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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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April 27, 1995

John Pappas
Sr. Environmental Engineer
AMAX Coal Company
P. O. Drawer PMC
Price, Utah 84501

Re: Sowbelly Canyon Reclamation, AMAX Coal Company, Castle Gate Mine,
ACT/007/004-94D & E, Folder #3, Carbon County, Utah

Dear Mr. Pappas:

The Division has completed a review of the Sowbelly Canyon Reclamation Plans received on September 7th and 22nd, 1994 and "as-builts" received on February 22, 1995. These plans were analyzed together with field investigations in order to determine how well reclamation at Sowbelly Canyon is progressing. At this point in time it has been determined that AMAX has not met the requirements for Phase I Bond release. There are numerous problems with the plans as well as on the ground problems that will need to be addressed before Phase I Bond release can be considered for the Sowbelly Canyon area. The enclosed technical document describes the Division's Findings and discusses the problems. Please review it carefully making sure you understand the requirements which must be addressed. Please respond by no later than June 27, 1995.

If you have any questions, please don't hesitate to call.

Sincerely,

A handwritten signature in cursive script that reads "Daron R. Haddock".

Daron R. Haddock
Permit Supervisor

enclosure

cc: P. Grubaugh-Littig
S. Johnson
W. Western
H. Sauer
P. Baker

sowcover.ama

**TECHNICAL FINDINGS FOR SOWBELLY
CANYON RECLAMATION PROJECT AND
AS-BUILT SUBMITTAL**

April 21, 1995

RECLAMATION PLAN

SOILS

Regulatory Reference: R645-301-230, -301-240

Analysis:

The following soils information is required for phase I bond release. 1) The soils surface must be shown to be devoid of coal or other objectionable material in quantities that could hinder achieving the revegetation performance standards. 2) The root zone material must be acceptable quality and depth. 3) The topsoil material must be distributed to a specified depth.

The majority of the surface is devoid of coal. However, there are some areas within the disturbed area which have substantial quantities of coal on the surface. The material located at or near the surface of the disturbed area is predominantly Mancos Shale in various phases of weathering. Mancos Shale is recognized by clay enrichment, highly soluble mineral salts and sodicity. These factors may inhibit plant growth and jeopardize achieving the revegetation performance standards.

Sowbelly Canyon was disturbed prior to SMCRA; therefore, redistribution of stockpiled topsoil was not required by the approved mining plan. However, the operator must use a soil medium that is the best available to support revegetation. The quality of the material which currently exists at the surface of the regraded disturbed area and for the purpose of this exercise comprises the root zone is not of suitable quality.

Findings:

The permittee has not demonstrated that the soil medium used to reclaim Sowbelly Canyon is of suitable quality and depth to support revegetation as required by R645-301-233.

REVEGETATION SUCCESS STANDARDS

Regulatory Reference: R645-301-350

Analysis:

The probability of revegetation success is related to several factors, including consistent and adequate moisture, soil conditions, slope and aspect, weed competition,

depredation by wildlife, seed quality, mulch, and others. This analysis only considers factors related directly to backfilling and grading.

Since this site was disturbed prior to 1977, the revegetation success standards include erosion control, vegetation diversity, and achieving the postmining land use. They do not include a direct comparison of vegetation cover. The reclaimed areas will be compared for these parameters with reference areas consisting of reclaimed abandoned mines in the Spring Canyon area. Revegetation at the abandoned sites has been relatively successful with good diversities of shrubs, grasses, and broadleaf forbs. In fact, the species established in these areas are generally more palatable to livestock and wildlife than species in adjacent undisturbed areas. The amount of vegetative cover is not quite as good as in undisturbed areas, however.

Topography and soils in the disturbed area are generally similar to those at some of the reclaimed abandoned mines. This would tend to indicate favorable chances for vegetation establishment. However, some reclamation practices used decrease the possibilities for success.

Soils

In 1993, six soil samples were taken and analyzed for certain chemical and physical parameters. These samples were not analyzed for all parameters enumerated in the mining and reclamation plan. In addition, the plan calls for one sample to be taken for every 2.3 acres. The total disturbed area in the area reclaimed is approximately 19.7 acres. This means at least three samples still need to be taken.

The six 1993 samples were taken from both graded and ungraded areas, but precise sampling locations were not documented. Also, it is unknown from how deep in the soil profile these samples were taken.

Amax needs to sample at least nine locations to a depth of four feet and have these samples analyzed for the parameters in the mining and reclamation plan. If Amax can document that the 1993 samples were taken to a depth of four feet, they may only need to take three more samples. However, Amax would still need to submit complete results, according to the mining and reclamation plan parameter list, for the six 1993 samples.

The Division is aware of one location that showed extremely high sodium salt levels in pre-grading soil sampling. Amax did not special handle soil from this area, and its disposition is unknown. Additional samples may locate this material.

The incomplete 1993 data show only one potential problem. (The samples were analyzed for total selenium rather than hot water extractable selenium. Total selenium

concentration is not a useful figