summarize, in the Green River Subbasin, the Colorado pikeminnow subpopulation appears to have declined somewhat and the number of adults is below the level needed for recovery. Recruitment is quite variable over time, and has not exceeded adult mortality in all years when measured over the past two decades. The number of age-0 Colorado pikeminnow is also quite variable over time, but fewer have been captured, on average, since the year 2000 than prior to 2000 (Figure 5). Colorado pikeminnow are generally distributed throughout the Green River Subbasin now nearly to the same extent that they were when they became listed, although their numbers have dwindled in the Yampa River and the reach in the White River above the Taylor Draw Dam is no longer occupied (see Baseline section).

SAN JUAN RIVER

Unlike the Green and upper Colorado River Basins, wild Colorado pikeminnow are extremely rare in the San Juan River. Between 1991 and 1995, 19 (17 adult and 2 juvenile) wild Colorado pikeminnow were collected in the San Juan River by electrofishing between RM 142 (the former Cudei Diversion) and Four Corners at RM 119 (Ryden 2000; Ryden and Ahlm 1996). The multi-threaded channel, habitat complexity, and mixture of substrate types in this area of the river appear to provide a diversity of habitats favorable to Colorado pikeminnow on a year-round basis (Holden and Masslich 1997). Estimates made during the seven-year research period between 1991 and 1997 suggested that there were fewer than 50 adult Colorado pikeminnow in a given year (Ryden 2000).

Monitoring for adult Colorado pikeminnow currently occurs every year on the San Juan River. In 2013, 149 Colorado pikeminnow were collected during monitoring from RM 180-77, the eighth consecutive year that more than 100 Colorado pikeminnow were caught in this reach (Schleicher 2014). However, only 7 of these fish were greater than 450 mm (18 in). In addition, 19 Colorado pikeminnow greater than 450 mm (18 in) were collected during the non-native fish removal trips in 2013 (Duran et al. 2014). In order to downlist the species, the San Juan River population of Colorado pikeminnow must reach at least 1,000 Age 5 fish (Service 2002).

The majority of individuals come from hatchery reared stocks supported by the San Juan River Recovery Implementation Program. This program has stocked more than 2 million age 0 and age 1+ fish in the San Juan River since 2002 (Furr and Davis 2009). River wide population estimates for age-2+ pikeminnow that have been in the San Juan River at least one year was approximately 4,600 and 5,400 individuals in 2009 and 2010, respectively (Duran et al. 2010; 2013). However, because few adult Colorado pikeminnow were detected in the San Juan River, this population estimate largely consists of juveniles. Other Colorado pikeminnow abundance estimates exhibit substantial annual variation, likely due to the effects of short-term retention from recent stocking events, but no clear population trends were evident in the San Juan River Basin (Durst 2014).

Successful Colorado pikeminnow reproduction was documented in the San Juan River in 1993, 1995, 1996, 2001, 2004, 2007, 2009-2011, and 2013. A total of 58 larval Colorado pikeminnow were collected since 1993 (Farrington and Brandenburg 2014); however, there has been little to no recruitment documented in the San Juan River. A total of 48 Age-1+ Colorado pikeminnow were collected in 2013; all presumably the result of augmentation efforts (Farrington and Brandenburg 2014). Since 1998, Colorado pikeminnow were collected during small-bodied monitoring every year except 2001-2003; however, young of year (YOY) Colorado pikeminnow were stocked in each of these years prior to monitoring efforts so these fish were likely hatchery-reared (Service 2015b). Larval Colorado pikeminnow detections occurred throughout the San Juan River from Reach 4 (RM 106-130) downstream to Reach 1 (RM 0-16) (Farrington and Brandenburg 2014, Service 2015b). Franssen et al. (2007) found that maintenance of a natural flow regime favored native fish reproduction and provided prey at the appropriate time for Age-1 Colorado pikeminnow.

Tissue samples from Colorado pikeminnow caught during research conducted under the Recovery Program have been analyzed as part of a basin-wide analysis of endangered fish genetics. The results of that analysis indicate that the San Juan River fish exhibit less genetic variability than the Green River and Colorado River populations, likely due to the small population size, but were very similar genetically to pikeminnow from the Green, Colorado, and Yampa rivers (Morizot in litt. 1996). These data suggest that the San Juan population is probably not a separate stock (Holden and Masslich 1997; Houston et al. 2010).

To summarize, the Colorado pikeminnow was quite rare in the San Juan River in the 1990s, with an estimate of less than 50 adults. Since 2002, millions of young Colorado pikeminnow have been stocked into the river. Adult fish are still rather uncommon, however, and not nearly at the level yet needed for recovery. Despite low numbers of adults, reproduction is occurring to some extent, but recruitment is low. Most of the Colorado pikeminnow in the San Juan River are stocked juveniles. Through augmentation, Colorado pikeminnow are generally distributed throughout the San Juan River within critical habitat.

2.1.4 Threats

The Colorado pikeminnow was designated as an endangered species prior to enactment of the ESA, and therefore a formal listing package identifying threats was not assembled. Construction and operation of mainstem dams, nonnative fish species, and local eradication of native minnows and suckers in advance of new human-made reservoirs in the early 1960's were recognized as early threats (Service 2002a). According to the 2002 Recovery Goals for the species, the primary threats to Colorado pikeminnow populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; and pesticides and pollutants (Service 2002a).

In the Upper Basin, 435 miles of Colorado pikeminnow habitat has been lost by reservoir inundation from Flaming Forge Reservoir on the Green River, Lake Powell on the Colorado River, and Navajo Reservoir on the San Juan River. Cold water releases from these dams have eliminated suitable habitat for native fishes, including Colorado pikeminnow, from river reaches downstream for approximately 50 miles below Flaming Gorge Dam and Navajo Dam. In addition to main stem dams, many dams and water diversion structures occur in and upstream from critical habitat that reduce flows and alter flow patterns, which adversely affect critical habitat. Diversion structures in critical habitat can divert fish into canals and pipes where the fish become permanently lost to the river system. It is unknown how many endangered fish are lost in irrigation systems, but in some years, in some river reaches, the majority of the river flow is diverted into unscreened canals. Peak spring flows in the Green River at Jensen, Utah, have decreased 13–35 percent and base flows have increased 10–140 percent due to regulation by Flaming Gorge Dam (Muth et al. 2000).

Although a good portion of the recovery factor criteria (Service 2002a) are being addressed, nonnative fish species continue to be very problematic. Recovery Goals (Service 2002a, 2002b, 2002c, 2002d) identified predation or competition by nonnative fish species as a primary threat to the continued existence or the reestablishment of self-sustaining populations of the Colorado pikeminnow and the other three endangered fishes (Martinez et al. 2014). Predation and competition from nonnative fishes have been clearly implicated in the population reductions or elimination of native fishes in the Colorado River Basin (Dill 1944, Osmundson and Kaeding 1989, Behnke 1980, Joseph et al. 1977, Lanigan and Berry 1979, Minckley and Deacon 1968, Meffe 1985, Propst and Bestgen 1991, Rinne 1991). Data collected by Osmundson and Kaeding (1991) indicated that during low water years nonnative minnows capable of preying on or competing with larval endangered fishes greatly increased in numbers. The Colorado River Basin is an altered riverscape and the interaction of native and nonnative species with non-adapted and competing life histories has contributed to what may be the largest expansion of nonnative fishes and displacement of native fishes in a North America river basin (Martinez et al. 2014). More than 50 nonnative fish species were intentionally introduced in the Colorado River Basin prior to 1980 for sportfishing, forage fish, biological control and ornamental purposes

(Minckley 1982, Tyus et al. 1982, Carlson and Muth 1989). The numerous nonnative species have begun to overshadow the 14 native fish species in the basin.

Nonnative fishes compete with native fishes in several ways and include predation, habitat degradation, competition for resources, hybridization or disease transmission (Martinez et al. 2014). The capacity of a particular area to support aquatic life is limited by physical habitat conditions. Increasing the number of species in an area usually results in a smaller population of most species. The size of each species population is controlled by the ability of each life stage to compete for space and food resources and to avoid predation. Some life stages of nonnative fishes appear to have a greater ability to compete for space and food and to avoid predation in the existing altered habitat than do some life stages of native fishes. Tyus and Saunders (1996) cite numerous examples of both indirect and direct evidence of predation on eggs and larvae by nonnative species.

The Service has begun discussions about the potential downlisting of Colorado pikeminnow, but the biggest obstacle may become the existing and future threat of invasive ecological impacts by nonnative aquatic species, particularly predatory sport fishes. The most problematic nonnative fish species in the basin have been identified as northern pike, smallmouth bass and channel catfish *Ictalurus punctatus*, although other nonnative percid, ictalurid, cyprinid, centrarchid and catastomid species continue to be problematic as well (Martinez et al. 2014). Arguably the biggest efforts of the Recovery Program today center around the control of nonnatives species.

Threats from pesticides and pollutants include accidental spills of petroleum products and hazardous materials; discharge of pollutants from uranium mill tailings; and high selenium concentration in the water and food chain (Service 2002a). Accidental spills of hazardous material into occupied habitat can cause immediate mortality when lethal toxicity levels are exceeded. Researchers now speculate that mercury may pose a more significant threat to Colorado pikeminnow populations of the upper Colorado River basin than previously recognized (Service 2014). Osmundson and Lusk (2012) have recently reported elevated mercury concentrations in Colorado pikeminnow muscle tissue; the highest concentrations were from the largest adults collected from the Green and Colorado River sub-basins.

To summarize, Colorado pikeminnow habitat loss and degradation from dams and diversions constructed decades ago generated some of the early, primary impacts to the species. Most of the long-term impacts from these structures continue and are unlikely to change significantly in the near term. In the remaining suitable habitats, nonnative fish species pose a significant ongoing threat and challenge to recovery. Contaminants, including mercury and selenium, pose a threat as well, but the magnitude of this threat is in need of further investigation.

2.2 Razorback Sucker

2.2.1 Species description

Like all suckers (family Catostomidae meaning "down mouth"), the razorback sucker has a ventral Mouth. It is a robust, river catostomid endemic to the Colorado River Basin (Sigler and

Sigler 1996; Service 2002b) and is the largest native sucker to the western United States. The species feeds primarily on algae, aquatic insects, and other available aquatic macroinvertebrates using their ventral mouths and fleshy lips (Sigler and Sigler 1996). Adults can be identified by olive to dark brown coloration above, with pink to reddish brown sides and a bony, sharp-edged dorsal keel immediately posterior to the head, which is not present in the young. The species can reach lengths of 3 ft and weights of 16 pounds (7.3 kg), but the maximum weight of recently captured fish is 11 to 13 pounds (5 to 6 kg) (Sigler and Sigler 1996; Service 2002b). Taxonomically, the species is unique, belonging to the monotypic genus *Xyrauchen*, meaning that razorback sucker is the only species in the genus (Service 2002b). Like Colorado pikeminnow, razorback suckers may live to be greater than 40 years.

Historically, the razorback sucker occupied the mainstem Colorado River and many of its tributaries from northern Mexico through Arizona and Utah into Wyoming, Colorado, and New Mexico (Service 2002b). In the late 19th and early 20th centuries, it was abundant in the Lower Colorado River Basin and common in parts of the Upper Colorado River Basin, with numbers apparently declining with distance upstream (Service 2002b). Bestgen (1990) reported that this species was once so numerous that it was commonly used as food by early settlers and that a commercially marketable quantity was caught in Arizona as recently as 1949. Distribution and abundance of razorback sucker declined throughout the 20th century across its historic range, and the species now exists naturally only in a few small, unconnected populations or as dispersed individuals. Specifically, razorback sucker are currently found in small numbers in the Green River, upper Colorado River, and San Juan River sub-basins; the lower Colorado River between Lake Havasu and Davis Dam; Lakes Mead and Mohave; in small tributaries of the Gila River sub-basin (Verde River, Salt River, and Fossil Creek); and in local areas under intensive management such as Cibola High Levee Pond, Achii Hanyo Native Fish Facility, and Parker Strip (Service 2002b).

The razorback sucker is listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et. seq.), under a final rule published on October 23, 1991 (56 FR 54957). The Service finalized the latest recovery plan for the species in 2002 (2002b), but is currently drafting an updated revision.

Fifteen reaches of the Colorado River system were designated as critical habitat for the razorback sucker totaling 2,776 km (1,724 mi) as measured along the center line of the river within the subject reaches. Designated critical habitat makes up about 49 percent of the species' original range and occurs in both the Upper and Lower Colorado River Basins. In the Upper Basin, critical habitat is designated for portions of the Green, Yampa, Duchesne, Colorado, White, Gunnison, and San Juan Rivers. Portions of the Colorado, Gila, Salt, and Verde Rivers are designated in the Lower Basin.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site specific management actions necessary to minimize or remove those threats. This BOs focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the razorback sucker in that unit.

2.2.2 Life history

Except during periods before and after spawning, adult razorback sucker are thought to be relatively sedentary and have high fidelity to overwintering sites (Service 2002b). Adults become sexually mature at approximately 4 years and lengths of 400 mm (16 in.) (Zelasko et al. 2009), at which time they travel long distances to reach spawning sites (Service 2002b). Mature adults breed in spring (mostly April–June) on the ascending limb of the hydrograph, congregating over cobble/gravel bars, backwaters, and impounded tributary mouths near spawning sites (Service 2002b; Snyder and Muth 2004; Zelasko et al. 2009). Flow and water temperature cues may play an important role prompting razorback adults to aggregate prior to spawning (Muth et al. 2000). Tyus and Karp (1990) and Osmundson and Kaeding (1991) reported off-channel habitats to be much warmer than the mainstem river and that razorback suckers presumably moved to these areas for feeding, resting, sexual maturation, spawning, and other activities associated with their reproductive cycle.

Razorback sucker have high reproductive potential, with reported average female fecundity of approximately 50,000 to 100,000 eggs per fish (Service 2002b). They are broadcast spawners that scatter adhesive eggs over gravel-cobble substrate (Snyder and Muth 2004). High springs flows are important to egg survival because they remove fine sediment that can otherwise suffocate eggs. Hatching is limited at temperatures less than 10°C (50° F) and best around 20°C (68° F) (Snyder and Muth 2004). Eggs hatch 6 to 11 days after being deposited and larval fish occupy the sediment for another 4 to 10 days before emerging into the water column. Larval fish occupy shallow, warm, low-velocity habitats in littoral zones, backwaters, and inundated floodplains and tributary mouths downstream of spawning bars for several weeks before dispersing to deeper water (Service 2002b; Snyder and Muth 2004). It is believed that low survival in early life stages, attributed to loss of nursery habitat and predation by non-native fishes, causes extremely low recruitment in wild populations (Muth et al. 2000). Wydoski and Wick (1998) identified starvation of larval razorback suckers due to low zooplankton densities in the main channel and loss of floodplain habitats which provide adequate zooplankton densities for larval food as one of the most important factors limiting recruitment.

Razorback sucker in the Upper Basin tend to be smaller and grow slower than those in the Lower Basin, reaching 100 millimeters (4 in.) on average in the first year (Service 2002b). Based on collections in the middle Green River, typical adult size centers around 510 mm (20 in.) (Modde et al. 1996). Razorback suckers are long-lived fishes, reaching 40+ years via high annual survival (Service 2002b). Adult survivorship was estimated to be 71 to 73 percent in the Middle Green River from 1980-1992 (Modde et al. 1996; Bestgen et al. 2002) and 76 percent from 1990 to 1999 (Bestgen et al. 2002).

Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (Tyus and Karp 1989, Osmundson and Kaeding 1989, Osmundson and Kaeding 1991, Tyus and Karp 1990). Their diet consists primarily of algae, plant debris, and aquatic insect larvae (Sublette et al. 1990).

2.2.3 Population dynamics

Population estimates during the 1980 to 1992 period were on average between 300 and 600 wild fish (Modde et al. 1996). By the early 2000s, the wild population consisted of primarily aging adults, with steep decline in numbers caused by extremely low natural recruitment (Service 2002b). Although reproduction was occurring, very few juveniles were found (Service 2002b).

In the early part of the 2000s, population numbers were extremely low. Population estimates from sampling efforts in the Middle Green River had declined to approximately 100 by 2002, with researchers hypothesizing that wild fish in the Green River Basin could become extirpated because of lack of recruitment (Bestgen et al. 2002). Similarly, in the upper Colorado River, razorback sucker were exceedingly rare. In the 2002 recovery plan, razorback sucker were considered extirpated in the Gunnison River, where fish were last captured in 1976 (Service 2002b). Similarly, in the Grand Valley, only 12 fish were collected from 1984 to 1990, despite intensive sampling (Service 2002b). No young razorback sucker were captured in the Upper Colorado River since the mid-1960s (Service 2002b).

Razorback sucker likely occurred in the San Juan River as far upstream as Rosa, New Mexico (now inundated by Navajo Reservoir) (Ryden 1997). In the San Juan River we know of only two wild razorback suckers that were captured in 1976 in a riverside pond near Bluff, Utah, and one fish captured in the river in 1988, also near Bluff (Ryden 2006). No wild razorback sucker were found during the 7-year research period (1991–1997) of the San Juan River Basin Recovery Implementation Program (Ryden 2006).

Because of the low numbers of wild fish, the Recovery Program has been rebuilding razorback sucker populations in the upper Colorado River Basin with hatchery stocks. Since 1995, over 375,000 subadult razorback suckers have been stocked in the Green and upper Colorado River subbasins. Preliminary population estimates were generated for razorback sucker in the Colorado River as a whole (from Palisade, CO downstream to its confluence with the Green River), for adult fish > 400 mm TL (Figure 6). Although razorback sucker numbers have begun increasing in the past decade in the Green River subbasin due to stocking efforts, no standardized monitoring program to produce a population estimate has begun for the Green River subbasin (Service 2012a).

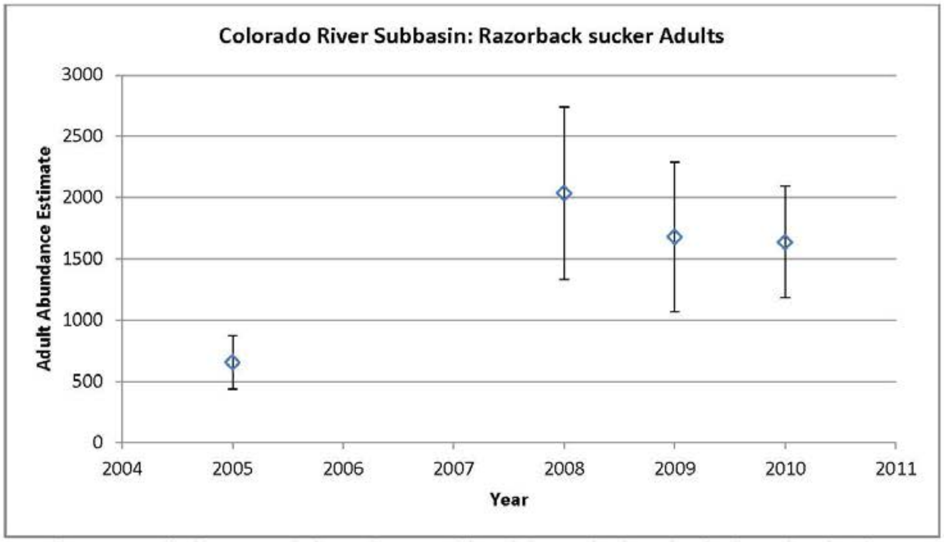

Figure 6. Preliminary population estimates of the adult razorback sucker in the Colorado River (Palisade, CO to the confluence of the Green River). Error bars represent the 95% confidence intervals (Service 2015a).

Razorback sucker stocked in the Green and Colorado Rivers have been recaptured in reproductive condition and often in spawning groups. Larval captures in the Green, Gunnison, and Colorado rivers document reproduction. Survival of larvae through their first year remains rare, largely due to a decrease in the availability of warm, food-rich floodplain areas and predation by a suite of nonnatives when the flood plain nursery habitats are available (Bestgen et al. 2011). However, occasional captures of juveniles (just over age-1) in the Green and Colorado rivers suggest that survival of early life stages is occurring. Collections of larvae by light trap in the middle Green River have been generally increasing since 2003; in 2013, the largest collection of light trapped larvae occurred (7,376; Figure 7, Service 2015a).

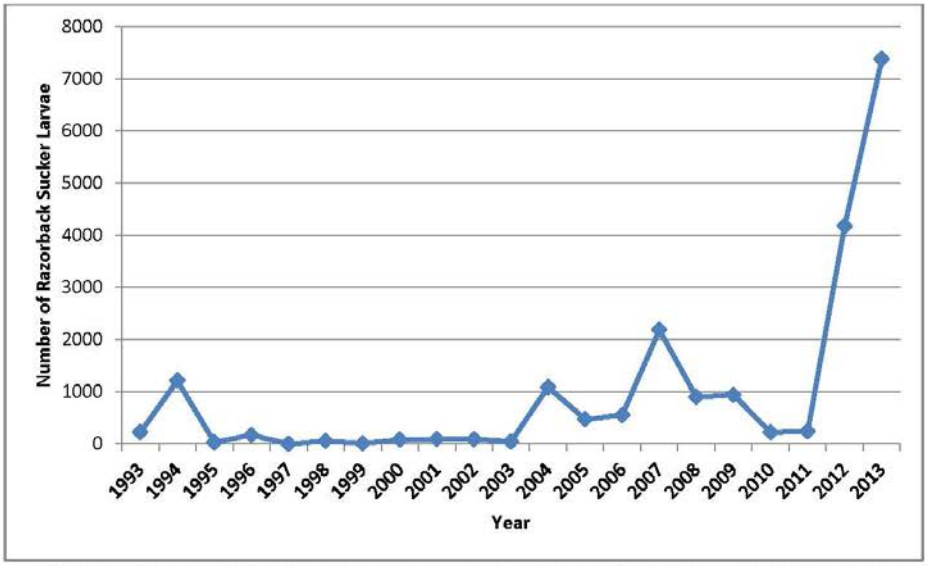

Figure 7. Numbers of razorback sucker larvae collected in light traps in the middle Green River since 1993.

In the San Juan River, 130,473 razorback suckers were stocked from 1994 through 2012. The number of endangered fishes stocked in the San Juan River is reported annually (see http://www.fws.gov/southwest/sjrip/). After stocking in the San Juan River began, river wide razorback sucker population estimates of 268 in October 2000 (Ryden 2001) have since grown to 1,200 in October 2004 (Ryden 2005), and to about 2,000 and 3,000 in 2009 and 2010, respectively (Duran et al. 2013). Additional mark-recapture data indicates increasing razorback sucker abundance estimates since 2009 (Durst 2014). However, because there is little to no documented recruitment in the San Juan River, this population increase should be attributed almost entirely to augmentation with hatchery-reared razorback suckers.

Three razorback sucker stocked in the San Juan River near Farmington, NM, for the San Juan Recovery Program were captured between Moab, UT and the state line with Colorado in 2008. This demonstrates that exchange of stocked razorback sucker between the San Juan River and the Upper Colorado River is certain, and may have ramifications for recovery criteria. Researchers have confirmed that hundreds of razorback sucker are using both transitional inflow areas and fully lacustrine (lake-like) habitats in Lake Powell. Razorback sucker are spawning in the lake and there is now evidence that recruitment may be occurring (Service 2015a). While the role of Lake Powell in the recovery of razorback sucker is unclear, 75 individuals were detected in the San Juan arm of Lake Powell in 2011 (Francis et al. 2013).

To summarize, the razorback sucker was facing extirpation in the Upper Colorado River basin approximately 20 years ago. To build population numbers in the Green, Colorado, and San Juan River subbasins, over a quarter of a million razorbacks have been stocked in these rivers. Stocking continues today and reproduction is occurring and increasing. Recruitment has also been documented recently, but appears to be the most limiting factor for re-establishing a self-sustaining population in the wild.

2.2.4 Threats

According to the 2002 Recovery Goals for the species, the primary threats to razorback sucker populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; and pesticides and pollutants (Service 2002b). No new threats have emerged since the completion of this document. The Service's status review of razorback sucker completed in 2012 (Service 2012b) reported that 85% of the downlisting recovery factor criteria (Service 2002b) have been addressed to varying degrees; however, nonnative fish species continue to be problematic.

Many researchers believe that nonnative species are a major cause for the lack of recruitment and that nonnative fish are the most important biological threat to the razorback sucker (e.g., McAda and Wydoski 1980, Minckley 1983, 59 FR 54957, Service 2002b, Muth et al. 2000). There are reports of predation of razorback sucker eggs and larvae by common carp, channel catfish, smallmouth bass, largemouth bass, bluegill, green sunfish, and red-ear sunfish (Marsh and Langhorst 1988, Langhorst 1989).

Marsh and Langhorst (1988) found higher growth rates in larval razorback sucker in the absence of predators in Lake Mohave, and Marsh and Brooks (1989) reported that channel catfish and flathead catfish were major predators of stocked razorback sucker in the Gila River. Juvenile razorback sucker (average total length [TL] 171 mm [6.7 in.]) stocked in isolated coves along the Colorado River in California, suffered extensive predation by channel catfish and largemouth bass (Langhorst 1989).

Carpenter and Mueller (2008) tested nine non-native species of fish that co-occur with razorback sucker and found that seven species consumed significant numbers of larval razorback suckers. The seven species consumed an average of 54 – 99 percent of the razorback sucker larvae even though alternative food was available (Carpenter and Mueller 2008). Lentsch et al. (1996) identified six species of nonnative fishes in the upper Colorado River Basin as threats to razorback sucker: red shiner, common carp, sand shiner, fathead minnow, channel catfish, and green sunfish. Smaller fish, such as adult red shiner, are known predators of larval native fish (Ruppert et al. 1993). Large predators, such as walleye, northern pike (*Esox lucius*), and striped bass, also pose a threat to subadult and adult razorback sucker (Tyus and Beard 1990). Until recently, efforts to introduce young razorback sucker into Lake Mohave have failed because of predation by nonnative species (Minckley et al. 1991, Clarkson et al. 1993, Burke 1994, Marsh et al. 2003).

Overall, the threats to the razorback sucker from nonnative fish are similar to those facing the Colorado pikeminnow, as described above. See the discussion on threats to the Colorado pikeminnow above for further information, particularly regarding the threat to all endangered fish due to predation from nonnative species. One threat from nonnative species peculiar to the razorback sucker is from hybridization. While hybridization between native and endangered razorback sucker may occur in the wild at a low level (Buth et al. 1987), the mass release of any native suckers hybridized with nonnative suckers would threaten gene pools of wild native or endangered suckers. McDonald et al. (2008) revealed that hybridization of native bluehead (*Catostomus discobolus*) and flannelmouth (*Catostomus latipinnis*) suckers with the nonnative white sucker (*Catostomus commersonii*) increased introgression between the native suckers. This mechanism could ultimately pose an increased threat of hybridization for razorback sucker (USFWS 2002b).

Selenium, a trace element, is a natural component of coal and soils in many areas of the western United States and can be released to the environment by the irrigation of selenium-rich soils and the burning of coal in power plants with subsequent emissions to air and deposition to land and surface water. Contributions from anthropogenic sources have increased with the increases of world population, energy demand, and expansion of irrigated agriculture. Selenium can enter surface waters through erosion, leaching, and runoff. Excess selenium in fish have been shown to have a wide range of adverse effects including mortality, reproductive impairment, effects on growth, and developmental and teratogenic effects including edema and finfold, craniofacial, and skeletal deformities (Hamilton et al. 2004; Holm et al 2005). Excess dietary selenium causes elevated selenium concentrations to be deposited into developing eggs, particularly the yolk (Buhl and Hamilton 2000). If concentrations in the egg are sufficiently high, developing proteins and enzymes become dysfunctional, leading to embryo deformation and a higher risk of mortality. Embryos that do survive, hatch, and grow may experience an elevated risk of predation as small fish. Of all the endangered fish in the Colorado River system, concern regarding elevated selenium levels is greatest for the razorback sucker (Hamilton et al. 2002; Osmundson et al. 2010).

Hamilton (1999) hypothesized that historic selenium contamination of the upper and lower Colorado River basins contributed to the decline of these endangered fish by affecting their overall reproductive success, including loss of eggs and larvae. Selenium concentrations in whole-body fish in the Colorado River Basin have been among the highest in the nation (Hamilton 1999). Several Department of the Interior National Irrigation Water Quality Program (NIWQP) studies in the Colorado River Basin have reported elevated levels of selenium in water, sediment, and biota, including fish (Hamilton 1999). In the NIWQP studies of 25 areas in the 15 western states, the middle Green River ranked 3rd for the highest median water concentration of selenium, 1st for sediment, and 1st for fish, and 14th for birds. The Gunnison River Basin/Grand Valley ranked 4th for the highest median water concentration of selenium, 2nd for sediment, 7th for fish, and 1st for birds (Engberg, 1998, as seen in Hamilton 1999). Unlike the Green, Gunnison, and Colorado Rivers, high selenium levels have not been reported in the Yampa and White Rivers (see section 3.3 Contaminants in the Action Area below for further discussion). While selenium has been more the focus of contaminants research involving the razorback sucker, mercury, which can pose a threat to any animal species, could also pose a threat at elevated concentrations. Because the razorback sucker is not a top predator, as is the Colorado pikeminnow, we expect mercury bioaccumulation (through prey) to pose less of a problem for this species.

To summarize, razorback sucker habitat loss and degradation from dams and diversions constructed decades ago posed some of the early, primary impacts to the species. Most of the long-term impacts from these structures continue and are unlikely to change significantly in the near term. In the remaining suitable habitats, nonnative fish species pose a significant ongoing threat and challenge to recovery. Contaminants, including mercury and selenium, pose a threat as well, but the magnitude of this threat is in need of further investigation.

2.3 Humpback Chub

2.3.1 Species description

The humpback chub is a medium-sized freshwater fish of the minnow family endemic to the Colorado River basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). The pronounced hump behind its head gives the humpback chub a striking, unusual appearance. It has an olive-colored back, silver sides, a white belly, small eyes, and a long snout that overhangs its jaw (Sigler and Sigler 1996). This fish can grow to nearly 500 mm (20 in.) and may survive more than 30 years in the wild (Service 2002c). The humpback chub does not have the swimming speed or strength of species such as the Colorado pikeminnow. Instead, it uses its large fins to "glide" through slow-moving areas, feeding on insects.

Historic distribution is surmised from various reports and collections that indicate the species inhabited canyons of the Colorado River and four of its tributaries: the Green, Yampa, White, and Little Colorado Rivers. Presently the species occupies about 68 percent of its historic habitat. Historic to current abundance trends are unclear because historic abundance is unknown (Service 2002c).

The Office of Endangered Species first included the humpback chub in the List of Endangered Species on March 11, 1967 (32 FR 4001). Subsequently, it was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (16 U.S.C. 668aa) and was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106). It is currently protected under the Endangered Species Act of 1973 as an endangered species throughout its range (ESA; 16 U.S.C. 1531 *et. seq.*). The Service finalized the latest recovery plan for the species in 2002 (Service 2002c), but is currently drafting an updated revision.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site-specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the humpback chub in that unit.

2.3.2 Life History

Like other large desert river fishes, the humpback chub is an obligate warm-water species that requires relatively warm temperatures for spawning, egg incubation, and survival of larvae. Unlike Colorado pikeminnow and razorback sucker, which are known to make extended migrations of up to several hundred miles to spawning areas, humpback chubs do not appear to make extensive migrations. Instead, humpback chub live and complete their entire life cycle in canyon-bound reaches of the Colorado River mainstem and larger tributaries characterized by deep water, swift currents, and rocky substrates (Service 2002c). Individuals show high fidelity for canyon reaches and move very little.

Mature humpback chub typically spawn on the descending hydrograph between March and July in the Upper Basin (Karp and Tyus 1990). Humpback chub are broadcast spawners who may mature as young as 2 to 3 years old. Eggs incubate for three days before swimming up as larval fish (Service 2002c). Egg and larvae survival are highest at temperatures close to 19 to 22°C (Service 2002c). Unlike larvae of other Colorado River fishes (e.g., Colorado pikeminnow and razorback sucker), larval humpback chub show no evidence of long-distance drift (Robinson et al.1998).

Recruitment appears to be successful in all known Upper Basin populations (Service 2002c). Survival of humpback chub during the first year of life is low, but increases through the first 2 to 3 years of life with decreased susceptibility to predation, starvation, and environmental changes. Survival from larvae to adult life stages was estimated at 0.1 percent (0.001) (Service 2002c). Survival of adults is high, with estimates approximating 75 percent based on Grand Canyon adults (Service 2002c).

Growth rates of humpback chub vary by populations, with fish in the Upper Basin growing slower than those in the Grand Canyon (Service 2002c). Individuals in Cataract Canyon were 50, 100, 144, 200, 251, and 355 mm total length from 1 to 6 years, respectively (Service 2002c). Based on sexual maturity and age-to-length ratios, adults are classified as those fish 200 mm or longer. Maximum life span is estimated to be 30 years in the wild.

Humpback chub move substantially less than other native Colorado River fishes, with studies consistently showing high fidelity by humpback chub for specific riverine locales occupied by respective populations. Despite remarkable fidelity for given river regions, individual humpback chub adults are known to move between populations. Movement by juveniles is not as well documented as for adults, but is also believed to be limited in distance. For example, no out-migration by young fish is seen from population centers such as Black Rocks and Westwater Canyon.

2.3.3 Population dynamics

Currently, five wild humpback chub populations occur upstream of Glen Canyon Dam and two downstream. In the Upper Colorado River Basin the two most stable populations are found near the Colorado/Utah border: one at Westwater Canyon in Utah; and one in an area called Black Rocks, in Colorado (Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program 2010). Smaller numbers in the Upper Basin were found in the Yampa and Green Rivers in Dinosaur National Monument, Desolation and Gray Canyons on the Green River in Utah, and Cataract Canyon on the Colorado River in Utah (Service 2002c). The two populations in the Lower Colorado River Basin occur in the mainstem Colorado and Little Colorado Rivers. The Little Colorado River population, found in the Grand Canyon, is the largest known population, harboring up to 10,000 fish (Service 2002c).

Recovery goal downlisting demographic criteria (USFWS 2002c) for humpback chub require each of five populations in the upper Colorado River basin to be self-sustaining over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-3 (150–199 mm TL) naturally produced fish must equal or exceed mean adult annual mortality. In addition, one of the five populations (e.g., Black Rocks/Westwater Canyon or Desolation/Gray Canyons) must be maintained as a core population such that each estimate exceeds 2,100 adults (estimated minimum viable population number).

Population estimates for four of the five upper basin population are shown in Figure 8. No population estimate is available for the Yampa/Green River population in Dinosaur National Monument (see Baseline section for further details). The Desolation/Gray Canyons population of wild adults was estimated at 1,300 in 2001, 2,200 in 2002, and 940 in 2003 (Jackson and Hudson 2005). Sampling in 2001 and 2002 was conducted in summer, whereas beginning in 2003, sampling was shifted to fall to avoid capturing Colorado pikeminnow that use Desolation Canyon for spawning. In a report on 2006–2007 estimates, researchers (Badame 2012) indicated that this population was trending downward. Badame (2012) linked declining catch of humpback chub in the upper portions of Desolation Canyon in the 2006–2007 estimates with increasing densities of nonnative smallmouth bass. Utah Division of Wildlife Resources (UDWR) researchers recommended securing a representative sample of adults in captivity. In 2009, 25 adults were taken to Ouray National Fish Hatchery. In 2011, six sites throughout Desolation Canyon were monitored for adults, 55 individual adults were encountered, but recaptures were too few to calculate a population estimate.

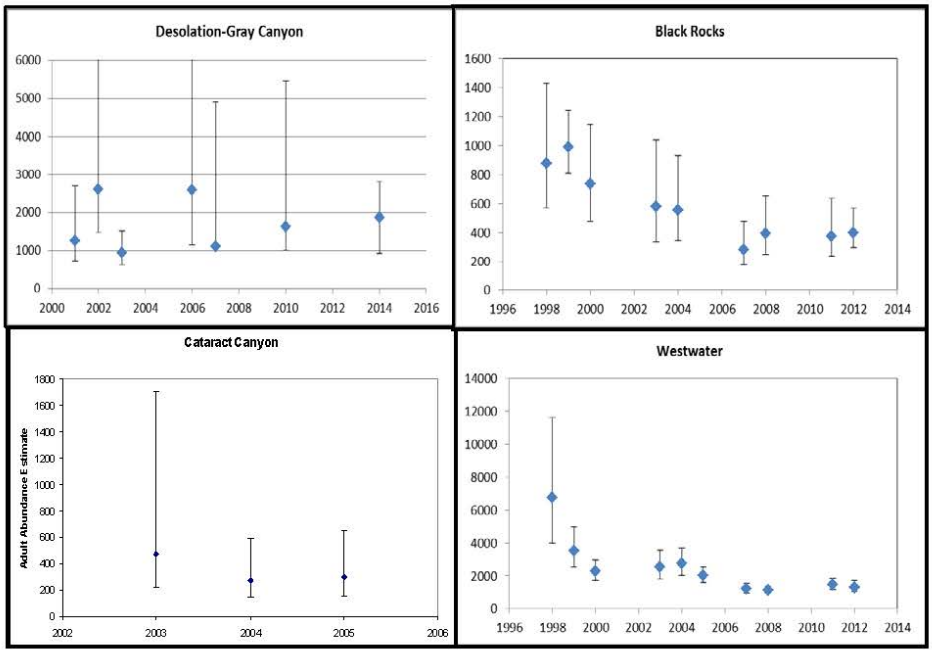

Figure 8. Adult humpback chub population estimates with confidence intervals for four populations in the upper Colorado River Basin (note that the scale differs among the graphs for the different populations). Clockwise from upper left: Desolation-Gray Canyons (from Badame 2011, 2012; Service 2015a); Black Rocks (from Francis and McAda 2011); Westwater Canyon (from Elverud 2011); and Cataract Canyon (from Badame 2008).

On the Colorado River of the upper Colorado River basin, three humpback chub populations are recognized. Black Rocks and Westwater Canyon have enough exchange of individuals that they are considered a single core population. In Black Rocks, estimates of wild adults have varied from about 800 in 1998, 900 in 1999, and 500 in 2000 and 2003 (Figure 8) (McAda 2007). The most recent estimates, in 2007–2008 were 345 and 287, respectively. During the fall of 2011 and 2012, 78 and 112 individual adult humpback chub were caught respectively - similar to the numbers caught in 2007 and 2008 (61 and 74, respectively). Population estimates for Black Rocks for 2011 and 2012 were 379 and 403, respectively. Researchers caution that 78 largemouth bass and the same number of gizzard shad were collected in Black Rocks in 2012. This represents a ten-fold increase over the 2011 catch. The Westwater Canyon estimates of wild adults range from about 4,700 in 1998 to 2,500 in 1999, 2000, and 2003 (Jackson and Hudson 2005). The 2007–2008 estimates were about 1,750 and 1,300. The large declines in humpback chub densities in both Black Rocks and Westwater Canyons occurred in the late 1990's and are not attributed to more recent increases of nonnative predators in the Colorado River.

In 2008, the core population (Black Rocks / Westwater combined) dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time. In 2011, we saw some recovery in those populations where the estimate for adults in Westwater Canyon alone was 1,467;

however, UDWR reported 1,315 adults in 2012. The core population estimates in 2011 and 2012 were 1846 and 1718, respectively (Figure 9). Population estimates in both Black Rocks and Westwater canyons declined dramatically during the first population estimation rotation in the late 1990s, but have remained relatively stable since that time. Colorado State University's recent robust population estimate analysis more clearly indicated that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment (i.e. adult survival rates have remained stable). Principle investigators agree that reinitiating an age-0 monitoring component is advisable. It should be noted that whatever is affecting humpback chub recruitment has not affected sympatric populations of native roundtail chub; roundtail chubs populations in both canyons have remained stable or have increased since population estimation started. In addition to the potential and recent negative interactions between humpback chub and nonnative predators discussed above, both the Westwater and Black Rocks populations are at risk of potential chemical contamination due to the proximity of a railroad located on the right bank of the Colorado River which at times transports toxic substances.

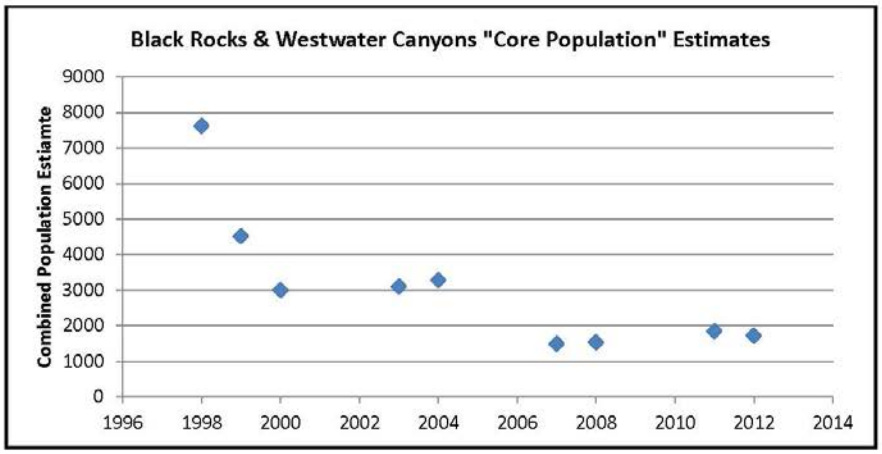

Figure 9. Combined population estimates for humpback chub in Black Rocks and Westwater Canyon based on a robust open model created by Dr.'s Bestgen and White, Colorado State University. The 2002 Recovery Goal downlist criteria for these combined ("core population") estimates is 2,100 adults.

The Cataract Canyon humpback chub population is small, with estimates of about 150 wild adults in 2003 and 66 in 2005 (Badame 2008). Estimates are difficult to obtain in Cataract; therefore, catch-per-unit-effort (CPUE) has been determined to be an effective replacement (began in 2008 on a 2-years-on, 2-years-off sampling regime). In 2011, UDWR reported that the Cataract population appears to be stable with CPUE ranging between 0.010 and 0.035 fish/net-hour. Despite additional effort to sample below Big Drop Rapid, no additional humpback chub were encountered in the new riverine habitat created by low Lake Powell levels.

2.3.4 Threats

The humpback chub was designated as an endangered species prior to enactment of the ESA, and therefore a formal listing package identifying threats was not assembled. Construction and operation of mainstem dams, nonnative fish species, and local eradication of native minnows and suckers in advance of new human-made reservoirs in the early 1960's were recognized as early threats (Service 2002c). According to the 2002 Recovery Goals for the species, the primary threats to humpback chub are streamflow regulation, habitat modification, predation by non-native fish species, parasitism, hybridization with other native *Gila* species, and pesticides and pollutants (Service 2002c). No new threats have emerged since the completion of this document. The Service's status review of humpback chub completed in 2011 (Service 2011b) reported that 60% of the recovery factor criteria (Service 2002c) have been addressed to varying degrees; however, nonnative fish species and issues dealing with the potential chemical contamination of the river from spills and pipelines continue to be problematic. Overall, the threats to the humpback chub from nonnative fish are similar to those facing the Colorado pikeminnow, as described above. See the discussion on threats to the Colorado pikeminnow above for further information, particularly regarding the threat to all endangered fish due to predation from nonnative species.

To summarize, humpback chub habitat loss and degradation from dams and diversions constructed decades ago posed some of the early, primary impacts to the species. Most of the long-term impacts from these structures continue and are unlikely to change significantly in the near term. In the remaining suitable habitats, nonnative fish species pose a significant ongoing threat and challenge to recovery. Contaminants, including mercury and selenium, may pose a lesser threat as well, but the magnitude of this threat is in need of further investigation.

2.4 Bonytail

2.4.1 Species description

The bonytail is a medium-sized freshwater fish in the minnow family, endemic to the Colorado River Basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). Individuals have large fins and a streamlined body that typically is very thin in front of the tail. They have a gray or olive colored back, silver sides, and a white belly (Sigler and Sigler 1996). The mouth is slightly overhung by the snout and there is a smooth low hump behind the head that is not as pronounced as the hump on a humpback chub. A very close relative to the roundtail chub (*Gila robusta*), bonytail can be distinguished by counting the number of rays in the fins, with bonytail having 10 dorsal and anal fin rays (Sigler and Sigler 1996). The fish can grow to be 600 mm (24 in.) and are thought to live as long as 20 to 50 years (Sigler and Sigler 1996). Little is known about the specific food and habitat of the bonytail because the species was extirpated from most of its historic range prior to extensive fishery surveys, but it is considered adapted to mainstem rivers, residing in pools and eddies, while eating terrestrial and aquatic insects (Service 2002d).

Bonytail were once widespread in the large rivers of the Colorado River Basin (Service 2002a). The species experienced a dramatic, but poorly documented, decline starting in about 1950, following construction of mainstem dams, introduction of nonnative fishes, poor land-use practices, and degraded water quality Service 2002d). Population trajectory over the past century and reasons for decline are unclear because lack of basin-wide fishery investigations precluded accurate distribution and abundance records.

Bonytail are now rarely found in the Green and Upper Colorado River sub-basins and are the rarest of all the endangered fish species in the Colorado River Basin. In fact, no wild, self-sustaining populations are known to exist upstream of Lake Powell. In the last decade only a handful of bonytail were captured on the Yampa River in Dinosaur National Monument, on the Green River at Desolation and Gray canyons, and on the Colorado River at the Colorado/Utah border and in Cataract Canyon. In the lower basin, bonytail exist in Lake Mohave and Lake Havasu.

The bonytail is currently listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et. seq.*), under a final rule published on April 23, 1980 (45 FR 27710). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002d), but is currently drafting an updated revision.

The Service designated seven reaches of the Colorado River as critical habitat for the bonytail on March 21, 1994 (59 FR 13374). These reaches total 499 km (312 mi) as measured along the center line of each reach. Portions of the Green, Yampa, and Colorado Rivers are designated as critical habitat, representing about 14 percent of the species' historic range.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the humpback chub in that unit.

2.4.2 Life history

Natural reproduction of bonytail was last documented in the Green River in 1959, 1960, and 1961 at water temperatures of 18°C (Service 2002d). Similar to other closely related *Gila* species, bonytail in rivers probably spawn in spring over rocky substrates. While age at sexually maturity is unknown, they are capable of spawning at 5 to 7 years old. Recruitment and survival estimates are currently unknown because populations are not large enough for research to occur.

Individuals in Lake Mohave have reached 40 to 50 years of age (Service 2002d), but estimates for river inhabiting fish are not available.

2.4.3 Population dynamics

Bonytail are so rare that it is currently not possible to conduct population estimates. In response to the low abundance of individuals, the Recovery Program is implementing a stocking program to reestablish populations in the Upper Basin; stocking goals were met or exceeded from 2008-2010 (Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin

Recovery Implementation Program 2010). Since 1996, over 380,000 tagged bonytail subadults have been stocked in the Green and upper Colorado River subbasins.

To date, most stocked bonytail do not appear to survive very long after release into a given river. To date, the bonytail stocking program has not been as successful as the razorback sucker stocking program. Researchers continue to experiment with pre-release conditioning and exploring alternative release sites to improve their survival. Since 2009, an increasing number of bonytail have been detected at several locations throughout the Upper Colorado River Basin where stationary tag-reading antennas are used. During high spring flows in 2011, more than 1,100 bonytail (16.6% of the 6,804 stocked in early April of that year) were detected by antenna arrays in the breach of the Stirrup floodplain on the Green River. The Price Stubb antenna array on the Colorado River detected 138 bonytail between October 2011 and September 2013. The fish detected in fall 2011 had been stocked above Price-Stubb in Debeque Canyon, but in spring 2012, some of those fish were moving upstream through the fish passage.

2.4.4 Threats

The bonytail was designated as an endangered species under a final rule published April 23, 1980 (45 FR 27710–27713). Reasons for decline of the species were identified as the physical and chemical alteration of their habitat and introduction of exotic fishes. The 1990 Bonytail Chub Recovery Plan further stated that the decline of the bonytail chub is attributed to stream alteration caused by construction of dams, flow depletion from irrigation and other uses, hybridization with other *Gila*, and the introduction of nonnative fish species. Hence, the primary threats to bonytail populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; hybridization; and pesticides and pollutants (Service 2002d). No new threats have emerged since the 2002 recovery goals were published. The Service's status review of bonytail completed in 2012 (USFWS 2012c) reported that 72 percent of the recovery factor criteria (USFWS 2002d) have been addressed to varying degrees.

Overall, the threats to the bonytail from nonnative fish are similar to those facing the Colorado pikeminnow, as described above. See the discussion on threats to the Colorado pikeminnow above for further information, particularly regarding the threat to all endangered fish due to predation from nonnative species.

No known wild, self-sustaining populations of bonytail exist in the Upper Colorado River Basin. Since listing, bonytail were stocked in the Upper Basin to augment populations, but recruitment and natural reproduction have not been documented. Recent recaptures of bonytail in the Green and Colorado Rivers a year after stocking provide promising results that individuals are surviving.

To summarize, bonytail habitat loss and degradation from dams and diversions constructed decades ago posed some of the early, primary impacts to the species. Most of the long-term impacts from these structures continue and are unlikely to change significantly in the near term. In the remaining suitable habitats, nonnative fish species pose a significant ongoing threat and challenge to recovery. Contaminants may pose a lesser threat as well, but the magnitude of this threat is in need of further investigation.

2.5 Critical Habitat

Critical habitat was designated for all four endangered fish at the same time in 1994 (59 FR 13374). It consists of river segments and associated areas within the 100-year floodplain within each species' historical range. Different reaches have been designated for each species, and are discussed in the baseline section for each species within the action area in the Baseline section below. Figure 6 shows critical habitat for the Colorado pikeminnow, which is confined to the upper Colorado River Basin (above Lake Powell). Critical habitats for the other 3 endangered fish are found in the lower Colorado River Basin as well. Within the upper Colorado River Basin, critical habitats for the other three endangered fish are largely subsets of that designated for the Colorado pikeminnow (i.e., shorter reaches) (see 59 FR 13374 for maps of all critical habitat units designated for each endangered fish).

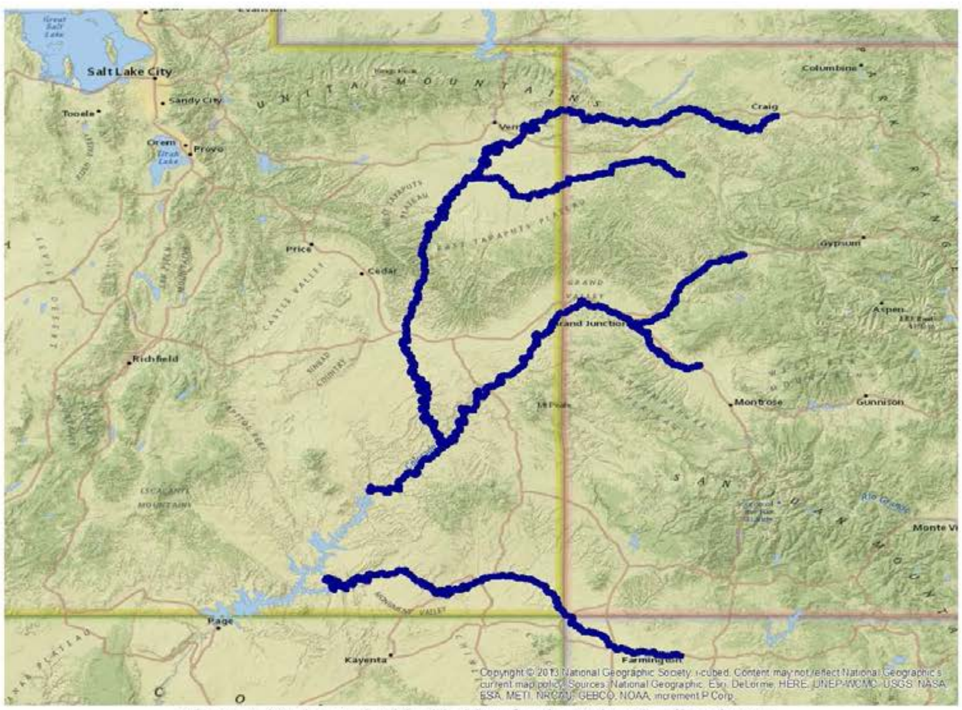

Figure 6. Designated critical habitat for the Colorado pikeminnow.

Critical habitat is defined as specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that are formally designated by rule. In the Colorado and elsewhere, many of these critical habitat reaches overlap. Critical habitat for the humpback chub and bonytail are primarily canyon-bound reaches, while critical habitat for the

Colorado pikeminnow and razorback sucker include long stretches of river required for migration corridors and larval fish drift.

Concurrently with designating critical habitat, the Service identified primary constituent elements (PCEs) of the habitat, which are identical for all four endangered fish species. PCEs are physical or biological features essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species historic geographic and ecological distribution. The PCEs of critical habitat are the same for each of the four endangered fish within the Colorado River system. The PCEs include:

Water: a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for the species;

Physical habitat: areas of the Colorado River system that are inhabited or potentially habitable for spawning, feeding, rearing, as a nursery, or corridors between these areas, including oxbows, backwaters, and other areas in the 100-year floodplain which when inundated provide access to spawning, nursery, feeding, and rearing habitats; and,

Biological environment: adequate food supply and ecologically appropriate levels of predation and competition.

2.6 Climate Change

The EPA (2015) has predicted that Colorado will experience the following general trends related to climate change (summarized from OSMRE EA, p. 4-19):

- The region will experience warmer temperatures with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations.
- Earlier snowmelt will result in earlier peak stream flows, weeks before the peak needs of ranchers, farmers, recreationalist, and others. In late summer, rivers, lakes, and reservoirs will be drier.
- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Drier conditions will reduce the range and health of ponderosa and lodge pole pine forests, and increase the susceptibility to fire.

Climate change has and will occur and affect endangered species and their habitat over the duration of the Proposed Action and beyond, whether or not the Proposed Action occurs.

Climate change over the coming decades and centuries has the potential to affect many organisms, including freshwater fish. EPA (2015) discussed a change in precipitation patterns, including the timing, intensity, and type of precipitation received; runoff patterns based on the amount of precipitation falling as snow and when snowmelt occurs; and atmospheric temperatures, which exhibit a strong influence on water temperatures.

According to the National Research Council (2012), air temperature has increased by 1.4°C in the last century. The Colorado River Basin has warmed more than any other part of the U.S. (Service 2015b). Drier conditions, warmer air temperatures, and earlier spring runoff peaks are expected to affect water availability and the quality and quantity of fish habitat, which are important elements to native fish in action area. It is impossible to predict with any degree of precision, however, to what extent endangered fish and their habitats will be affected.

However, given that these endangered fish live in main-stem rivers, generally downstream from most of the dams on tributaries within the Upper Colorado River Basin, it is possible that some of the effects of climate change in the area could be moderated by dam releases, particularly if they are done to benefit endangered fish. For example, earlier snow melt and runoff in upper tributaries would influence stream levels above downstream dams, but downstream flows are controlled by dam releases. Warming water temperatures would be counteracted to some extent by cold water releases from the base of a dam. These endangered fish are not cold water dependent fish; cool water temperatures may be more limiting to some or all of them than warm water temperatures (on the up-river limits of their distribution). Higher summer-time base flows as a result of dam releases also work to keep water temperatures from climbing as high as they otherwise would under lower flows. Most or all of the reaches occupied by these endangered fish are influenced by upstream dams.

These dams, whether main-stem dams or on up-basin tributaries, have numerous negative effects on the endangered fish and their habitats. However, in the face of a warming and drying climate, some of the potentially negative effects of climate change (e.g., change in timing of runoff, water temperature increase, drop in base flows) could be ameliorated by dam releases. Alternatively, some of the negative effects of existing dams may be ameliorated by climate change (e.g., warming of below-dam cold waters, a lower water level in Lake Powel resulting in the eventual emergence of more potentially habitable river miles on the Colorado and San Juan Rivers). Aside from the interaction of dams and climate change, increasing water temperatures could potentially extend suitable habitat for one or more of the endangered fish (non-canyon bound species) up river into what may currently be too cold.

See also Climate Change in the Action Area (section 3.4) within the Baseline below.

3.0 ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, and private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal section 7 consultation; and the impact of State or private actions contemporaneous with the consultation process.

The action area is defined at 50 CFR 402 to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of this consultation, the action area, as defined earlier, has been defined to include the topographic mercury deposition airshed (Figure 9 in BA), along with endangered fish critical habitats within and downstream from the airshed along the Yampa and White Rivers (see Figure 6 in BA for endangered fish critical habitats in action area).

3.1 Critical Habitat In The Action Area

The PCEs of critical habitat are identical for all four endangered fish species and are discussed in section 2.5 above. Descriptions of critical habitats within the action area are provided below. The BA (Figure 9) provides a map of all critical habitats in the action area.

3.1.1 Colorado pikeminnow

Critical habitat designated for the Colorado pikeminnow along the Yampa River extends from the Highway 13 Bridge over the Yampa River down to the confluence with the Green River. This is an undammed, free-flowing, approximately 145-mile reach. Along the White River, it extends from Rio Blanco Lake down to the confluence with the Green River in Utah. Within this reach, Taylor Draw Dam above the town of Rangely, Colorado, built in 1984, completely blocks fish passage. Although Colorado pikeminnow previously occupied the White River above Taylor Draw Dam, that is no longer the case. Colorado pikeminnow currently occupy the 106-mile reach below Taylor Draw Dam.

3.1.2 Razorback sucker

Critical habitat designated for the razorback sucker along the Yampa River extends from the mouth of Cross Mountain Canyon to the confluence with the Green River in Utah. This approximately 55-mile reach is largely within Dinosaur National Monument. Critical habitat has been designated for the razorback sucker along the lower 24 miles of the White River as it travels through the Uintah and Ouray Indian Reservation.

3.1.3 Humpback chub and bonytail

Critical habitats designated for the humpback chub and bonytail along the Yampa River are identical and extend 45 miles from the boundary of Dinosaur National Monument downstream to its confluence with the Green River. No critical habitat has been designated along the White River for the humpback chub or bonytail. Critical habitats for all four endangered fish continue out of the action area downstream along the Green River below its confluence with the Yampa River and below its confluence with the Green River.

3.2 Endangered Fish In The Action Area

Broader population estimates, which may include fish in the action area, are provided above in the Status of the Species section. Additional information specific to the endangered fish populations and their threats in the Yampa and White Rivers is included here.

3.2.1 Colorado pikeminnow

Low numbers of Colorado pikeminnow were captured in the Yampa River during population estimation sampling in 2011-2013. Bestgen et al. (2013, p.4) states, "Captures were particularly low in the Yampa River, where only six Colorado pikeminnow were captured, in spite of high effort associated with northern pike and smallmouth bass removal sampling, as well as regular Colorado pikeminnow sampling passes (up to eight sampling passes)." And for 2013, only 8 Colorado pikeminnow were captured in the Yampa River, in spite of high effort, once again. Preliminary population estimates based on these captures are shown in Figure 7.

A somewhat higher number of Colorado pikeminnow currently occupy the White River. Captures in the White River during population estimation sampling between 2011-2013 ranged from 50-96 fish (Bestgen et al. 2013). Final population estimates based on these captures are not yet available. However, numbers of Colorado pikeminnow have been larger in the past. As stated in the BA (p. 23), adult Colorado pikeminnow abundance estimates in the White River declined from 1,115 animals in 2000 to 465 animals in 2003. Adult Colorado pikeminnow resident to the White River are known to spawn in the Green and Yampa rivers. However, in 2011, researchers documented for the first time Colorado pikeminnow spawning in the White River. Juvenile and subadult Colorado pikeminnow also utilize the White River on a year-round basis (Recovery Program 2015).

As part of the process of revising the 2002 Colorado Pikeminnow Recovery Goals into recovery plans, a recovery team for Colorado pikeminnow was assembled in late 2012 consisting of species and threat experts. During initial discussions in November 2012, the Recovery Team linked persistent low densities of adult Colorado pikeminnow in the Yampa River to persistent high densities of nonnative predators (e.g., smallmouth bass and northern pike; northern pike abundance shown in Figure 7). These estimates, which indicate that northern pike are outnumbering Colorado pikeminnow at least 3:1, point up the ongoing challenge of managing nonnative predators (Service 2015a). A published fish density model (McGarvey et al. 2010) supported the importance of competition among top predators in lotic systems and suggested that partitioning available energetic resources among multiple predator species would inevitably reduce carrying capacity for Colorado pikeminnow. Examination of historic and recent trends in densities of large-bodied Colorado pikeminnow, northern pike, and smallmouth bass in the middle Yampa River suggests that large-bodied invasive predators have functionally replaced Colorado pikeminnow as the river's top predator (Martinez et al. 2014).

The number of adult Colorado pikeminnow residing in the Yampa River has been greatly reduced, largely because of persistent high densities of nonnative predators, and perhaps also because of extended drought (Recovery Program 2015). The Recovery Program initiated a campaign to remove nonnative predators from the critical habitat reaches of the Yampa River in the early 2000s when it became apparent that smallmouth bass were decimating the native fish populations (Anderson 2005). Since that time removal efforts have increased both geographically (now encompassing ~ 170 miles of Yampa River + Catamount Reservoir) and in intensity (with some reaches receiving more than 10 removal passes / yr).

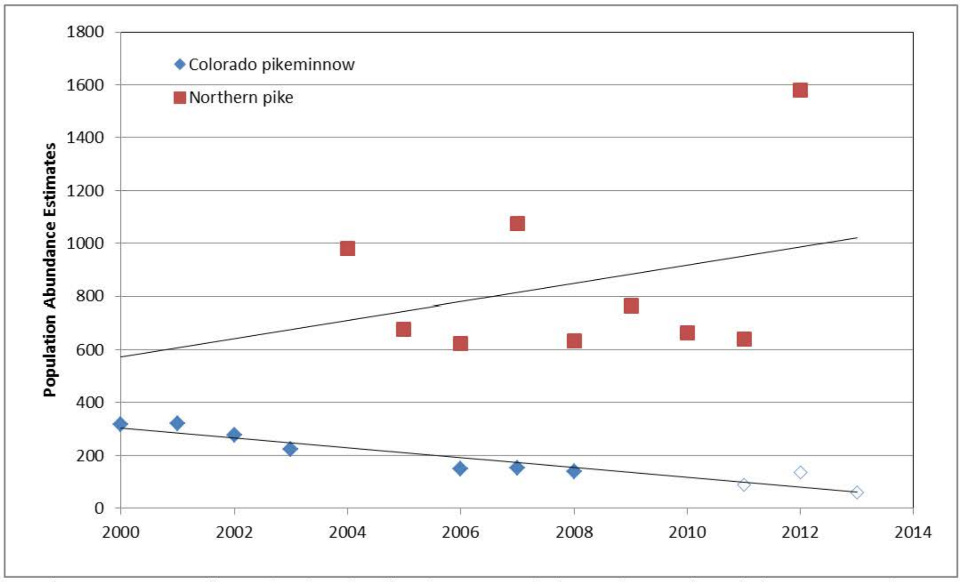

Figure 7. Comparison of Colorado pikeminnow population estimates (CPM) (2000 – 2008 data from Bestgen et al. 2010) and northern pike (Battige 2012) in the middle Yampa River. The 2011-2013 data points for Colorado pikeminnow are preliminary. Northern pike population estimates were not conducted in 2013.

As stated in Martinez et al. (2014), the dramatic decline of native fishes in the Yampa River provides a stark example of the cumulative detrimental impacts of an increase in the number and abundance of nonnative aquatic species, particularly increases in the range and abundance of invasive species including northern pike and smallmouth bass, and virile crayfish *Orconectes virilis*. The Yampa River has been previously described as the "crown jewel" of the upper Colorado River Basin due to its formerly robust native fish populations (Johnson et al. 2008) and its comparatively unregulated hydrograph. It contains designated critical habitat for all four of the endangered fish in the basin. In recent decades, the Yampa River has been progressively invaded by nonnative species, altering the native aquatic community and food web and increasing the threat of invasive impacts to native and endangered fishes (Johnson et al. 2008; Martinez 2014). Examples of these threats include the detection of Asian tapeworm *Bothriocephalus acheilognathi*, hybridization between native sucker species and nonnative white sucker *Catostomus commersoni*, and predation or apparent competition with and hyperpredation on native and endangered fishes (Martinez 2014). Endangered Colorado pikeminnow have steadily declined in the Yampa River, despite pikeminnow increases in four other major population areas in the Green River basin (Bestgen et al. 2010; Martinez et al. 2014). It has become imperative that preventive, eradication and control measures be diligently, vigorously, and more rapidly applied to restore the native aquatic community in the Yampa River (Martinez et al. 2014).

3.2.2 Razorback sucker

Less is known about the numbers of the other three endangered fish within the Yampa and White Rivers. The Yampa River at the mouth of Yampa Canyon was an historical site for razorback sucker reproduction, and in fact, was the first such spawning site described in the Upper Colorado River Basin (McAda and Wydoski 1980, Bestgen 1990). More recently, only a few razorback larvae have been captured in the lower Yampa River in 2000, 2008, and 2011 (Bestgen et al. 2012). Although substantial numbers of razorback sucker do not occur in the Yampa River, scattered individuals can occasionally be found (Bestgen et al. 2012).

Razorback suckers are not stocked into the Yampa River or White Rivers. They are, however, stocked into the Green River and can swim up and into the Yampa or White River. A few substantial captures of adult razorback suckers occurred in the lower White River in 2011. A passive integrated antenna array near the Bonanza Bridge (installed September 2012) demonstrated that razorback sucker and Colorado pikeminnow use the Utah portion of the White River in higher numbers than previously thought. However, a recent expansion of smallmouth bass in the White River is a cause for concern for this native fish stronghold (Recovery Program 2015). In 2011, researchers documented spawning by razorback sucker in the White River for the first time (Bestgen et al. 2012).

The current and increasingly most significant threat to the razorback sucker in the action area is from nonnative species, which is discussed in the Status of the Species section. Seealso the discussion regarding nonnative species in the Colorado pikeminnow Status of the Species and Baseline sections above, as this threat is similar for all endangered fish in the upper Colorado River basin, particularly regarding predation from nonnative predators.

3.2.3 Humpback chub

The Yampa River humpback chub population exists in the lower Yampa River Canyon and into the Green River through Split Mountain Canyon. This population is small, with an estimate of about 400 wild adults in 1998-2000. Sampling during 2003–2004 caught only 13 fish, too few to estimate population size (Finney 2006). In 2007, the Recovery Program brought 400 young-of-year *Gila* spp. caught in Yampa Canyon into captivity as a research activity to determine the best methods for capture, transport, and holding at two different hatchery facilities. Approximately 15 percent of the *Gila* species were tentatively identified as humpback chub by physical characteristics. Geneticists at Southwest Native Aquatic Resources and Recovery Center (SNARRC), Dexter, NM, have since provided preliminary results indicating that the Yampa fish in captivity were hybrids between humpback chub and roundtail chub. These fish were considered unsuitable for broodstock and were released into the Green River in Dinosaur National Monument. Currently, it is not known if pure humpback chubs occur in Yampa Canyon. The Recovery Program (2015) states that a small population of humpback chub historically existed in the Yampa River in Dinosaur National Monument (Service 2002a), but is now believed to be reduced to a few individuals.

The current and increasingly most significant threat to the humpback chub in the action area is from nonnative species, which is discussed in the Status of the Species section. See also the discussion regarding nonnative species in the Colorado pikeminnow Status of the Species and Baseline sections above, as this threat is similar for all endangered fish in the upper Colorado River basin, particularly regarding predation from nonnative predators.

3.2.4 Bonytail

As stated in the Status of the Species section, wild bonytail are so rare that it is currently not possible to conduct population estimates. However, the Recovery Program is implementing a stocking program to reestablish populations in the Upper Basin. Limited stocking of bonytail has begun recently in the Yampa River and White River (in Utah).

The current and increasingly most significant threat to the bonytail in the action area is from nonnative species, which is discussed in the Status of the Species section. See also the discussion regarding nonnative species in the Colorado pikeminnow Status of the Species and Baseline sections above, as this threat is similar for all endangered fish in the upper Colorado River basin, particularly regarding predation from nonnative predators.

3.3 Contaminants In The Action Area

The Colowyo Mine has been in operation for many years, first as an underground coal mine, then as an open pit mine starting in 1977. Mine discharge (waste water that is released into surface waters or ground water) may have contained some level of mercury and selenium since mining began. Past and current discharge levels up to this point are considered part of the baseline for the purposes of this consultation. As mining at the South Taylor/Lower Wilson area continues, mine discharge is expected to continue at current levels, which is considered part of the proposed action. Thus, the mercury and selenium concentrations in current mine discharges can be considered both as part of the baseline and the proposed action, as they continue. Given this, contaminants in the action area in general are discussed directly below. Contaminants in the watershed containing the Colowyo Mine, a subset of the action area, are primarily discussed in the Effects of the Action section below.

3.3.1 Mercury

An analysis of mercury deposition and its effects on endangered fish in the San Juan River was recently completed for the Four Corners Power Plant (EPRI 2014). Over 10 times more coal was involved in the modeling for that effort than under consultation here, but the mechanics of mercury emissions and deposition analyzed there are informative for this consultation. Numerous activities, natural sources, and legacy sources have emitted mercury in the past and, given that mercury is a global pollutant, we can assume an unknown quantity of that mercury has been deposited in the action area over time. Since the surface area of water is low in the Yampa and White River Basins compared with land area, almost all mercury deposition falls on land, primarily as elemental or ionic mercury. The deposited mercury either evades back to the atmosphere or sequesters to soil. Over time, when overland flow takes place, soil is eroded from the catchment surface and carries adsorbed mercury (e.g., mercury ions; EPRI 2014) with it to the river. A very small portion (about 0.1 percent in the San Juan River, EPRI 2014) of ionic mercury deposited in the watershed enters surface waters. Because of the relatively large amount of past mercury deposited to the soils in a watershed from local, regional and global

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sources, mercury in water and fish are slow to respond to changes in mercury deposition, including reductions in the deposition of mercury (EPRI 2014). Thus, due to the time it takes for mercury to cycle through the environment, mercury emission and deposition in the action area that may have occurred in the past may continue to affect the listed species and critical habitats today and into the future, and yet are considered part of the environmental baseline.

Water mercury concentrations in the Yampa and White Rivers, which includes all critical habitats in the action area, have not been measured within endangered fish critical habitat in over a decade. Older measurements were not made at precise detection levels. Water mercury concentrations were tested in the White River above Kinney Reservoir (formed by Taylor Draw Dam) from 1990-1993 (USGS 2015). This reach of the White River is within the action area, as is all of the White River below Rio Blanco Lake, which marks the upper limit of critical habitat for the Colorado pikeminnow. Although mercury was not detected in 6 of the 8 samples, the maximum concentration measured was 0.10 µg/L, which is 10 times the chronic aquatic toxicity standard of 0.01 µg/L; the level of concern was listed as High, but clearly more sampling is needed. Chronic toxicity is the development of negative effects as the result of long term exposure to a toxicant or other stressor. It can manifest as direct lethality but more commonly refers to sub-lethal endpoints such as decreased growth, reduced reproduction, or behavioral changes such as impacted swimming performance.

Mercury water concentrations of 0.10 and 0.2 µg/L were also measured in the 1990s in the Yampa River at the Maybell and Craig stations, respectively, although the median values for the datasets were below the detection limit (assumed to be zero) (USGS 2015). Despite occasional high water mercury concentrations, most values were low enough (all median values were below the detection limit) that the Yampa and White Rivers are not listed as impaired for mercury on the EPA 303(d) list (CDPHE 2012b). Water mercury concentrations are not currently measured in the Yampa or White Rivers within endangered fish critical habitat.
As explained more fully in the Effects of the Action section below, and provided as reference here, mercury in whole body fish ≤ 0.2 micrograms per gram (µg/g) wet weight (WW) is an approximate threshold below which mercury tissue concentrations can be considered protective of juvenile and adult fish (see Beckvar et al. 2005 and further discussion in Effects of the Action section). This translates to a value of 0.31 µg/g WW in muscle tissue (often sampled as muscle plugs—a small, circular, shallow sample of muscle tissue taken from a live fish without significant injury). Osmundson and Lusk (2012) found a range of 0.25 to 0.35 ug/g whole body WW with a mean concentration level of 0.30 µg/g in Yampa River pikeminnow. Colorado pikeminnow that were captured in the 1960's from the Yampa River and recently tested had roughly similar mercury concentrations (all archival pikeminnow averaged 0.39 µg/g whole body mercury WW) (Osmundson and Lusk 2012). Muscle tissue samples, which are approximately 1.6 times greater than whole body concentrations, taken from adult pikeminnow (length 20-26 inches) in the Yampa River in 2006 had levels of mercury between 0.42 and 0.68 µg/g (CDPHE 2015).

Within the White River, Osmundson and Lusk (2012) found that mercury concentrations in pikeminnow muscle plugs were higher there than within any other occupied critical habitat unit, with estimated whole body concentrations for these fish ranging from 0.27 to 1.0 ug/g WW (after conversion to whole body from muscle tissue) (Osmundson and Lusk 2012). Roundtail chub

(*Gila robusta*) were also tested in the White River as a part of the same study and were found to have elevated mercury levels as well (Osmundson and Lusk 2012). Whole body mercury concentrations in four adult pikeminnow (502-760 mm in length) taken from the White River immediately below Kinney Reservoir in 1986 ranged from 0.31 to 0.96 µg/g (after conversion to wet weight from dry weight (Krueger 1988). Osmundson and Lusk (2102) state that the White, Green, Colorado, and Yampa Rivers should be placed on the 303(d) list of state impaired waters due to these high mercury concentrations found in fish tissue.

To summarize, Colorado pikeminnow have repeatedly shown elevated mercury levels in both the Yampa and White Rivers. Some of the mercury levels measured in pikeminnow from the White River have been especially high. It is reasonable to assume that some individuals are being adversely affected by these levels. However, we do not know what level of impact mercury has had on the Colorado pikeminnow at the population level in the action area in the past. We do not know if it is affecting or preventing successful reproduction, particularly in the White River where mercury levels are higher and reproduction is rare. Although likely to be lower than Colorado pikeminnow due, in large part, to trophic position, mercury levels have not been tested in the other three endangered fish species.

3.3.2 Selenium

During sampling of the Yampa River between 1997 and 1998, selenium concentrations ranged from; <1 to 4.8 µg/L near Craig, < 1 to 4.9 µg/L near Maybell, and <1 to 3.6 µg/L near Deerlodge Park (USGS 2001). The peak reported selenium concentrations for these sites occurred in March, possibly during the beginning of the snow runoff. Concentrations were <1 µg/L during May through October. A longer term data set from 1991 to 2011 for the Yampa River below Craig Colorado (USGS Station 09247600)(n=91), showed that close to half of the sample values were reported at less than the laboratory reporting level (assumed to be zero), and the maximum reported selenium concentration was 17.0 µg/L (USGS 2015; OSMRE 2015b). The chronic aquatic life standard for selenium is 5 µg /L total and 4.6 ug/L dissolved (CDPHE 2012a). In sum, historic selenium concentrations measured in the Yampa River below Craig have exceeded the chronic aquatic life selenium standard approximately 10 percent of the time, but are generally below the standard, and this segment is not listed under 303(d) of the Clean Water Act as impaired for selenium (CDPHE 2012b; USGS 2015).

According to USGS (2015) water sampling in the White River beginning in the 1990s, water selenium concentrations have always remained below the chronic aquatic life standard both above and below Taylor Draw Dam.

Because selenium bioaccumulates in aquatic food chains, selenium concentrations in fish tissue, rather than water, provide a better indication of potential adverse impacts. The available data is limited, but a few studies have provided selenium concentrations measured in fish tissue samples collected from the Yampa and White Rivers. Osmundson and Lusk (2012) reported on selenium in muscle plug samples taken from archival Colorado pikeminnow collected from the Yampa River during 1962-1966, which averaged 7.5 µg/g DW (5.9-10.1ug/g DW). According to Lemly (1995, p.281), these fish would be ranked into the "High" hazard category (after conversion of whole body to egg concentrations), which "denotes an imminent, persistent toxic threat sufficient to cause complete reproductive failure in most species of fish and aquatic birds." Selenium concentrations in muscle plugs taken from five Colorado pikeminnow collected from the Yampa River during 1996 ranged from 1.7-2.8 ug/g DW (mean of 2.3 ug/g DW) (Hamilton et al. 2004) which places them in the "Minimal" hazard category (Lemly 1995). The Minimal hazard category which indicates "that no toxic threat is identified but concentrations of selenium are slightly elevated in one or more ecosystem components (water, sediment, invertebrates, fish, birds) compared to uncontaminated reference sites; continued comprehensive environmental monitoring is recommended." Thus, selenium tissue concentrations in Colorado pikeminnow from the Yampa River have varied over time, with earlier values indicating a high hazard and more recent values indicating a minimal hazard.

3.4 Climate Change In The Action Area

We discuss climate change on a global and regional level in the Status of the Species section above (2.6). That discussion includes the action area. In this section we provide further insights into the potential effects of climate change within the action area.

Native fish in the Yampa River could potentially move upstream in response to periods of warming and drying associated with climate change because there is no dam blocking up-river migration. In the White River, however, the Taylor Draw Dam precludes migration to potentially more favorable upstream areas as a behavioral adaptation to changing climatic conditions. The Yampa and White Rivers are at the upper end of the distribution of the endangered fishes within the Colorado River watershed, however. As far as water temperatures are concerned, these fish inhabit warmer waters downstream and are presumably not currently near the upper limit of their temperature tolerances within any given season unless low flows and dry conditions become a problem, which can greatly affect water temperature.

If the modeled predictions of more frequent, more severe, and possibly longer-lasting droughts, along with generally warmer temperatures and less snowfall occur, it will likely become increasingly challenging to meet the flow recommendations for the Yampa and White Rivers (Service 2005, 2013), established to protect listed fish and other native fish species, perhaps both the high-flows that provide for channel maintenance and create or renew habitat for listed fish, and minimum base flows, which support feeding, sheltering, and movement. Reduced flow levels may also exacerbate contaminant issues, as less dilution of contaminants in the river would occur.

Climate change could also affect nonnative fish in the action area, which we believe to be the greatest threat to the endangered fish in the action area. As stated in Martinez et al. (2014), the challenges in restoring and conserving native aquatic species will likely become more difficult due to the interaction of invasive species and climate change. The abundance of nonnative species can increase rapidly under favorable conditions such as low flow prolonged by drought. Reductions in water stores and stream flows due to climate change may intensify demand for remaining water supplies and may hasten proposed water development, including in the Yampa River.

For example, long-term climate and water development forecasts suggest flow scenarios for the Yampa River that will functionally mimic drought conditions, including reduced stream discharge, smaller stream size, and an increase in summertime water temperatures (Roehm 2004; Johnson et al. 2008). Several invasive species, including green sunfish *Lepomis cyanellus* and largemouth bass *Micropterus salmoides*, have higher thermal tolerances than many of the fish species native to the Colorado River Basin. The projected increase in channel catfish growth rate (McCauley and Beitinger 1992) could increase piscivory by larger catfish in the Colorado River Basin.

Climate change and its effects on water temperature may also alter the dynamics of parasite and disease transmission and host susceptibility, exposing immunologically naïve native fish to outbreaks of pathogens. For example, thermophilic Asian tapeworm *Bothriocephalus acheilognathi* may become more widespread and increase its infection intensity due to higher water temperatures associated with lower summertime flows. Incidence of infection may be higher in small fish and infected fish may grow more slowly, prolonging their exposure to increased infection and predation, and potentially reducing the survival of native cyprinids (Martinez et al. 2014).

Given the uncertainties, however, involved with climate change, including the possibility for both positive and negative effects on endangered fish, particularly at a local level such as the action area, it is currently not possible to predict with any confidence how endangered fish and their habitats will be affected overall. We believe, however, that the primary net effect is likely to be in an increase in the competitive edge for nonnative fish at the expense of native fish, including the four endangered fish in the upper Colorado River Basin. We also believe, however, that in the near term, over the course of the projected coal mining at the Colowyo Mine that is under review, climate change impacts will not be great enough to be readily measurable or have an immediate effect on the endangered fish.

4.0 EFFECTS OF THE ACTION

In this section we analyze the direct and indirect effects of the action on the four endangered fish species and their critical habitats, together with the effects of other activities that are interrelated or interdependent with the proposed action, that will be added to the environmental baseline (per 50 CFR 402.02). Indirect effects are those that are caused by a proposed action and are later in time, but are still reasonably certain to occur. If a proposed action includes off-site measures to reduce or offset net adverse effects by improving habitat conditions and survival, the Service will evaluate the net combined effects of that proposed action and the off-site measures as interrelated actions. Interrelated actions are those that are part of a larger action and depend on the larger action for the justification; 'interdependent actions' are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Future federal actions that are not a direct effect of the action under consideration, and not included in the environmental baseline or treated as indirect effects, are not considered in this consultation.

Analysis challenges

There are many unique challenges to analyzing the effects of the proposed action. They are outlined below:

- We have an estimate as to the amount of mercury released from the combustion of Colowyo coal at the Craig Generating Station, but there is currently a lack of specific information on the amount of selenium released during this process.

- There is currently a lack of reliable information on how much of the emitted mercury and selenium are deposited on the landscape within the action area.

- There is currently a lack of reliable information on the amount of deposited mercury and selenium that eventually enters occupied and critical habitat and becomes available to be taken up by the four endangered fish species.

- The analysis is confounded by other sources of selenium and particularly mercury, a global pollutant, which also contribute to the amounts available to be taken up by the four endangered fish species.

- There is currently a lack of information regarding the specific effects of elevated mercury and selenium on any of the four endangered fish. Assumptions can be drawn only from information relative to other fish species.

These limitations make it very difficult to precisely describe effects to individuals of the four endangered fish species. To satisfy Congress's direction in 7(a)(2) regarding insuring that an action not jeopardize the species, OSMRE and the Service must use the best available information and basic conservation biology principles to explore the overall impact to the populations that are likely to occur and how those effects relate to the likelihood of Jeopardy.

OSMRE has committed to two different actions to mitigate the effects of their action. One of those (Species Preservation and Recovery Actions Funding, discussed above) will help to improve the status of the species. The second is a study to fill information gaps noted above and to provide data to inform the reasonableness of assumptions that have to be made to move the analysis forward. And as provided for in the regulations, reinitiation of this consultation is triggered if new information reveals effects to the species in a manner or to an extent that was not considered in this analysis.

In the discussion below we describe the effects of the action on the four endangered fish. There are many uncertainties and unanswered questions, however, leading us to necessarily make some reasonable assumptions. Some of these unanswered questions will be addressed through a mercury transport and deposition analysis as described in the conservation measures section above.

This biological opinion considers the following effects to the four federally listed fish species and their designated critical habitat:

1. Potential mercury and selenium contamination from mine discharge (runoff into surface or ground water).

2. Potential mercury and selenium contamination from coal combustion.

Note: water depletions associated with the Colowyo Mine and Craig Generating Station were addressed in previous biological opinions, as explained in the Consultation History section above.

4.1 Emissions from the Craig Generating Station

4.1.1 Mercury

Mercury is a naturally occurring element. It can be found in soils and the atmosphere, as well as water bodies. Mercury is contained in coal and can be released upon combustion. Atmospheric transport and deposition is an important mechanism for the global deposition of mercury (EPRI 2014), as it can be transported over large distances from its source regions and across continents. It is considered a global pollutant. Atmospheric mercury is primarily inorganic and is not biologically available. However, once this mercury is deposited to the earth, it can be converted into a biologically available form, methylmercury (MeHg), through a process known as methylation. Methylmercury bioaccumulates in organisms and biomagnifies up food chains, particularly in aquatic food chains, meaning that organisms exposed to MeHg in their food can build up concentrations that are many times higher than the ambient concentrations in the environment.

Inorganic atmospheric mercury occurs in three forms:

- Elemental mercury vapor (Hg(0)), also referred to as gaseous elemental mercury (GEM);

- Gaseous divalent mercury, Hg(II), also referred to as reactive gaseous mercury (RGM) or gaseous oxidized mercury;

- Particulate mercury, Hg(p), also referred to as particle bound mercury (PBM); PBM can be directly emitted or can form when RGM adsorbs on atmospheric particulate matter.

In the global atmosphere, Hg(0) accounts for more than 90 percent of total mercury, on average, while both RGM and PBM typically account for less than 5 percent (EPRI 2014). The reactive form of mercury is often deposited to land or water surfaces much closer to their sources due to its chemical reactivity and high water solubility. PBM is transported and deposited at intermediate distances depending on aerosol diameter or mass. Within the atmosphere, numerous physical and chemical transformations of mercury can occur depending on many factors.

The various forms of mercury have very different physical and chemical characteristics, resulting in large differences in their removal rates from the atmosphere, and consequently, in their atmospheric lifetimes (EPRI 2014). GEM has a lifetime of the order several months to more than a year because of its low reactivity, low water solubility, and slow deposition rate. Thus, it is considered a global pollutant since it is transported over long distances. On the other hand, the lifetimes of both RGM and PBM are much smaller, ranging from a few hours to days, because they are removed efficiently by dry and wet deposition, particularly RGM. Thus, mercury is a pollutant at all scales ranging from global to local.

Mercury is emitted by both natural and anthropogenic sources. Natural sources include volcanoes, geothermal sources, and exposed naturally mercury-enriched geological formations. These sources may also include re-emission of historically deposited mercury as a result of evasion from the surface back into the atmosphere, fires, meteorological conditions, as well as changes in land use and biomass burning. Anthropogenic sources of mercury include burning of fossil fuels, incinerators, mining activities, metal refining, and chemical production facilities.

As stated in the BA, combustion of coal at the Craig Generating Station mined at the Colowyo Mine would likely continue at current levels through the end of the life of the South Taylor pit (2019). Therefore, assuming a constant rate of mining at the Colowyo Mine and combustion at the Craig Generating Station each year, approximately 16.3 kg of mercury would be emitted annually through 2019 from the South Taylor Proposed Action (4 mtpy). This would result in a total of 73.5 kg of mercury emitted from the Craig Generating Station as a result of the combustion of South Taylor coal over the next 4.5 years.

Once mercury is emitted from the smoke stacks at the Craig Generating Station, it is transported some distance through the atmosphere before deposition on the land scape takes place. Apportioning the deposition of mercury based on emissions from multiple emissions sources is a complicated endeavor. Currently no requirement or program exists for modeling the source apportionment of mercury emissions. Regional scale photochemical modeling that accounts for simulated chemical transport, dispersion within the atmosphere, and chemical interactions of pollutants within the atmosphere are required for such an effort. An effort to conduct such modeling is discussed in the Conservation Measures section above.
No data or modeling is available to indicate how much of the mercury emitted by the Craig Station is deposited annually within the airshed analyzed in this consultation or within the greater Yampa and White River watersheds. However, a recent contaminant modeling effort was done on the emissions and deposition of mercury produced at the Four Corners Power Plant in New Mexico (EPRI 2014). In that modeling effort, it was determined that approximately 95 percent of all mercury emitted by the Four Corners Power Plant rises high enough into the atmosphere that prevailing wind currents will carry those out of the area analyzed in that situation. Although environmental conditions at the Craig Generating Station may be somewhat different, and our analysis here involves less than 1/10th the amount of coal to be combusted, that modeling effort provides a roughly comparable situation that will assist us with our analysis.

A mercury deposition network (MDN) monitoring site is located in Routt County just east of Steamboat Springs on Buffalo Pass. It is just east of the airshed analyzed for this project (map provided in BA, Figure 9). These monitoring stations measure the levels of mercury that are deposited during precipitation events (i.e. wet deposition). The Buffalo Pass site is the nearest MDN receptor to the action area. It is approximately 68 miles east of the Colowyo Mine and 45 miles east of the Craig Generating Station. This site has provided data on the wet deposition of mercury to the MDN since 2007. Data from this station in 2013 indicated that there was an annual deposition of 9.757 μg/m2 of mercury at that location (NAPD 2015). The Hayden Generating Station, another, smaller coal-fired power plant in Moffat County, is approximately 29 miles west of Buffalo Pass and this MDN site.

According to the BA, deposition monitoring values for total wet deposition at the Routt Monitoring Station increased approximately 2 micrograms per square meter ($\mu g/m^2$) from 7.8 $\mu g/m^2$ in 2008 to 9.8 $\mu g/m^2$ in 2013. This increase occurred during a period when additional pollution controls began to be put into place at regional generating stations within the western U.S. as part of the MATS rule required by the EPA in February 2012. Existing power plants are allowed four years (until 2016) to comply with the MATS rule and implement pollution controls; therefore, it is possible that most power plants had not yet complied by 2013. Nevertheless, the cause for increasing mercury wet deposition at this monitoring site in the face of potentially decreasing emissions from local sources is not known. It is possible that an increasing amount of mercury was emitted from other global or regional sources during this time period.

As calculated in the BA, using the results of the emission and deposition modelling conducted at the Four Corners Power Plant as a possible scenario, and assuming that the average annual deposition of 9.757 $\mu g/m^2$ of mercury is equally distributed throughout the Yampa and White River watersheds (a combined total of 34,362 km^2); an annual deposition of 335.27 kg of mercury is calculated. The action area (i.e., the entirety of the Colorado River Fish analysis area (see Figure 9 in BA)) is within these two watersheds and is 10,514 km^2. Therefore, assuming an even distribution of mercury deposited, there would be a total of 102.59 kg of mercury deposited annually over the action area. However, if we use the results of the Four Corners Power Plant emissions model (EPRI 2014), only 5 percent of all the mercury deposited was determined to be emitted from regional sources and the other 95 percent comes from global or other distant sources, then the amount of mercury deposited annually that comes from the two local generating stations is 5.13 kg over the entire action area. The assumption of an even deposition of mercury is not realistic as prevailing winds from the west to the east likely results in higher amounts of deposition occurring east of the two generating stations. This also assumes no other local sources of mercury emissions beyond the two power plants are contributing to the depositions, and likely overestimates emissions from the power plants. However, barring further detailed modeling and analysis of mercury deposition, this is the best available information at this time.

Using the latest estimates provided by the EPA, in 2013 the total mercury emitted by the two local generating stations was 26.7 kg. Of that amount, coal from the Colowyo Mine accounted for 16.3 kg, or 61.1 percent of the mercury emitted. Using the same ratio, of the 5.13 kg of annual mercury deposited associated with the two generating stations, 3.13 kg of mercury annually would come from the Colowyo Mine coal that is combusted at the Craig Generating Station. This amounts to 3 percent of all mercury being deposited in the action area coming from the burning of South Taylor/Lower Wilson coal from the Colowyo Coal Mine at the Craig Generating Station. To put this amount of mercury in perspective, 3.13 kg of mercury would fit in an 8 ounce coffee cup. This amount of mercury from the project would be deposited over the entire action area each year. However, even small amounts of mercury can be very toxic.

It is important to note that the calculations above are in reference to wet deposition of mercury. Some research has shown that dry deposition can be equal to or greater than wet deposition. Research has shown this rate to be anywhere from 0.8 to 4.8 times higher (Zhang et al. 2012). The rate of dry deposition is highly dependent on the meteorological conditions, including precipitation amounts, and the chemical speciation of the mercury. Although most all of the sites analyzed in Zang et al. (2012) were in the eastern United States with more precipitation than that experienced in western Colorado, one site analyzed was in Salt Lake City, Utah. At that site, total mercury was 2.5 times that of the wet deposition of mercury. Although total mercury was not estimated in the BA due to the uncertain ratio of wet/dry mercury deposition in the action area, we find it reasonable to use the ratio measured in Salt Lake City as it has a roughly similar climate to that found in northwestern Colorado. Therefore, for the purposes of this consultation, we assume that 7.8 kg of mercury (3.13 x 2.5) would be emitted annually from the Craig Generating Station from the combustion of the Colowyo coal subject to this consultation.

4.1.2 Selenium

In addition to mercury, impacts to the Colorado River fish from increases in selenium from the combustion of coal at the Craig Generating Station could occur. Selenium, a trace element, is a natural component of coal and soils in the area and can be released to the environment by the irrigation of selenium-rich soils and the burning of coal in power plants with subsequent emissions to air and deposition to land and surface water. Contributions from anthropogenic sources have increased with the increases of world population, energy demand, and expansion of irrigated agriculture. Selenium, abundant in western soils, enters surface waters through erosion, leaching, and runoff.

When selenium is present in flue gas after combustion, it tends to behave much like sulfur and is removed to some extent via the Sulfur dioxide (SO_2) air scrubbers in place and also absorbs onto alkaline fly ash that is subsequently removed by a fabric filter baghouse (EPRI 2008). Nevertheless, combustion of coal at the Craig Generating Station could result in some amount of selenium moving beyond pollution control processes, being emitted, and subsequently deposited on the landscape. However, unlike mercury, it is not monitored as it is emitted and no information is available as to how much is released. Thus, no estimate as to the amount of selenium emitted annually and potentially deposited into the area was made in the BA. However, the BA did note that when the Colowyo coal was last tested in March of this year, it contained less than 1 microgram of selenium per gram of coal (µg/g) (i.e., less than 1 part per million (ppm)), which was the detection limit. Given the lack of site-specific information on selenium releases at the Craig Generating Station, to estimate selenium emissions we need to make certain assumptions. If we assume that selenium is removed from coal at the Craig Generating Station at the same rate as its removal at the Four Corners Power Plant during combustion with pollution control (98 percent removal, EPRI 2014), and the coal contains 1 ppm selenium (at most), then the 12.7 million tons of coal remaining at the South Taylor/Lower Wilson area would emit up to 231 kg of selenium from the Craig Generating Station stacks. Assuming the coal from this area would be mined over the course of 5 years (2015-2019), that would be up to approximately 46.2 kg of selenium per year.

4.2 Discharge (Runoff) from the Colowyo Mine

The Colowyo Mine has been in operation for many years, first as an underground coal mine, then as an open pit mine starting in 1977. Mine discharge may have contained some level of mercury and selenium since mining began. Past and current discharge levels up to this point are considered part of the baseline. As mining at the South Taylor/Lower Wilson area continues, mine discharge is expected to continue at current levels, which is considered part of the proposed action. Thus, the mercury and selenium concentrations in current mine discharges can be considered both as part of the baseline and the proposed action, as they continue, as discussed below.

4.2.1 Mercury

In addition to the potential for mercury to be deposited from coal combustion at the Craig Generating Station, mercury may also be released from water discharges directly from the mine, which ultimately drain into the Yampa River. Water discharge is specifically managed under Colowyo Mine's NPDES permit issued by the EPA. However, under the EPA NPDES standard, discharge water is not typically monitored for mercury levels. During the renewal process of the NPDES permit every five years, the EPA may require that a permit holder sample for mercury (or other contaminants not normally sampled for) if contamination is demonstrated (e.g. abnormally high levels shown from other sampling efforts, such as the Colorado Division of Reclamation Mining and Safety (CDRMS) sampling discussed below). To date, Colowyo has not been required to do so by the EPA, according to the BA.

The CDRMS, which issues the state mining permit, does not require that discharges from ponds be monitored for mercury and does not set limits on the amount of mercury that can be discharged from the ponds. CDRMS does, however, require mercury analyses of samples from points on receiving waters upgradient and downgradient of a mine, when a permit is first written. The operator is required to develop a monitoring plan for receiving waters; this includes background data (before mining), upstream sample points, and downstream sample points, including groundwater.

Three surface water monitoring stations are in place downstream of potential discharge points from the Colowyo Mine. All permitted discharge points first flow into sediment ponds. Two of the locations are found in Good Spring Creek (sampling points: Lower Good Spring Creek and New Upper Good Spring Creek), and the other is in Taylor Creek (sampling point: Lower Taylor Creek). The fourth point is upstream of the mine in the West Fork of Good Spring Creek (sampling point: Upper West Fork of Good Spring Creek). When CDRMS staff review annual hydrology reports that contain the data for receiving waters, they compare this data to CDPHE standards (Regulation 31, The Basic Standards and Methodologies for Surface Water). Prolonged or extreme exceedances of the mercury standard could result in the writing of a violation of the permit.

Regarding discharge volume, most discharge locations from the Colowyo Mine do not have regular flow. The Taylor Creek discharge point, however, has a constant flow into Taylor Creek of 0.039 cubic feet per second, on average. The discharge flow is the result of drainage through an underdrain structure below the West Taylor fill, which is immediately upgradient of the West Taylor settling pond, which then drains to the discharge point.

According to the BA, samples collected at these sampling locations and analyzed for mercury, according to EPA method 245.1, have reported mercury levels of 0.001 milligrams per liter (mg/L). This is also the state mandated detection level for mercury under the current South Taylor/Lower Wilson mining permit. All mercury levels at the four locations, above and below the mine, have been reported at this level since 2008. According to the BA, it is possible that this is the detection limit and that actual mercury levels are potentially below this amount.

Using these data, it is not possible to determine whether or not there is some amount or no amount of mercury being released from Colowyo Mine discharge. We can only say that mine discharges may be releasing mercury that may ultimately reach the Yampa River at some concentration less than 0.001 mg/L in minor flows that average less than one tenth of one cubic foot per second. We believe it is reasonable to assume that the amount of mercury released in mine discharge, if any, is small in comparison to the mercury released into the environment through eventual combustion of the coal. The Yampa River is not listed on the EPA 303(d) list of impaired waters for mercury, including the reach of the Yampa River downstream from confluence of the tributary watershed containing the Colowyo Mine (USGS water quality data station near Maybell). Although the data is incomplete (USGS 2015), it does not appear that the mercury in mine discharge, if any, is high enough to impair the Yampa River; this reach of the Yampa River is designated critical habitat for the Colorado pikeminnow.

4.2.2 Selenium

Selenium in surface waters has been tested in tributaries surrounding the Colowyo Mine both before and after approval of the South Taylor/Lower Wilson mining plan (2008). Dissolved selenium rates ranged from 1 µg/L to 36 µg/L in samples taken between 1983 and 2006 in three streams near the mine (OSMRE 2015b). Note that, as stated above, surface mining began at the Colowyo Mine in 1977. Sampling after 2007 has shown a range of 5 µg/L to 20 µg/L in these same tributaries plus one additional site near the mine. All sites are at or greater than the chronic aquatic life standard criterion for selenium, which is 5 µg/L total and 4.6 ug/L dissolved (CDPHE 2012a).

The mine's National Pollution Discharge Elimination System (NPDES) permit does not include an effluent limit for selenium. This permit expired and was administratively extended in 2010 and is still currently under administrative extension. As required, CDPHE completed a water quality assessment for the COLCLY03e area, which includes the nearby Good Spring Creek and Wilson Creek tributaries adjacent to the mine, and determined no effluent limitations for selenium were required. CDPHE also determined that COLCLY03e is Use Protected and not subject to antidegradation requirements, although selenium monitoring is required (OSMRE 2015b).

Although selenium concentrations in the tributaries adjacent to the mine are not protective of fish, the Colowyo Mine is approximately 9 miles from Colorado pikeminnow occupied and critical habitat in the Yampa River. Although dissolved selenium is readily transported downstream, selenium concentrations in the water flowing from the small tributaries surrounding the mine would be diluted as they combine with other tributaries (e.g., Milk Creek, Jubb Creek) (assuming a lesser selenium concentration) and particularly upon entering the Yampa River. Selenium concentrations were measured in the Yampa River near Maybell (USGS Station 09251000) from 1990-2003. This monitoring station is below the Yampa River's confluence with Milk Creek and its watershed, which receives drainage from the Colowyo Mine and the tributaries surrounding it. Selenium concentrations were also measured from 1991-2013 upstream in the Yampa River at the Craig monitoring station (USGS Station 09247600), which is at the upper end of critical habitat for the Colorado pikeminnow and above any influence of Colowyo drainage. At both monitoring stations in the Yampa River, one above and one below the influence of drainage from the Colowyo mine, median selenium concentrations of less than 1 μg/L and 85th percentile concentrations below the chronic aquatic life standard were measured.

4.3 Effects to Endangered Fish

4.3.1 Mercury

Mercury is an environmental contaminant that can have adverse effects on riparian and aquatic wildlife (Scheuhammer et al. 2012; Wentz et al. 2014). Elevated levels of mercury in living organisms in mercury-contaminated areas may persist for as long as 100 years after the source of pollution has been discontinued (Eisler 1987). Eisler (1987, p. iii) states:

> Most authorities agree on six points: (1) mercury and its compounds have no known biological function, and the presence of the metal in the cells of living organisms is undesirable and potentially hazardous; (2) forms of mercury with relatively low toxicity can be transformed into forms of very high toxicity, such as methylmercury, through biological and other processes; (3) mercury can be bioconcentrated in organisms and biomagnified through food chains; (4) mercury is a mutagen, teratogen, and carcinogen, and causes embryocidal, cytochemical, and histopathological effects; (5) some species of fish and wildlife contain high concentrations of Hg that are not attributable to human activities; (6) anthropogenic use of Hg should be curtailed, as the difference between tolerable natural background levels of Hg and harmful effects in the environment is exceptionally small.

Aquatic systems receive mercury by direct deposition from the atmosphere and from overland transport from within the watershed (EPA 1997). Mercury primarily enters aquatic systems in an inorganic form where it can adsorb to suspended solids and settle to the bottom (EPA 1997). It can also be photo reduced in the upper few centimeters of the water's surface and then evade to the atmosphere. RGM at the sediment water boundary can be transformed into MeHg by sulfate-reducing bacteria, but this process can also go the other direction, depending on site-specific conditions. The most important areas for methylation are anoxic areas of the aquatic environment, such as wetlands or poorly mixed aquatic areas. The vast majority of mercury in fish tissue is in the form of MeHg (EPA 1997). Rates of methylation processes and bioaccumulation typically vary and depend on many factors.

The potential effects of mercury on fish are numerous. Lusk (2010) describes the potential affects as:

1. Potent neurotoxin:
   a. Affects the central nervous systems (reacts with brain enzymes, then lesions);
   b. Affects the hypothalamus and pituitary, affects gonadotropin-secreting cells;
   c. Altered behaviors: Reduced predator avoidance, reproduction timing failure;
   d. Reduced ability to feed (emaciation and growth effects).
2. Endocrine disruptor
   a. Suppressed reproduction hormones in male and female fish;
   b. Reduce gonad size and function, reduced gamete production;
   c. Altered ovarian morphology, delayed oocyte development;
   d. Reduced reproductive success;
   e. Transfer of dietary Hg of the maternal adult during oogenesis and into the developing embryo.
3. Inability to grow new brain cells or significantly reduce brain mercury.

It should be noted that piscivorous fish inhabiting fresh waters in the midwestern and eastern United States, and some waters in the western United States contaminated by mining activities, contain concentrations exceeding 1.0 µg/g WW in muscle tissue. Thus, adverse effects to predatory fish from mercury are not unique to the action area. The harmful effects of methylmercury on fish populations at existing exposure levels in many North American freshwaters would be sub-lethal, such as cellular damage, reduced vigor, and reduced reproduction. Direct mortality due to methylmercury has been observed only at high concentrations (6-20 µg/g WW in muscle) (Sandheinrich and Wiener 2011).

Rather than direct mortality, we expect that chronic toxicity from exposure to mercury in the action area may be affecting the endangered fish, as discussed below. Chronic toxicity is the development of negative effects as the result of long term exposure to a toxicant or other stressor. It can manifest as direct lethality but more commonly refers to sub-lethal endpoints such as decreased growth, reduced reproduction, or behavioral changes such as impacted swimming performance.

4.3.3.1 Colorado pikeminnow

Of the four endangered fish in the Yampa and White Rivers, we expect the Colorado pikeminnow to be at greatest risk from exposure to mercury that has been deposited from the emissions from the Craig Generating Station and discharged from the Colowyo Mine into the Yampa and White rivers. This is due to two factors. First, Colorado pikeminnow have a higher likelihood of bioaccumulating mercury. Predatory organisms at the top of the food web generally have higher mercury concentrations in their bodies because mercury tends to biomagnify up through the food chain and concentrate in upper trophic levels (EPA 1997). Unlike the other three endangered fish, the Colorado pikeminnow is a top predator and is almost entirely piscivorous once it grows to be 80-100 mm (3 to 4 inches) long (Vanicek and Kramer 1969). The Colorado pikeminnow is also a long-lived fish, living 55 years or more (Osmundson et al. 1997). Thus, mercury will accumulate more rapidly and over a longer time period than in the other three endangered fish species.

Second, Colorado pikeminnow generally occupy habitats closer to the Colowyo Mine and Craig Generating Station than the other endangered fish and would, therefore, be exposed to the highest concentrations of mercury resulting *from the project*. Critical habitats designated for each endangered fish were based on areas of known occupancy. Only critical habitat designated for the Colorado pikeminnow is found within the airshed identified around the Craig Generating Station for analysis in this consultation. The other three endangered fish and their critical habitats are found lower down in and along the Yampa River (razorback sucker, humpback chub, bonytail), and lower down in and along the White River (razorback sucker). We expect the contribution of mercury from the Craig Generating Station and Colowyo Mine in the Yampa and White Rivers to diminish with distance from those point sources through dilution (from additional water entering from tributaries) and removal (through biological uptake and potential adsorption to sediments).

Beckvar et al. (2005) suggested a threshold-effect level of ≤ 0.2 micrograms per gram (µg/g) wet weight (WW) mercury in whole body fish as being generally protective of juvenile and adult fish; concentrations below this level would not result in <u>any</u> detectible effects to these fish. This translates to a value of 0.31 µg/g WW in muscle tissue. More recently, after an examination of numerous mercury studies, Sandheinrich and Wiener (2011) stated that freshwater fish begin to exhibit sub-lethal, yet detectible negative effects through changes in biochemical processes, damage to cells and tissues, and reduced reproduction at methylmercury concentrations of about 0.3-0.7 µg/g WW mercury in whole body fish and about 0.5-1.2 µg/g WW mercury in muscle tissue. They state that nearly all mercury in fish is in the form of methylmercury, as this is the form that bioaccumulates and biomagnifies up through the food chain. Note also that the EPA human health consumption threshold is 0.3 µg/g/day of mercury (WW) in fish tissue (EPA 2001).

As stated in the Baseline section above, we have information on the levels of mercury found within Colorado pikeminnow in the Yampa and White Rivers in the past, unlike with the other three endangered fish. Osmundson and Lusk (2012) reported that 78 percent of the Colorado pikeminnow collected in Colorado (including the Yampa and White River Basins) had concentrations of muscle mercury above 0.2 µg/g, ranging from 0.39 to 0.58 µg/g with a mean level of 0.48 µg/g in muscle plug samples taken from Yampa River pikeminnow. Prior to that, muscle plug samples taken from pikeminnow in the Yampa River in 2006 had levels of mercury between 0.42 and 0.68 µg/g (CDPHE 2015). Earlier still, Osmundson and Lusk (2012) reported on the mercury concentrations in muscle plugs taken from archival pikeminnow collected in the Yampa River during 1964-1966, which measured 0.26-0.52 µg/g mercury (whole body WW). Most of these muscle tissue mercury concentrations are above the effects threshold suggested by Beckvar et al. (2005), but are below or at the concentrations identified by Sandheinrich and Wiener (2011) where negative effects would become detectible.

Osmundson and Lusk (2012) found that mercury concentrations in White River Colorado pikeminnow were higher than concentrations in Colorado pikeminnow in other critical habitats. They found a mean muscle tissue concentration of 0.95 µg/g (whole body of concentration of 0.6 µg/g) in White River pikeminnow with a range of 0.43 to 1.83 µg/g (Osmundson and Lusk 2012). Whole body mercury in pikeminnow taken from the White River over 20 years earlier was reported at 0.31 to 0.96 µg/g WW by Krueger (1988). The measured mercury concentrations indicate that some individuals with higher mercury concentrations have exceeded toxicity measurement thresholds and have mercury concentrations at a level where sub-lethal harmful effects are may become measurable in many other fish species (Sandheinrich and Wiener 2011).

Based on these results, we expect that some Colorado pikeminnow in the action area may already be experiencing chronic, sub-lethal harmful effects, such as potentially reduced reproductive success or reduced vigor, from elevated mercury concentrations. As stated above, however, piscivorous fish inhabiting fresh waters in the midwestern and eastern United States, and some waters in the western United States contaminated by mining activities, have been reported to contain concentrations exceeding 1.0 µg/g WW in muscle tissue (Sandheinrich and Wiener 2011). Thus, harmful effects to predatory fish from mercury are not isolated to the action area; this is, rather, a geographically widespread problem. These studies indicate that while harmful effects may begin to be measurable in individual fish with concentrations of 0.5 µg/g (WW, muscle tissue), or possibly less, fish apparently persist with muscle tissue concentrations exceeding 1.0 µg/g (WW).

Data from the Colorado Department of Public Health and Environment, Water Quality Control Division maintains a list of all waters in Colorado that exceed the total maximum daily loads for a variety of contaminants (CDPHE 2012b). Maintenance of this list is in accordance with Section 303(d) of the Federal Clean Water Act. The Water Quality Control Division does not list the Yampa or White Rivers as impaired for mercury levels. It should be noted, however, that impairment under this program relates to human effects and not necessarily to impacts to aquatic species.

As stated above, we know that the combustion of coal from the Colowyo Mine at the Craig Generating Station is releasing mercury into the air and we know approximately how much. We do not know, however, what proportion of that mercury deposits within the action area, the greater Yampa or White River watersheds, or is transported to distant locations beyond the limits of the local watersheds, although we have made a reasonable assumption of this amount. We have estimated that the proportion of the total mercury deposited within the action area from the Craig Generating Station is approximately 3 percent of the total, as we have described above. We also do not know to what extent the emitted mercury is transformed by chemical reactions within the atmosphere. Tri-State has committed to funding a study to address these questions and assumptions, as mentioned in the Conservation Measures section. For this consultation, we rely on mercury studies from other locations to make reasonable assumptions and estimate the amount of mercury being deposited within the action area from the burning of Colowyo Coal at the Craig Generating Station.

Although not fully understood or quantified, we believe the primary impact from coal combustion to the Colorado River fish is from the emission and subsequent deposition of mercury and eventual integration into fish tissue. Mercury poses a greater threat to the Colorado pikeminnow, as compared to the other endangered fish in the action area, and a greater threat than selenium, which is discussed below. Mercury has no beneficial use at any concentration for vertebrates and is considered toxic at much lower tissue concentrations. The chronic aquatic life standard for mercury concentrations in water is more than two orders of magnitude smaller than that for selenium. In most endangered fish tissue samples tested from the action area, mercury was close to or somewhat above the safe tissue standard. As discussed below, selenium tissue concentrations tested in the action area have ranged from levels indicating a minimal hazard to those indicative of a high hazard.

It is possible that the mercury concentrations measured in Colorado pikeminnow might result in a minor reduction of vigor through reduced mental and physical reaction times, which would impact their ability to escape predation from northern pike, smallmouth bass, or other piscivorous predators. Reduced swimming ability could also lead to a reduction in feeding success (i.e., capturing other fish to eat). However, the nonnative competitors and predators in the action area, such as northern pike and smallmouth bass, are experiencing the same water mercury concentrations and would therefore presumably not have a competitive advantage or increased predation success over Colorado pikeminnow in the presence of elevated mercury.

Despite the uncertainties outlined above, we can come to basic conclusions regarding the effect to endangered fish from the mining of Colowyo coal and its eventual combustion. Given fish tissue mercury concentrations have been determined to be somewhat elevated in Colorado pikeminnow from both the Yampa and White Rivers, and coal mining and combustion adds mercury to the system, this additional mercury adds to the negative effects of mercury. Based on the best available science, we believe some Colorado pikeminnow individuals are experiencing low, chronic negative health effects from mercury already in the action area. The mercury added by this project will add to the effects of this chronic condition, although the relative contribution of project-related mercury is assumed to be 3 percent of total mercury that has been and will continue to be deposited in the action area, as explained above.

Despite the chronic, low-level harmful effects of mercury that Colorado pikeminnow are experiencing, we believe the population decline seen in Colorado pikeminnow populations within the Yampa and White Rivers over the past decade or more is primarily a result of increased nonnative species in these rivers, especially northern pike and smallmouth bass. As explained in the baseline section above, these nonnative fish populations have increased and have applied increasing pressure on the Colorado pikeminnow population. Coal emissions from the Craig Generating Station have been largely constant since it became fully operational in the 1970s. The more recent decline of Colorado pikeminnow numbers in the action area coincides more closely with the expansion of nonnative fish, rather than any increase in mercury in the action area. While some Colorado pikeminnow individuals are likely to be experiencing low-level harmful effects from mercury in the system, we do not believe that the additional amount of mercury from the Colowyo Mine will be enough to significantly or measurably reduce population numbers, reproduction, or constrain Colorado pikeminnow distribution.

4.3.3.2 Razorback sucker

The effects to the razorback sucker from project-generated mercury are similar to those described for the Colorado pikeminnow above, although likely to be less severe in the action area. The razorback sucker is not a predaceous fish and would not bioaccumulate mercury as rapidly. Additionally, the razorback sucker does not occur as far upstream in the Yampa and White Rivers as the Colorado pikeminnow; thus, it does not occur as close to the point-sources for mercury resulting from the project. As with the Colorado pikeminnow, we believe nonnative species are the primary limiting factor for razorback sucker numbers, successful recruitment, and their distribution within the action area. While the evidence indicates that some razorback sucker individuals are likely being adversely affected by mercury in the system, we do not see evidence indicating that the negative effects from mercury rise to the level of reducing population numbers, are limiting reproduction, or are constraining razorback sucker distribution.

4.3.3.3 Humpback chub

The effects to the humpback chub from project-generated mercury are similar to those described for the Colorado pikeminnow above, although likely to be less severe in the action area. The humpback chub is not a top predator and would not bioaccumulate mercury as rapidly. Additionally, the humpback chub does not occur as far upstream in the Yampa River as the Colorado pikeminnow, and is not known to occupy the White River in any significant way; thus, it does not occur as close to the point-sources for mercury resulting from the project. As with the Colorado pikeminnow, we believe nonnative species are the primary limiting factor for humpback chub numbers, successful recruitment, and their distribution within the action area. While the evidence indicates that some humpback chub individuals are likely being adversely affected by mercury in the system, we do not see evidence indicating that the negative effects from mercury rise to the level of reducing population numbers, are limiting reproduction, or are constraining humpback chub distribution.

4.3.3.4 Bonytail

The effects to the bonytail from project-generated mercury are similar to those described for the Colorado pikeminnow above, although likely to be less severe in the action area. The bonytail is not a top predator and would not bioaccumulate mercury as rapidly. Additionally, the bonytail does not occur as far upstream in the Yampa River as the Colorado pikeminnow, and has only recently been stocked into the lower White River; thus, it does not occur as close to the point-sources for mercury resulting from the project. As with the Colorado pikeminnow, we believe nonnative species are the primary limiting factor for bonytail numbers, successful recruitment, and their distribution within the action area. While the evidence indicates that some bonytail individuals are likely being adversely affected by mercury in the system, we do not see evidence indicating that the negative effects from mercury rise to the level of reducing population numbers, are limiting reproduction, or are constraining bonytail distribution.

4.3.2 Selenium

Selenium is required in the diet of fish at very low concentrations (0.1 µg/g) (Sharma and Singh 1984), but at higher concentrations it becomes toxic. The safe level of selenium concentration in water for protection of fish and wildlife is considered to be less than 2 ug/L, and chronically toxic levels are considered by some to be greater than 2.7 ug/L (Lemly 1993; Maier and Knight 1994). In Colorado, the chronic aquatic life standard for total selenium in water is 5 µg /L (CDPHE 2012a). However, dietary selenium is the primary source for selenium in fish (Lemly 1993); selenium in water may be less important than dietary exposure when determining the potential for chronic effects to a species (USEPA 1998).

Excess selenium in fish has been shown to have a wide range of adverse effects including mortality, reproductive impairment, effects on growth, and developmental and teratogenic effects including edema and finfold, craniofacial, and skeletal deformities. Excess dietary selenium also causes elevated selenium concentrations to be deposited into developing eggs, particularly the yolk (Buhl and Hamilton 2000). If concentrations in the egg are sufficiently high, developing proteins and enzymes become dysfunctional or result in oxidative stress, conditions that may lead to embryo mortality, deformed embryos, or embryos that may be at higher risk for mortality.

Of the four Colorado River fish species, we expect that excess selenium would disproportionately affect the razorback sucker somewhat more than the other three species (Hamilton et al. 2002; Osmundson et al. 2010). As with all sucker species, the razorback sucker is a bottom feeder and more likely to ingest selenium that has adsorbed to river sediments. Simpson and Lusk (1999) and Osmundson and Lusk (2011) reported on the concentrations of selenium in muscle tissues collected from Colorado pikeminnow and razorback suckers from the San Juan River. They found higher concentrations in razorback sucker than in Colorado pikeminnow; however, the average difference was only modest (3.5 mg/kg in razorback suckers vs. 3.0 mg/kg in Colorado pikeminnow, dry weight).

As stated in the Baseline section, the Yampa River has not exceeded the aquatic chronic toxicity standard for selenium. Water selenium concentrations in the White River have always registered below the chronic standard. Neither river is listed as impaired in the 303(d) EPA Clean Water Act list.

4.3.2.1 Colorado pikeminnow

Despite low selenium concentrations in the Yampa and White Rivers, selenium was detected at high levels in Colorado pikeminnow tissue in the 1960s in the Yampa River. In the White River, the few Colorado pikeminnow that were tested in the 1980s showed that their selenium fish tissue levels indicated a minimal hazard. We do not know where current selenium fish tissue levels stand in Colorado pikeminnow in the Yampa or White Rivers, but given that water concentrations in these two rivers are generally below the chronic standard, we have no recent data indicating that there is immediate cause for alarm. This contrasts with the water selenium concentrations that have been measured within Colorado pikeminnow critical habitat along the Gunnison River, for example, where surface waters have often exceeded Colorado Water Quality Standards for selenium (CDPHE 2011).

As stated above, we believe nonnative species are the primary limiting factor for Colorado pikeminnow numbers, successful recruitment, and their distribution within the action area. While we do believe that further sampling and testing for selenium is warranted, we do not see any evidence indicating that potential effects from selenium rise to the level of reducing population numbers, are limiting reproduction, or are constraining Colorado pikeminnow distribution.

4.3.2.2 Razorback sucker

We have no data on past or current selenium fish tissue levels in razorback sucker in the Yampa or White Rivers. However, water selenium concentrations in these two rivers are generally below the chronic standard; we have no indication that there is immediate cause for alarm. This contrasts with the water selenium concentrations that have been measured within razorback sucker critical habitat along the Gunnison River, for example, where surface waters have often exceeded Colorado Water Quality Standards for selenium (CDPHE 2011).

As stated above, we believe nonnative species are the primary limiting factor for razorback sucker numbers, successful recruitment, and their distribution within the action area. While further sampling and testing for selenium is warranted, we do not see any evidence indicating that potential effects from selenium rise to the level of reducing population numbers, are limiting reproduction, or are constraining razorback sucker distribution.

4.3.2.3 Humpback chub

We have no data on past or current selenium fish tissue levels in humpback chub in the Yampa or White Rivers. However, water selenium concentrations in these two rivers are generally below the chronic standard. Very few humpback chub currently occupy the Yampa River and we have no data indicating that they occur in the White River. We have no data indicating that there is immediate cause for alarm, although further sampling and testing for selenium is warranted.

As stated above, we believe nonnative species are the primary limiting factor for humpback chub numbers, successful recruitment, and their distribution within the action area. While further sampling and testing for selenium is warranted, we do not see any evidence indicating that potential effects from selenium rise to the level of reducing population numbers, are limiting reproduction, or are constraining humpback chub distribution.

4.3.2.4 Bonytail

We have no data on past or current selenium fish tissue levels in bonytail in the Yampa or White Rivers. However, water selenium concentrations in these two rivers are generally below the chronic standard. Bonytail have only recently been stocked into the lower Yampa and White Rivers. We have no data indicating that there is immediate cause for alarm, although further sampling and testing for selenium is warranted.

As stated above, we believe nonnative species are the primary limiting factor for bonytail numbers, successful recruitment, and their distribution within the action area. While further sampling and testing for selenium is warranted, we do not see any evidence indicating that potential effects from selenium rise to the level of reducing population numbers, are limiting reproduction, or are constraining bonytail distribution.

4.5 Effects to Critical Habitat

In addition to impacts to individual Colorado River fish, impacts would also potentially occur to those species' designated critical habitats in the action area. The PCEs of critical habitat for all four endangered fish are identical and contain the following (50 CFR 13378):

1. Water: This includes a quantity of water of sufficient quality (i.e. temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species;
2. Physical Habitat: This includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottom lands, side channel, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats;
3. Biological Environment. Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, can be out of balance due to introduced nonnative fish species.

4.5.1 Colorado pikeminnow

Mercury from the combustion of Colowyo coal at the Craig Generating Station that is deposited either directly or indirectly into the designated critical habitat for this species would have the potential to adversely impact its critical habitat. As stated in the Baseline section above, critical habitat for the Colorado pikeminnow occurs within the mercury deposition zone of analysis for this project. An increase in the amount of mercury in river water negatively impacts water quality (PCE #1). It is difficult to quantify the level of impact from the proposed actions to critical habitat given the lack of information on where the mercury in the analysis area originates from. However, if it assumed that only five percent of the mercury deposited into the analysis area is generated locally, the impact directly from the proposed action may be relatively small. Nevertheless, when added to the other regional and global sources of mercury being deposited into the action area and the mercury already within the system, additional mercury from the proposed action is likely to result in an adverse impact to critical habitat through a reduction in water quality.
Although likely in smaller quantities, mercury from mine discharge would contribute as well. Mine discharge occurs within the Milk Creek watershed, which contains the Colowyo Mine, and ultimately enters the Yampa River within Colorado pikeminnow critical habitat. Although mercury amounts entering Colorado pikeminnow critical habitat from Colowyo Mine discharge are likely to be relatively minor, they would contribute to total mercury in the Yampa River and further reduce water quality incrementally.

Although potentially smaller than mercury, impacts to critical habitat from selenium added to the system through coal combustion and mine discharge, together with selenium added to the system by other sources, may also result adverse impacts to critical habitat for the endangered fish. However, current water quality data from the Yampa and White Rivers indicate that selenium levels have not exceeded the chronic aquatic life standard, and are likely to have less of an impact on water quality in critical habitat than mercury.

The Yampa and White Rivers are not currently listed as impaired for either mercury or selenium on the EPA 303(d) list (CDPHE 20102b). However, mercury concentrations have not been tested as recently as selenium and have exceeded the chronic aquatic life standard at given water quality monitoring stations along both the Yampa and White Rivers in the past.

Considering together the contributions of mercury and selenium from the project to the Yampa and White Rivers in the context of existing water quality data, the weight of evidence indicates that PCE #1 in Colorado pikeminnow critical habitat would be adversely affected through a reduction in water quality, but is not and would not be compromised to a point that it no longer provides water of sufficient quality essential for the conservation of the species.

As discussed in the Status of the Species and Baseline sections above, endangered fish physical habitat (PCE#2) (e.g., dams, diversions) and the biological environment (PCE#3) (e.g., nonnative species) are currently experiencing the most severe impacts, which are unrelated to the project.

4.5.2 Razorback sucker

Razorback sucker critical habitat would be affected in a similar way by the project that Colorado pikeminnow critical habitat would be, as described above, but we expect the impacts to be of a lesser magnitude. Razorback sucker critical habitat does not extend as far up the Yampa or White Rivers and is, therefore, further from the point sources of Colowyo Mine discharge and emissions from the Craig Generating Station. Razorback sucker critical habitat is located downstream from, but not within, the mercury deposition airshed analyzed for this consultation. Colowyo Mine discharge also enters the Yampa River above, but not directly into, razorback sucker critical habitat. Mercury and selenium contributions to the action area diminish with distance from these two point sources. This increases our confidence that the project would not diminish water quality to a point where critical habitat can no longer provide the PCEs essential for the conservation of the species.

4.5.3 Humpback chub and bonytail

Critical habitat for the humpback chub and bonytail are identical in the action area. Their critical habitats would be affected in a similar way by the project that Colorado pikeminnow critical habitat would be, as described above, but we expect the impacts to be of a lesser magnitude. No critical habitat has been designated for the humpback chub or bonytail along the White River. Humpback chub and bonytail critical habitat does not extend as far up the Yampa River as Colorado pikeminnow or razorback sucker critical habitats and is, therefore, further from the point sources of Colowyo Mine discharge and emissions from the Craig Generating Station. Humpback chub and bonytail critical habitat is located downstream from, but not within, the mercury deposition airshed analyzed for this consultation. Colowyo Mine discharge also enters the Yampa River above, but not directly into, humpback chub and bonytail critical habitat. Mercury and selenium contributions to the action area diminish with distance from these two point sources. This increases our confidence that the project would not diminish water quality to a point where these critical habitats can no longer provide the PCEs essential for the conservation of the species.

4.6 Cumulative Effects

The implementing regulations for section 7 define cumulative effects as "*...those effects of future State, or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation.*" 50 CFR § 402.02

Within the action area, two coal fired power plants exist, the Craig Generating Station and the Hayden Generating Station, located approximately 4 miles east of Hayden, Colorado and 21 miles east of the Craig Generating Station (Figure 9 in BA). According to the BA, in 2013, the last year data is available, the Craig and Hayden Generating Stations emitted 19.2 and 7.5 kg of mercury, respectively for a total of total of 26.7 kg. The Hayden Generating station emits less than half the amount of the Craig Generating Station, and is 21 miles further from habitats occupied by endangered fish in the Yampa River, but is also within the airshed analyzed for effects in this consultation, and therefore in the action area. The effects from all non-federal coal combusted at both of these two power plants, which is expected to continue (i.e., reasonably certain to occur), are considered to be cumulative effects.

Consistent with the EPRI (2014) mercury deposition modeling results, we have assumed that only 5 percent of the mercury emitted by the local power plants is deposited within the action area. Given this, we assume that less than 1/2 kg of mercury (7.5 kg x 0.05 = 0.375 kg) per year would be deposited within the action area from coal combustion at the Hayden Generating Station. Given that some coal purchased and combusted by the Hayden Generating Station in the future may be Federal coal, which would be subject to future section 7 consultation and therefore not considered a cumulative effect here, this calculation could be an overestimate. The mercury deposition modeling that will be funded by the project applicant (Conservation Measure #2, described above) will help to shed light on the relative contributions of mercury from both local power plants in context with that transported into the action area from distant sources.

As explained above, according to the EPRI (2014) modelling effort, the majority of mercury depositions (95 percent) within the greater area surrounding a power plant are from regional and global sources. Mercury deposition from non-federal actions generated outside of the action area are considered part of the cumulative effects. Thus, the bulk of the mercury that will be deposited in the action area in the future will come from regional and global non-federal actions (e.g., coal-fired power plants in Asia). These regional and global mercury sources have been depositing and will continue to deposit mercury within the action area. We assume that these inputs will continue at roughly the same deposition rate that the action area has experienced in the past. We have no information about any increase or decrease of coal-fired power plants globally, or of the increasing use of pollution control measures that would work to reduce mercury emissions.

Therefore, we assume a continuation of the mercury inputs into the action area that have been ongoing for years. These inputs have contributed to the current state of the action area regarding mercury, and will continue to maintain current mercury levels within the action area through future emissions, which is described in the Baseline section above. The effects to the endangered fish and their critical habitats from mercury within the action area are described in the Effects of the Action above. We are not assuming an increase or decrease in mercury inputs or outputs to the action area, and thus, do not expect a worsening of the condition of the endangered fish or their critical habitats from mercury contamination. Instead we expect a continuation of the status quo—chronic, sub-lethal insults to the most sensitive individuals, which does not rise to the level of a significant and detectable decrease in numbers, reproduction, or distribution.

4.7 Jeopardy discussion and Conclusion

After reviewing the current status of the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the project, as described in this biological opinion, is not likely to jeopardize the continued existence of the four endangered fish. We have reached this conclusion based on the following reasons:

- Of the four endangered fish, mercury concentrations in fish tissue have only been recorded in the Colorado pikeminnow, which is the species most likely to bioaccumulate mercury. Mercury concentrations in many Colorado pikeminnow within the action area have been somewhat elevated in the past and indicate that the species is likely to be experiencing negative, sub-lethal impacts from mercury that are not insignificant. We do not have evidence, however, that mercury in the action area in general, or the mercury released by project activities in particular, is causing population level effects for any of the endangered fish species.

- To the extent a degraded baseline condition exists within the endangered fish from mercury contamination, we believe the proposed action does not contribute to the deepening of such degradation in a significant way. The baseline condition is not degraded by mercury to an extent that recovery would be precluded solely due to the additional amount of mercury that will result from the action.

- Although selenium fish tissue concentrations have not been measured in all four of the endangered fish (Colorado pikeminnow only), the most recent fish tissue concentrations indicated a minimal risk to fish health.

- None of the four endangered fish species are meeting recovery targets within the Green River subbasin, which includes the Yampa and White Rivers in the action area. However, we believe this is primarily a result of nonnative species that have increased in the action area and large-scale habitat alteration (e.g., dams and diversions). These impacts are not increased as a result of the proposed action.

4.8 Destruction and Adverse Modification Discussion and Conclusion

After reviewing the current status of the critical habitats for the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail, the environmental baseline for critical habitats within the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the project, as described in this biological opinion, is not likely to destroy or adversely modify any of the critical habitats designated for the four endangered fish. We have reached this conclusion based on the following reasons:

- Despite a few elevated mercury concentrations in the water, most reported values in both the White and Yampa Rivers, which includes all critical habitats in the action area, have been below the detection limit. Neither the Yampa River nor the White River is on the 303(d) list of impaired waters for mercury. If the project is approved, current project activities would continue. Given this, we do not expect mercury water concentrations to increase from project activities if approved.

- Water selenium concentrations in the Yampa and White Rivers, which includes all critical habitats in the action area, have not exceeded the chronic aquatic life standard in the past, according to the best available data. Neither the Yampa River nor the White River is on the 303(d) list of impaired waters for selenium. If the project is approved, current project activities would continue. We do not expect selenium water concentrations to increase from project activities if approved.

5.0 INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, and federal regulations prohibit the take of endangered and threatened species, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

As the Service explained in the effects section, there were many challenges to describing specific effects to individuals of the four endangered fish. Anticipation and exemption of incidental take is at the individual of the species scale and must be reasonably certain to occur (CFR 50 402.14(g)(7)). This requires that the Service build a reasonable basis to conclude that individuals of the four endangered fish will be subjected to adverse effects that in turn are reasonably certain to result in actual injury or death. In this biological opinion we are unable, based on the best available information, to find circumstances that support such a conclusion. Without, specific information on the potential range of effects to individuals, we are also unable to develop a surrogate for the potential take of the four endangered fish. Therefore, no take is anticipated or exempted by this incidental take statement.

We were, however, able to explain that the broad range of potential adverse effects to the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail in the action area would not be likely to result in jeopardy to any of these species or destruction or adverse modification to their critical habitats. This finding satisfies Congress' direction in 7(a)(2) of the Act that "*Each Federal agency ...insure that any action ...is not likely to jeopardize the continued* *existence of any endangered species or threatened species, or result in destruction or adverse modification of habitat...determined by the Secretary... to be critical.*"

We also explained that OSMRE committed to a study examining the potential effects in more specific detail and it may increase our knowledge regarding specific effects to individuals. This may reveal whether (and to what extent), and how many individuals (if any) will be actually injured or killed.

Monitoring and Reporting

OSMRE shall monitor the progress of the proposed action (including implementation of conservation measures) and report that progress to the Service on an annual basis. The report shall be sent to the Western Colorado Ecological Services office by no later than March 31st. This information can also be used by OSMRE to identify any potential need to reinitiate consultation on this action (see reinitiation triggers below).

6.0 CONSERVATION RECOMMENDATIONS

1. As stated in the Effects of the Action section, water is tested for mercury in receiving waters both above and below the discharge points at the Colowyo Mine. However, the detection limit appears to be too high to accurately measure the amount of mercury leaving the mine through discharges. We recommend that OSMRE require more sensitive mercury testing be done to be able to accurately quantify the mercury being discharged from the mine.

2. The BA did not discuss whether or not selenium is tested at the Colowyo Mine discharge points. We recommend that OSMRE require selenium to be tested with a sufficiently sensitive method to be able to accurately measure the amount of selenium leaving the Colowyo Mine through discharges. Alternatively, the selenium concentration could be measured in Milk Creek just prior to its confluence with the Yampa River to determine the level of selenium entering Colorado pikeminnow critical habitat from the watershed containing the Colowyo Mine.

3. There is a significant level of uncertainty as to what extent and how cuckoos use the Yampa River corridor. We recommend that OSMRE solicit applicant-supported protocol cuckoo surveys to be conducted at accessible locations within critical habitat that has been proposed along the Yampa River.

7.0 REINITIATION

This concludes formal consultation on OSMRE's proposed action for the Project involving coal mining at the South Taylor/Lower Wilson Area at the Colowyo Coal Mine and eventual combustion at the Craig Generating Station. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action.

As part of our approach to analysis, we have had to make a series of assumptions. One of those assumptions is the amount of mercury deposited within the action area from local combustion sources. Together with OSMRE we have assumed that only 5 percent of the mercury deposited in the action area is from local sources (including the Craig and Hayden Generating Stations). If the applicant-committed mercury deposition study demonstrates this assumption to be substantially incorrect, reinitiation of this consultation may be necessary.

We have also assumed that the current levels of mercury and selenium in endangered fish tissue within the action area is similar to what has been measured in the past, as discussed in the Baseline and Effects of the Action sections above. A separate effort, funded in part through the Bureau of Land Management, is planned that would shed new light on mercury and selenium levels in fish tissue in the action area. If the results of this or similar studies indicate that fish tissue levels are much higher than expected based on past sampling, reinitiation of this consultation may be necessary. Other future studies may contribute information relevant to the effects of the action and this consultation.

If, during implementation of the proposed action, changes in circumstances, situation, or information regarding this proposed action occur, OSMRE will assess the changes and any potential impacts to listed species, review the re-initiation triggers above, coordinate with the Service, and make a determination as to whether re-initiation is necessary.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES/GJ-6-CO-04-F-012-YP016
TAILS 65413-2006-F-0178

07-02-20-03

March 9, 2007

Memorandum

To: Natural Resources Specialist, Office of Surface Mining, Reclamation and Enforcement, Denver, Colorado

From: Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Final Biological Opinion for Colowyo Coal Company, L.P., Colowyo Mine Permit C-81-019, Revision 02

In accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), the U.S. Fish and Wildlife Service (Service) transmits this correspondence to serve as the final biological opinion for Revision 02, to Permit C-81-019, proposed by Colowyo Coal Company, L.P., for the Colowyo surface coal mine in Moffat and Rio Blanco counties, Colorado. The mine is approximately 28 miles south of the town of Craig, Colorado on State, private, and lands managed by the Bureau of Land Management. The Colowyo Coal Company, L.P. estimates the current operations at the project result in a depletion of 527.48 acre-feet per year to the Yampa River, and that Permit Revision 02 will result in an additional annual depletion of 27.0 acre-feet due to the construction of 4 new sediment ponds – for a total net annual water depletion of 554.48 acre-feet. The applicant made a payment of $1270 in 1988 for a depletion of 127.43 acre-feet/year, and a payment of $29.90 in 1992 due to an additional depletion of 2.6 acre-feet; therefore, the new depletion is 554.48 minus 130.03 = 424.45 acre-feet. The new one-time payment was calculated by multiplying the project's average annual new depletion of 424.45 acre-feet by the Fiscal Year 2007 charge of $17.24 per acre-foot, which equals a total contribution of $7,317.52 for this project's share of the Recovery Program costs. In a letter received by the Service on February 20, 2007, Rio Tinto Energy America notified the Service that Colowyo Coal Company, L.P. has submitted a payment of $7,317.52 to the National Fish and Wildlife Foundation.

A Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin was initiated on January 22, 1988. The Recovery Program was intended to be the reasonable and prudent alternative for individual projects to avoid the likelihood of jeopardy to the endangered fishes from impacts of depletions to the Upper Colorado River Basin. In order to further define and clarify the process in the Recovery Program, a section 7 agreement was implemented on October 15, 1993, by the Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner.

On January 10, 2005, the Service issued a final programmatic biological opinion on the *Management Plan for Endangered Fishes in the Yampa River Basin* (this document is available for viewing at the following internet address: http://www.r6.fws.gov/crrip/yampaPBO.htm). The Service has determined that projects that fit under the umbrella of the Yampa River PBO would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts. The Yampa River PBO states that in order for actions to fall within the umbrella of the PBO and rely on the RIPRAP to offset its depletion, the following criteria must be met.

1. A Recovery Agreement must be offered and signed prior to conclusion of section 7 consultation.

2. A fee to fund recovery actions will be submitted as described in the proposed action for new depletion projects greater than 100 acre-feet/year. The 2007 fee is $17.24 per acre-foot and is adjusted each year for inflation.

3. Reinitiation stipulations will be included in all individual consultations under the umbrella of this programmatic.

4. The Service and project proponents will request that discretionary Federal control be retained for all consultations under this programmatic.

The Recovery Agreement was signed by the Service and the Water User. In the letter received by the Service on February 20, 2007, Rio Tinto Energy America notified the Service that Colowyo Coal Company, L.P. has submitted a one-time contribution based on its share of the costs of the Recovery Implementation Program, to fund recovery actions specified in the Colorado River PBO. The Office of Surface Mining, Reclamation and Enforcement has agreed to condition its approval documents to retain jurisdiction should section 7 consultation need to be reinitiated. Therefore, the Service concludes that the subject project meets the criteria to rely on the RIPRAP to offset depletion impacts and is not likely to jeopardize the continued existence of the species and is not likely to destroy or adversely modify designated critical habitat.

REINITIATION NOTICE

This concludes formal consultation on the subject action. The Recovery Action Plan is an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modification of the Recovery Action Plan. Therefore, the Recovery Action Plan is reviewed annually and updated and changed when necessary and the required time frames include changes in timing approved by means of the normal procedures of the Recovery Program, as explained in the description of the proposed action. Every 2 years, for the life of the Recovery Program, the Service and Recovery Program will review implementation of the Recovery Action Plan actions that are included in this biological opinion to determine timely compliance with applicable schedules. As provided in 50 CFR section 402.16, reinitiation of formal consultation is required for new projects where discretionary Federal Agency involvement or control over the action has been retained (or is authorized by law) and under the following conditions:

1. The amount or extent of take specified in the incidental take statement for this opinion is exceeded. The implementation of the Recovery actions contained in this opinion will further decrease the likelihood of take caused by water depletion impacts.

2. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion. In preparing this opinion, the Service describes the positive and negative effects of the action it anticipates and considered in the section of the opinion entitled "EFFECTS OF THE ACTION." New information would include, but is not limited to, not achieving one or more response criteria that will be developed as part of the terms and conditions to minimize incidental take. The Service retains the authority to determine whether a significant decline in population has occurred, but will consult with the Recovery Program's Biology Committee prior to making its determination. In the event that one or more population criteria have not been achieved, the Service is to first rely on the Recovery Program to take timely actions to correct the deficiency.

3. The section 7 regulations (50 CFR 402.16 (c)) state that reinitiation of consultation is required if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion. It would be considered a change in the action subject to consultation if the Recovery Action Plan items listed as part of the proposed action (Green River Action Plan: Yampa and Little Snake rivers) in this opinion are not implemented within the required timeframes. Also, the analysis for this biological opinion assumed implementation of the Green River Mainstem Action Plan of the RIPRAP because the Colorado pikeminnow and razorback sucker that occur in the Yampa River use the Green River and are considered one population. The essential elements of the Green River Plan are as follows: 1) provide and protect instream flows; 2) restore floodplain habitat; 3) reduce impacts of nonnative fishes; 4) augment or restore populations; and 5) monitor populations and conduct research to support recovery actions. The analysis for the non-jeopardy determination of the Yampa Plan that includes about 53,000 AF/year of new water depletions from the Yampa River Basin relies on the Recovery Program to provide and protect flows on the Green River. Specifically, the analysis for this biological opinion assumed operation of Flaming Gorge Dam to meet the flow recommendations according to the upcoming Record of Decision on the Flaming Gorge Dam Operations environmental impact statement (EIS)[a].

   The Service recognizes that the RIPRAP is an adaptive management plan that is modified according to additional information and changing priorities. The plan is reviewed annually and updated when necessary. The required timeframes include changes in timing approved by means of normal procedures of the Recovery Program. In 2006, and every 2 years thereafter, for the life of the Recovery Program, the Service and the Recovery Program will review implementation of the RIPRAP actions to determine timely compliance with applicable schedules.

[a] That decision has not been made as of the date of this letter.

Also, the analysis for this biological opinion assumed impacts to peak flows based on anticipated future uses of water, if water is used in a substantially different timing regime that adversely affects endangered fishes in a way not considered in this opinion, then reinitiation of consultation is required. The Recovery Program will monitor all new water projects that deplete more than 100 AF/year to determine their impacts to peak flows on the Yampa River. In addition, the Recovery Program will monitor projects individually depleting 100 AF/year or less in cumulative increments of 3,000 AF/year to determine their impacts to peak flows.

4. The Service lists new species or designates new or additional critical habitat, where the level or pattern of depletions covered under this opinion may have an adverse impact on the newly listed species or habitat. If the species or habitat may be adversely affected by depletions, the Service will reinitiate consultation on the programmatic biological opinion as required by its section 7 regulations. The Service will first determine whether the Recovery Program can avoid such impact or can be amended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for such depletion impacts. If the Recovery Program can avoid the likelihood of jeopardy and/or adverse modification of critical habitat no additional recovery actions for individual projects would be required, if the avoidance actions are included in the Recovery Action Plan. If the Recovery Program is not likely to avoid the likelihood of jeopardy and/or adverse modification of critical habitat then the Service will reinitiate consultation and develop reasonable and prudent alternatives.

If the annual assessment indicates that either the recovery actions specified in this opinion have not been completed or that the status of all four fish species has not sufficiently improved, the Service intends to reinitiate consultation on the Yampa Plan to specify additional measures to be taken by the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletions. If other measures are determined by the Service or the Recovery Program to be needed for recovery prior to the review, they can be added to the Recovery Action Plan according to standard procedures, outlined in that plan. If the Recovery Program is unable to complete those actions which the Service has determined to be required, consultation on projects with a Federal nexus may be reinitiated in accordance with ESA regulations and this opinion's reinitiation requirements. The Service may also reinitiate consultation on the Recovery Program if fish populations do not improve according to the population response criteria to be developed within one year of the issuance of this biological opinion. Failure to maintain a positive response, whenever achieved, will be considered a negative response and subject to reinitiation.

If the Service reinitiates consultation, it will first provide information on the status of the species and recommendations for improving population numbers to the Recovery Program. Only if the Recovery Program does not implement recovery actions to improve the status of the species, will the Service reinitiate consultation with individual projects. The Service intends to reinitiate consultations simultaneously on all depletions.

All individual consultations conducted under this programmatic opinion will contain language requesting the applicable Federal agency to retain sufficient authority to reinitiate consultation should reinitiation become necessary. The recovery agreements to be signed by non-Federal entities who rely on the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts related to their projects will provide that such non-Federal entities also must request the Federal agency to retain such authority. Non-Federal entities will agree by means of recovery agreements to participate during reinitiated consultations in finding solutions to the problem which triggered the reinitiation of consultation.

If you have any questions regarding this consultation or would like to discuss it in more detail, please contact Larry Thompson of our Grand Junction Ecological Services Field Office at (970) 243-2778, extension 39.

Sincerely,

Allan R. Pfister

Allan R. Pfister
Western Colorado Supervisor

Attachment: Recovery Agreement

RECOVERY AGREEMENT

This RECOVERY AGREEMENT is entered into this 18th day of January, 2007, by and between the United States Fish and Wildlife Service (Service) and Colowyo Coal Company, L.P. (Water User).

WHEREAS, in 1988, the Secretary of Interior, the Governors of Wyoming, Colorado and Utah, and the Administrator of the Western Area Power Administration signed a Cooperative Agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program); and

WHEREAS, the Recovery Program is intended to recover the endangered fish while providing for water development in the Upper Basin to proceed in compliance with state law, interstate compacts and the Endangered Species Act; and

WHEREAS, the Colorado Water Congress has passed a resolution supporting the Recovery Program; and

WHEREAS, on January 10, 2005, the Service issued a programmatic biological opinion (2005 Opinion) on the *Management Plan for Endangered Fishes in the Yampa River Basin* concluding that implementation of specified elements of the Recovery Action Plan (Recovery Elements), along with existing and a specified amount of new depletions, are not likely to jeopardize the continued existence of the endangered fish or adversely modify their critical habitat in the Yampa River subbasin and Green River subbasin downstream of the Yampa River confluence; and

WHEREAS, Water User is the owner of Colowyo Mine, Permit C-81-019 – South Taylor/Lower Wilson Mining Area (Water Project), which causes or will cause depletions to the Yampa River subbasin; and

WHEREAS, Water User desires certainty that its depletions can occur consistent with section 7 and section 9 of the Endangered Species Act (ESA); and

WHEREAS, the Service desires a commitment from Water User to the Recovery Program so that the Program can actually be implemented to recover the endangered fish and to carry out the Recovery Elements.

6. This Recovery Agreement shall be in effect until one of the following occurs.

a. The Service removes the listed species in the Upper Colorado River Basin from the endangered or threatened species list and determines that the Recovery Elements are no longer needed to prevent the species from being relisted under the ESA; or

b. The Service determines that the Recovery Elements are no longer needed to recover or offset the likelihood of jeopardy to the listed species in the Upper Colorado River Basin; or

c. The Service declares that the endangered fish in the Upper Colorado River Basin are extinct; or

d. Federal legislation is passed or federal regulatory action is taken that negates the need for [or eliminates] the Recovery Program.

7. Water User may withdraw from this Recovery Agreement upon written notice to the Service. If Water User withdraws, the Service may request reinitiation of consultation on Water Project without reinitiating other consultations as would otherwise be required by the "Reinitiation Notice" section of the 2004 Opinion.

Water User Representative — Date: 1/18/2007

Western Colorado Supervisor
U.S. Fish and Wildlife Service — Date: 3/7/07

(ES/GJ-6-CO-04-F-012-YP016)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES/GJ-6-CO-04-F-012-YP016
TAILS 65413-2006-F-0178

06-11-13-07

November 6, 2006

Memorandum

To: Natural Resources Specialist, Office of Surface Mining, Reclamation and Enforcement, Denver, Colorado

From: Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado Allan R. Pfister

Subject: Biological Opinion for Colowyo Coal Company, L.P., Colowyo Mine Permit C-81-019, Revision 02

This is in response to your letter dated August 28, 2006, concerning Revision 02, to Permit C-81-019, proposed by Colowyo Coal Company, L.P., for the Colowyo surface coal mine in Moffat and Rio Blanco counties, Colorado. The mine is approximately 28 miles south of the town of Craig, Colorado on State, private, and lands managed by the Bureau of Land Management. This U.S. Fish and Wildlife Service (Service) response is in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402).

Your letter includes effects determinations for the bald eagle, black-footed ferret, Mexican spotted owl, Canada lynx, Dudley Bluffs bladderpod, Dudley Bluffs twinpod, yellow-billed cuckoo, Graham beardtongue, White River beardtongue, and the 4 endangered Colorado River fishes: Colorado pikeminnow, humpback chub, razorback sucker, and bonytail.

Your analysis arrives at "no effect" determinations for the black-footed ferret, Mexican spotted owl, Dudley Bluffs bladderpod, Dudley Bluffs twinpod, yellow-billed cuckoo, Graham beardtongue, and White River beardtongue. Your "no effect" determinations were based on effects analyses indicating no suitable habitat for these species within the project area. Because the Office of Surface Mining, Reclamation and Enforcement (OSM) determined that the proposed action would not affect the black-footed ferret, Mexican spotted owl, Dudley Bluffs bladderpod, Dudley Bluffs twinpod, yellow-billed cuckoo, Graham's beardtongue, and White River beardtongue, consultation and concurrence are not necessary on these species.

Your analysis arrives at a "may affect, but not likely to adversely affect" determination for the bald eagle and yellow-billed cuckoo. Bald eagles are known to nest in the Yampa River and White River Valleys, and to winter in the Yampa River Valley north of the project area. However, your analysis indicates that on-site surveys revealed no suitable roosting habitat or nest sites. You determined that bald eagles may forage in the project area, and could potentially be adversely affected by vehicular collisions or contact with power lines and poles at or near the site. Based on the information provided in your analysis, the Service concurs with your "may affect, but not likely to adversely affect" determination for the bald eagle.

Regarding the Canada lynx, your analysis indicates that no lynx occupancy in the project area is known and no suitable habitat for this species exists in the area. You found that lynx could travel through the project area, and determined that the project is "not likely to adversely affect" the species. Based on the information provided in your analysis, the Service concurs with your "may affect, but not likely to adversely affect" determination for the Canada lynx.

Regarding the endangered Colorado pikeminnow, razorback sucker, humpback chub, and bonytail, the Colowyo Coal Company, L.P. estimates the current operations at the project result in a depletion of 527.48 acre-feet per year to the Yampa River, and that Permit Revision 02 will result in an additional annual depletion of 27.0 acre-feet due to the construction of 4 new sediment ponds – for a total net annual water depletion of 554.48 acre-feet. This depletion to the Yampa River may affect the 4 endangered Colorado River fishes and their designated critical habitat. Therefore, you were correct to request formal consultation under section 7 of the Endangered Species Act of 1973, regarding the potential effects of the project.

A Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin was initiated on January 22, 1988. The Recovery Program was intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fishes from impacts of water depletions to the Upper Colorado River Basin. In order to further define and clarify the process in the Recovery Program, a section 7 agreement was implemented on October 15, 1993, by the Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner.

On January 10, 2005, the Service issued the final programmatic biological opinion on the *Management Plan for Endangered Fishes in the Yampa River Basin* (this document is available for viewing at the following internet address: http://www.r6.fws.gov/crrip/yampaPBO.htm). The Service has determined that projects that fit under the umbrella of the Yampa River Programmatic Biological Opinion (PBO) would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts to the Yampa River basin. The Service has determined that if the subject project meets the following criteria, then it fits under the umbrella of the Yampa River PBO.

1. The project depletes water from the Yampa River basin.

2. The Colowyo Coal Company, L.P. (applicant) signs the attached Recovery Agreement and returns it to the Service.

3. The subject project will deplete 554.48 acre-feet of water. In order to rely on the Recovery Program to offset the subject depletions, the project sponsors are to make a one-time monetary contribution for water depletions greater than 100 acre-feet to help fund their share of the costs of recovery actions. It is the understanding of the Service that the applicant made a payment of $1270 in 1988 for a depletion of 127.43 acre-feet/year, and a payment of $29.90 in 1992 due to

an additional depletion of 2.6 acre-feet; therefore, the new depletion is 554.48 – 130.03 = 424.45 acre-feet. The new one-time payment is calculated by multiplying the project's average annual new depletion (424.45 acre-feet) by the water users share of Recovery Program costs (the charge) in effect at the time payment is made. For Fiscal Year 2007 (October 1, 2006, to September 30, 2007), the charge is $17.24 per acre-foot for the average annual depletion which equals a total contribution of $7,317.52 for this project's share of the Recovery Program costs. This amount will be adjusted annually for inflation on October 1 of each year based on the Consumer Price Index. Ten percent of the total contribution ($7,317.52), or total payment, will be provided to the Service's designated agent, the National Fish and Wildlife Foundation, at the time of issuance of the Federal approvals from the OSM. The balance will be due at the time the construction commences. The payment will be included by the OSM as a permit stipulation. The funds will be used for acquisition of water rights (or directly-related activities) to meet the instream flow needs of the endangered fishes; or to support other recovery activities for the endangered fishes described in the RIPRAP. All payments should be made to the Foundation.

National Fish and Wildlife Foundation
28 Second Street, 6th Floor
San Francisco, California 94105

Each payment should be accompanied by a cover letter that identifies the project and biological opinion number (ES/GJ-6-CO-04-F-012-YP016), the amount of the payment enclosed, and the check number. A copy of the cover letter and a copy of the payment check should be sent to the Service office issuing this biological opinion. The cover letter should identify the name and address of the payor, the name and address of the Federal agency responsible for authorizing the project (OSM), and the address of the Service office conducting the section 7 consultation. This information will be used by the Foundation to notify the payor, the lead Federal agency, and the Service that payment has been received. The Foundation is to send notices of receipt to these entities within 5 working days of its receipt of payment.

4. The Service requests that the OSM retain discretionary Federal authority for the subject project in case re-initiation of section 7 consultation is required. The OSM should return the Recovery Agreement signed by the applicant, and provide a letter from the applicant stating that they agree to make the subject payment within the time frames outlined above. The OSM should also provide a statement that they intend to retain discretionary Federal authority for the subject project in case re-initiation of section 7 consultation is required. These documents should be sent to the following address.

Attn: Larry Thompson
U. S. Fish and Wildlife Service Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506

When the Service receives the signed Recovery Agreement and any other required documentation, the Service will provide the OSM with documentation that the project may rely on the RIPRAP to offset its impacts as described in the Yampa River PBO.

If you have any questions regarding this consultation or would like to discuss it in more detail, please contact Larry Thompson of our Grand Junction Ecological Services Field Office at (970) 243-2778, extension 39.

Attachment: Recovery Agreement

LThompson:OSMColoWyoMinePR-02YPBO1.doc:103006

OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix E

SHPO Consultation and Tribal Consultation

Caveny, Nicole <ncaveny@osmre.gov>

SHPO question and/or action

Tobias - HC, Mark <mark.tobias@state.co.us> Wed, Jun 3, 2015 at 1:21 PM
To: ncaveny@osmre.gov

Dear Ms. Caveny:

Based on your description as well as the information contained within OSMRE's letter dated May 21, 2015, our office does not have additional concerns at this time for the South Taylor Permit Area (the undertaking). However, the Section 106 consultation process does involve other consulting parties such as local governments and Tribes, which as stipulated in 36 CFR 800.3 are required to be notified of the undertaking. Additional information provided by the Bureau of Land Management, local government, Tribes or other consulting parties may cause our office to re-evaluate our comments and recommendations. Please let me know if I may be of additional assistance,

Mark Tobias
Section 106 Compliance Manager
Office of Archaeology and Historic Preservation
History Colorado
1200 Broadway
Denver, Colorado 80203
(303) 866-4674
mark.tobias@state.co.us

> From: **Caveny, Nicole** <ncaveny@osmre.gov>
> Date: Wed, Jun 3, 2015 at 12:50 PM
> Subject: SHPO question and/or action
> To: kevin.black@state.co.us, thomas.carr@state.co.us, todd.mcmahon@state.co.us, katherine.arntzen@state.co.us, stefanie.baltzell@state.co.us
> [Quoted text hidden]

United States Department of the Interior

OFFICE OF SURFACE MINING
RECLAMATION AND ENFORCEMENT
Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050

June 16, 2015

Dear Chairman St. Clair Jr.,

The U.S. Department of the Interior (DOI), Office of Surface Mining Reclamation and Enforcement (OSMRE), Western Region Office, will prepare an environmental assessment (EA) for the mining plan modification for the Colowyo Coal Mine's South Taylor area (the Project). In accordance with the 2011 Department of Interior Policy on Consultation with Indian Tribes and 36 CFR Part 800.2(c)(2)(ii), the regulations implementing Section 106 of the National Historic Preservation Act of 1966 (as amended), OSMRE requests continued consultation with your tribe for the stages of the proposal development and implementation of the final federal action.

Background

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Providing Comments

Please provide comments within 30 days of receipt of this letter to:

ATTN: Colowyo Coal Mine South Taylor Area Mining Plan Modification EA

C/O: Nicole Caveny
Office of Surface Mining Reclamation and Enforcement
1999 Broadway, Suite 3320
Denver, CO 80202

You also have the option to submit comments and/or questions to: OSM-Colowyo-Mine-EA@osmre.gov, or call Nicole Caveny at (303) 293-5078. If you wish, you may also contact me, Marcelo Calle, at (303) 293-5035. For your convenience, information about the South Taylor Project can be accessed on the OSMRE Western Region website at: http://www.wrcc.osmre.gov/initiatives/colowyoMineSouthTaylor.shtm

Sincerely,

M. C. Calle

Marcelo Calle, Manager
Field Operations Branch

Copy:
Mr. Wilford Ferris III, Eastern Shoshone Tribe (Wind River Reservation) THPO
Ms. Jennifer Maiolo, Mining Enginee, BLM Little Snake Field Office

United States Department of the Interior

OFFICE OF SURFACE MINING
RECLAMATION AND ENFORCEMENT
Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050

June 16, 2015

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Because of a recent court decision, OSMRE is preparing this EA to reevaluate the environmental impacts resulting from the originally proposed and currently approved mining plan modification for the South Taylor Permit Expansion Area, pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA). *See Wildearth Guardians v. U.S. Office of Surface Mining et al.*, Case 1:13-cv-00518-RBJ (D. Colo. 2015). Under the currently approved mining plan modification issued in 2007, mining operations have disturbed 789 acres of the originally approved 1,492 acres to be disturbed. The mine estimates that 20 acres remain to be disturbed in the South Taylor Permit Expansion Area for a total of 809 acres of disturbance. To date, the company has mined an estimated 21.3 million tons of coal and an estimated 11.8 million tons of coal remains to be mined. Prior to approval of PR02, the average production rate was approximately 4.5 million tons per year (mtpy). PR02 proposed that the average production rate and the maximum production rate would increase and vary from 5.8 to 6.0 mtpy for the life of the mining operation. Since 2008, the production rate has ranged from a high of about 4.95 mtpy in 2008 to a low of about 2.1 mtpy in 2012. In 2014 the production rate was about 2.48 mtpy. Based on remaining coal reserves and the 2014 production rate mining at the South Taylor Permit Expansion Area would be completed in approximately five years. It is not reasonably foreseeable that a production rate of 6.0 mtpy could be achieved. Therefore, the EA will evaluate production rates not to exceed 5.0 mtpy.

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C/O: Nicole Caveny
Office of Surface Mining Reclamation and Enforcement
1999 Broadway, Suite 3320
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Sincerely,

M. Calle

Marcelo Calle, Manager
Field Operations Branch

Copy:
Mr. Terry Knight, Ute Mountain Ute Tribe NAGPRA Representative/THPO
Mr. Lynn Hartman, Ute Mountain Ute Tribe
Ms. Jennifer Maiolo, Mining Enginee, BLM Little Snake Field Office

United States Department of the Interior

OFFICE OF SURFACE MINING
RECLAMATION AND ENFORCEMENT
Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050

June 16, 2015

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Sincerely,

M. P. Calle

Marcelo Calle, Manager
Field Operations Branch

Copy:
Ms. Betsy Chapoose, Ute Indian Tribe (Uintah & Ouray Reservation) NAGPRA Representative
Ms. Jennifer Maiolo, Mining Enginee, BLM Little Snake Field Office

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Sincerely,

M. C. Calle

Marcelo Calle, Manager
Field Operations Branch

Copy:
Ms. Elise Redd, Southern Ute Indian Tribe Cultural Department Director
Mr. Alden Naranjo, Southern Ute Indian Tribe Cultural Department
Ms. Jennifer Maiolo, Mining Enginee, BLM Little Snake Field Office

OSMRE - Colowyo Coal Mine

South Taylor/Lower Wilson Permit Expansion Area Project Mining Plan Modification

Environmental Assessment

Appendix F

Public Comments on the Draft EA and OSMRE Response

Contents

I. PUBLIC COMMENT RESPONSE SUMMARY

Introduction

Consistent with the National Environmental Policy Act (NEPA), 40 C.F.R. 1503.4(b) and 43 C.F.R. 46.305, responses included in this report address the comments received on the South Taylor/Lower Wilson Permit Expansion Area Mining Plan Modification Environmental Assessment (EA) and unsigned Finding of No Significant Impact (FONSI). Each letter and email was read and analyzed to identify substantive comments. Conclusions on whether or not comments were considered substantive were based on the following definitions:

- Substantive comments include those that challenge, with reasonable basis, the information in the EA or the FONSI as being inadequate or inaccurate; develop reasonable alternatives not considered by the agency, or offer new specific information that may have a bearing on the decision.
- Non-substantive comments are those that do not pertain to the Project Area, Proposed Action or alternatives, or express opinions or position statements about the project or agency policy without accompanying factual basis or rationale to support the opinion.

All comments—substantive or not substantive—and agency responses, are part of the administrative record for this EA, and have been considered during the decision-making process. The purpose of this document is to provide responses to *substantive* comments received on the EA and the FONSI.

Comment Analysis Process

A standardized content analysis process was conducted to analyze the public comments on the Mining Plan Modification EA and unsigned FONSI. Each comment letter or email received was read by OSMRE to ensure that all substantive comments were identified. The comments were not weighted by organizational affiliation or status of respondents, and the number of duplicate comments did not bias the analysis. The process was not one of counting votes, and no effort was made to tabulate the exact number of people for or against any given aspect of the EA. Rather, emphasis was placed on the content of a comment.

Comment Overview

Comments were accepted from the release of the EA on July 27, 2015 through August 14, 2015. A total of 9,525 comment letters and emails were received. If substantive comments were identified within a letter, the resource area or concern was noted and summarized in the response to comments presented herein.

Summary Comments and Responses

This section paraphrases the substantive comments into Summary Comments and provides both general and specific responses. The comment letters were reviewed, commenter data logged into a spreadsheet, and all information entered into the Administrative Record. Most of the comment letters and emails consisted of one of two basic form letters originating from two websites: www.wildearthguardians.org and SupportColowyo.org. One form letter generally opposed the project while the other supported it. In addition, other individual comments were received generally in support or opposition to the project. The following summary comments were identified after reviewing all of these comments.

Summary Comment 1

The Colowyo South Taylor/Lower Wilson Mining Plan Decision requires preparation of an EIS.

OSMRE has completed an Environmental Assessment (EA) to determine if there would be significant effects as a result of approving the Colowyo Coal Mine South Taylor/Lower Wilson Mining Plan and an Environmental Impact Statement (EIS) is required. In NEPA documents, significance is determined by context and intensity as defined by CEQ regulations at 40 CFR 1508.27. The significance of the impacts to all resources is analyzed in the EA in chapters 4 and 5, and the rationale for the conclusions reached is provided. For the reasons described in the FONSI, we have determined that there are no significant impacts for the selected alternative (Alternative B). Therefore, an EIS is not required.

OSMRE received a number of comments on both sides of the issue as to whether an EIS was required. A number of comments indicated general support for the conclusion there are no significant impacts and that an EIS is not required for this project. In contrast, a number of comments generally indicated that an EIS is required to be prepared for this project. According to these commenters, the primary reason necessitating the preparation of an EIS relates to alleged significant impacts from the project on climate change and GHGs from coal combustion.

The commenters that opined that an EIS was required relied on two primary justifications. First, one of the commenters claim that other future activities at the same mine were required to be considered in the same NEPA document, which would have significant impacts in the aggregate. This comment is addressed below as part of Summary Comment 3. Second, another commenter pointed out that the Department of the Interior's Department Manual at 516 DM 13 identifies specific criteria for when an EIS is required and that this project appears to meet those criteria. Thus, this commenter concludes that an EIS is required.

We disagree. To begin, as a point of clarification, 516 DM 13 does not automatically mandate the preparation of an EIS if certain criteria are met. This guidance document only identifies major actions "normally requir[ing] the preparation of an EIS." 516 DM 13.4(A). It also explicitly recognizes that OSMRE may choose not to prepare an EIS for any of the listed actions. See 516 DM 13.4(A) ("If for any of these actions it is proposed not to prepare an EIS, an EA will be prepared and handled in accordance with Section 1501.4(e)(2)). Thus, there is nothing in the Departmental Manual that diminishes OSMRE's discretion to follow the NEPA requirements in order to determine whether any particular action is significant.

In addition, we disagree with the commenter that this project would meet the criteria of 516 DM 13.4(A)(4), which states that an EIS must normally be prepared for:

> Approval of a proposed mining and reclamation plan for a surface mining operation that meets the following:
>
> > (a) The environmental impacts of the proposed mining operation are not adequately analyzed in an earlier environmental document covering the specific leases or mining activity; and
> >
> > (b) The area to be mined is 1280 acres or more, or the annual full production level is 5 million tons or more; and
> >
> > (c) Mining and reclamation operations will occur for 15 years or more.

Alternative B, the alternative selected in the FONSI, does not meet the scenario described in the Departmental Manual, which requires all three criteria to be met. While one commenter estimated "1,562 acres will be disturbed as a result of the proposed mining plan," as described in the EA, Alternative B has a total disturbance of 1,250 acres of which 809 acres is new disturbance and 441 acres is re-disturbance of land disturbed from previously approved mining. The actual area to be mined (South Taylor Pit) is 429 acres. Thus, under either measure (acres disturbed or "area to be mined"), this action is below the 1280 acre threshold. In addition, the maximum production level allowed under Alternative B would be 4 mtpy, which also does not rise to the 5 mtpy threshold of (b). Because criteria (b) is not met, an EIS would not "normally" be required in accordance with the Departmental Manual.

Summary Comment 2

The range of alternatives considered in the EA is not adequate.

The EA analyzes three alternatives: Alternative A, PR02 as Approved in 2007, the proposed action as directed by the court; Alternative B, PR02 as Revised; and Alternative C, the No Action Alternative. Other alternatives were also considered but eliminated from further analysis as described in **Section 2.5.**

Commenters raised a concern that the range of alternatives considered in the EA was not adequate, that alternatives identified during the public outreach period were ignored, and that additional alternatives should be considered. Alternatives identified in public outreach comments included limiting coal production, underground mining, placing limits on the emission of criteria pollutants, hazardous air pollutants and carbon dioxide from the Craig Power Plant, Colowyo Mine and regional oil and gas operators; and consideration of an alternative that requires mitigation, including off-site mitigation, for air quality impacts from criteria and hazardous air pollutants and greenhouse gases. We considered including each of these alternatives. **Section 2.5** of the EA, explains in more detail why some of these alternatives, including underground mining and air quality mitigation, and mining plans with reduced disturbance were in fact considered but not brought forward for analysis in the EA because they were not considered reasonable alternatives in accordance with CEQ regulations at 40 CFR 1502.14. For example, air quality impacts from criteria pollutants, hazardous air pollutants and greenhouse gases were analyzed for Alternative A (the proposed alternative), Alternative B (the selected alternative) and the No Action Alternative in **Section** 4.3 of the EA. This analysis concluded there would be no significant impacts. No mitigation beyond Colowyo's permitted Air Quality Dust Mitigation Plan was required. In response to a comment recommending OSMRE consider an alternative requiring low or no emission mining equipment and require more rigorous maintenance requirements for pollutant emitting machinery, as discussed above, direct air quality impacts from criteria pollutants, hazardous air pollutants and greenhouse gases attributed to mining were analyzed for all alternatives and no significant impacts were identified.

In addition to the original proposed action (Alternative A), OSMRE did consider a reasonable alternative that would mine substantially less coal at a lower maximum production rate and disturb less surface acreage—Alternative B. In addition, OSMRE considered an alternative that would have prohibited any additional mining—Alternative C. Thus, OSMRE considered a reasonable range of alternatives, including those submitted by commenters during scoping. The final paragraph of **Section 2.5.2** has been broken out into **Section 2.5.3** titled **Mining Plan with Reduced Disturbance Alternative** and revised language has been provided to clarify the intent of the discussion.

Summary Comment 3

The determinations of "connected" and "similar" actions (as defined in CEQ regulations) and the related analysis of cumulative impacts are not adequate.

Comments identified that the EA does not address the impacts of the pending Collom Mine expansion, the proposed coal lease modification under consideration by the BLM, and the burning of coal in a power plant. The comments indicate these actions should be considered "connected actions" to the South Taylor action in accordance with CEQ regulations at 40 CFR 1508.25(a)(1). OSMRE evaluated these actions under the CEQ regulations and determined that they are separate, discrete actions that are distinct and not interdependent with the South Taylor action. None of these other actions automatically trigger other actions and can proceed independently of the South Taylor action. As such those actions do not meet the criteria for "Connected Actions" as defined by CEQ regulations at 40 CFR 1508.25(a)(1). As required by NEPA, the Collom Mine permit expansion and the BLM lease modification are considered as reasonably foreseeable actions in Chapter 5, Cumulative Impacts. Chapter 5 provides a summary of both proposals in **Section 5.3**, and describes cumulative effects in **Sections 5.4.3**, **5.4.4**, **5.4.9**, **5.4.11**, **5.4.12**, and **5.4.20**. The burning of coal at the power plant is considered at several points in the EA in accordance with NEPA and is addressed in **Sections 3.5.2**, **4.3.1.4**, **4.3.2.3**, **4.3.3.2**, **4.3.3.3**, **4.3.3.4**, **4.3.3.5**, **4.3.3.6**, **4.5.1**, **4.9.1**, **4.9.2**, **5.4.2**, and **5.4.8**.

Commenters further argue that mining operations at the Trapper Mine are "similar" actions, as defined under CEQ regulations at 40 CFR 1508.25(a)(3) because of their timing, geography, and commonality of providing coal to the Craig Generating Station. Those comments pointed out that the EA should, but allegedly fails to, analyze the impacts at the Trapper Mine. Operations at the Trapper Mine are not "Connected Actions" as defined by CEQ regulations at 40 CFR 1508.25(a)(1). Mining at the Trapper Mine is not an interdependent action to the South Taylor mining operation, does not automatically trigger other actions such as the South Taylor action, and can and will proceed regardless of the South Taylor action. As required by NEPA, operations at the Trapper

Mine are, however, considered reasonably foreseeable actions and are considered in Chapter 5 - Cumulative Impacts.

Another comment indicated that pending BLM coal leasing decisions in Utah, Montana, and Wyoming should be considered and analyzed in the EA as "similar" actions to the OSMRE/ASLM decision on the South Taylor PR02 mining plan modification. Similar actions, are actions which when viewed with other reasonably foreseeable or proposed agency actions, have similarities, such as common timing or geography, that provide a basis for evaluating their environmental consequences together. BLM coal leasing decisions in Utah, Montana and Wyoming are not considered to exhibit common geography with the Colowyo mining plan approval and consequently are not evaluated within the EA.

Commenters also opined that because of these actions, the project would have significant impacts and require an EIS. We disagree. As discussed above, none of the actions the commenters mention as are dependent on the South Taylor Pit expansion. We analyzed the cumulative impacts of these actions and, as described in the EA and the FONSI, we did not determine any significant impacts. Thus, an EIS is not warranted.

Summary Comment 4

The impact analyses of climate change and GHG, including the cost of carbon emissions from coal combustion, are inadequate.

The potential impacts on climate change and GHG are discussed in **Section 4.3** and **Section 5.4.2** of the EA. The EA analysis followed the Draft CEQ Guidance regarding GHG and Climate Change in NEPA analysis (CEQ 2014).

While many comments identified that the EA presents a comprehensive and more than adequate assessment of the potential environmental impacts, many others raise concerns that the analyses of climate change and GHGs are inadequate. One commenter identified that the EA indicates that no public outreach comments were received by OSMRE that expressed concerns over the potential impacts on climate change from coal. All comments received during the public outreach period (May 21, 2015 to June 15, 2015) were considered. The topics covered in those comments, the total numbers of comments received for each topic, and the overall total number of comments received are summarized in **Table 1.6-1** of the EA. The number of comments received on the potential impacts on climate change and GHG are included in the table, in the total number under the category of "Air Quality", which is the section of the EA in which we discuss GHGs and climate change. A description of public outreach comments expressing concern about impacts to climate change and GHG is also included in the EA. For clarity, the category "Air Quality" in **Table 1.6-1** will be relabeled to expressly include the topic of "Climate Change".

Other comments stated that OSMRE failed to analyze the potential effects of approving the proposed mining plan on climate change. As indicated above, those potential effects are analyzed in the sections of the EA cited in accordance with draft CEQ guidance. The draft guidance notes that quantifying the emissions from a government action or approval is more a statement about the nature of the climate change challenge, and that agencies have substantial discretion in how they tailor their NEPA processes so long as they provide the public and decision-makers with explanations of the basis for the determinations. Specifically, the draft guidance states:

Inherent in NEPA and the CEQ Regulations is a rule of reason which ensures that agencies are afforded the discretion, based on their expertise and experience, to determine whether and to what extent to prepare an analysis based on the availability of information, the usefulness of that information to the decision-making process and the public, and the extent of the anticipated environmental consequences."

In light of the difficulties in attributing specific climate impacts to individual projects, CEQ recommends agencies use the projected GHG emissions and also, when appropriate, potential changes in carbon sequestration and storage, as the proxy for assessing a proposed action's potential climate change impacts. This approach allows an agency to present the environmental impacts of the Proposed Action in clear terms and with sufficient information to make a reasoned choice between the no-action and proposed alternatives and mitigations, and ensure the professional and scientific integrity of the discussion and analysis."

Agencies are encouraged to apply this guidance to all new agency actions moving forward and, to the extent practicable, to build its concepts into currently on-going reviews.

OSMRE prepared the EA in accordance with this draft guidance. The direct and indirect effects from mining operations and coal combustion on GHGs and Climate Change are discussed in **Section 4.3** of the EA and cumulative effects are discussed **Section 5.4.2.** Both analyses included a quantification of projected GHG emissions as CO2 equivalents.

Several comments stated that the EA needs to assess the costs of projected carbon emissions associated with the combustion of coal at the Craig Generating Station resulting from the South Taylor Mining Plan Modification. Other comments expressed concern that the EA is misleading because it presumes carbon costs are $0, and one comment points out that the EA only discloses the economic benefits of mining. Additional comments call for the EA to show the calculation of the cost of carbon for the projected coal combustion emissions. The social cost of carbon is addressed in **Sections 4.3.1.4, 4.3.2.3** and **4.3.3** of the EA. The EA does not assume that there is no cost ($0) of GHG emissions. As discussed in these section, OSMRE explains that without a complete monetary cost-benefit analysis, which includes the social benefits of energy production, inclusion solely of a social cost of carbon analysis would be misleading and not informative to the decision maker.

The social cost of carbon (SCC) protocol was developed by an Interagency Working Group (IWG), including the Environmental Protection Agency (EPA) and others, and is intended for use as part of cost-benefit analyses of proposed regulations that could impact cumulative global emissions (Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, available at: http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-

RIA.pdf).[1] EO 12866 requires cost-benefit analyses when developing regulations and the IWG encourages the use of the SCC protocol in those cases.

The South Taylor Mining Plan Modification EA is not subject to EO 12866 because it was not prepared to support the promulgation of regulations. Instead, the analysis was prepared pursuant to NEPA to inform OSMRE's decision as to whether or not to recommend approval, disapproval or approval with conditions of the South Taylor Mining Plan Modification. Moreover, neither NEPA nor any other law requires OSMRE to perform a cost-benefit analysis for this action. Thus, a cost-benefit analysis, including the SCC protocol was not performed.

NEPA does require agencies to consider socio-economic impacts.[2] 40 CFR 1508.8. Thus, OSMRE did attempt to quantitatively analyze those impacts. Although this quantitative analysis did determine some of the benefits of mining in dollars, it was not designed as a cost-benefit analysis like those performed under EO 12866. In fact, many costs other than the SCC that would have been considered in a cost-benefit analysis, such as compliance costs, were not considered in this environmental analysis. Thus, simply because some of the NEPA analysis used dollars to describe the impacts, it does not mean that a cost-benefit analysis was performed that would require the use of the SCC protocol.

Despite not using the SCC protocol, OSMRE did not ignore the effects or costs of carbon emissions. The South Taylor Mine Plan Modification EA evaluated the climate change impacts of the proposed action and alternatives using quantitative measures other than dollars. For instance, the South Taylor Mining Plan Modification EA quantified the estimated greenhouse gas emissions that would result from both direct and indirect actions associated with all alternatives. The direct and indirect effects from mining operations and coal combustion on GHGs and Climate Change are discussed in **Section 4.3** of the EA and cumulative effects are discussed **Section 5.4.2.** Both analyses included a quantification of projected GHG emissions as CO2 equivalents. OSMRE also provided context for these numbers by comparing these estimated emissions with state (for direct emissions), national and global emissions levels (for direct and indirect emissions). In addition to the quantitative measures, the EA also qualitatively described the potential GHG/climate change impacts associated with emissions increases and complexities of these linkages in order to inform OSMRE's decision making.

Another commenter noted that the EA indicates that mining at the Colowyo Mine would reasonably foreseeably result in 0.231 percent of all global GHG emissions. The EA quantified the estimated GHG emissions that would result from a variety of proposed development scenarios for both direct and indirect impacts. The total potential GHG emissions percentage reported on **Table** 4.1-1, page 4-3, are for components of each of the direct and indirect components. For the indirect combustion of GHG emissions referenced in the comment, the global and U.S. percentages have been inadvertently reversed for Alternative A. These values have been corrected, the Alternative A

[1] The SCC protocol is used to monetize damages associated with an incremental increase in carbon emissions in a given year. It includes (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.

[2] Although not mandatory, CEQ NEPA regulations do permit agencies to use cost-benefit in NEPA analyses in certain circumstances. 40 CFR 1502.23.

indirect combustion impacts would result in 0.048 percent of global emissions and 0.231 percent of the U.S. total GHG emissions. Alternative B indirect combustion impacts would result in 0.015 percent of global emissions and 0.071 percent of the U.S. total GHG emissions. These percentages were included to provide context to other sources of GHG emissions.

Summary Comment 5

The analyses of impacts to rare, imperiled fish, wildlife and plants are inadequate.

Many comments identified that the EA presents a comprehensive and more than adequate assessment of the potential environmental impacts of the Project. However, other comments received stated that the EA does not analyze and assess impacts to rare, imperiled fish, wildlife and plants, including T&E species. In particular those comments identify concerns about the impacts of mercury and selenium discharge from water outflows and from the combustion of coal. Some commenters indicated particular concern over the potential impacts to the endangered Colorado pikeminnow and the razorback sucker.

The EA provides an adequate analysis of the potential direct effects from mercury and selenium from water discharge and the potential indirect effects of mercury and selenium from coal combustion. The potential for mercury and selenium impacts resulting from water discharge outflows from the mine is analyzed in depth in **Section 4.5** of the EA. Similarly, the potential for mercury and selenium deposition from coal combustion is analyzed in detail in **Section 4.3** and in **Section 5.4.1.4**. Potential impacts to threatened, endangered, and candidate species from mercury and selenium deposition resulting from coal combustion at the Craig Generating Station are analyzed in **Section 4.9** and in **Section 5.4.8** of the EA. For Alternative B, and as described in **Section 4.9.2**, formal consultation under Section 7 of the ESA has been completed with the USFWS on the effects of coal combustion and associated mercury and selenium deposition in the Yampa River Basin on threatened and endangered fish species. A final determination of effect to these species and their designated critical habitats has been made and mitigation measures volunteered by Colowyo that are now required by USFWS have been incorporated into the EA within the biological opinion included in Appendix D and documented in the signed Finding of No Significant Impact.

Summary Comment 6

The socioeconomic impacts of the Project are not adequately analyzed.

A number of commenters raised the concern that while the SCC emissions was not calculated for the Project, the economic benefits of mining were disclosed. See response under **Summary Comment 4** above.

One commenter identified that many secondary and tertiary businesses exist because of the mining industry in Moffat and Rio Blanco Counties. The comment indicates that a 2014 Colorado Mining Association report shows that the Colowyo Mine purchases more than $50 million annually in services and goods. The comment continues to state that in the absence of the mining plan approval many businesses would decline or disappear. **Section 3.12** addresses secondary and tertiary businesses and describes annual purchases of goods and services by Colowyo as provided by Tri-State Generation and Transmission. **Section 4.12** and **Section 5.4.11** incorporate such expenditures in the analysis of potential impacts. The numbers provided by Tri-State differ from those provided in the comment but the comment does not include the 2014 report identified for documentation. The report referenced is acknowledged but OSMRE has not revised the EA to reflect these numbers because a copy of the report was not provided and OSMRE feels the numbers provided by Tri-State are suitable for the analysis.

Summary Comment 7

The effect of the Project design features to reduce environmental impacts and the enforceability of those features is inadequately described.

Concerns were raised in one comment that the EA does not provide enough details about the design features incorporated into the Project through the SMCRA permit approval process. Those design features, which would mitigate potential environmental impacts, are enforceable requirements of the approved permit issued by CDRMS. The comment continues by requesting that a description of these design features be included in the discussions of mitigation measures in Chapter 4.

In Chapter 2 of the EA, **Sections 2.2.3** and **2.3.3,** provides a discussion of the mitigating effect of project design features, and **Tables 2.2-1** and **2.3-2** provide summary lists of the design features. **Appendix B** also contains a more comprehensive list of the design features. The design features are incorporated into the Proposed Action and Alternative B and, thus, are an integral part of the proponent proposal.

In contrast to design features, mitigation measures are requirements determined by OSMRE to be necessary to further reduce the potential impacts of the proposal, based the impact analysis in Chapter 4 of the EA. Since design features are incorporated into the proponent's proposed action, they are not considered "mitigation measures" developed through the NEPA analysis. However, because of the extensive nature of the design features, OSMRE has added language to the Introduction for Chapter 4 reminding the reader of the general purpose and effect of the design features and where they can be found in the EA.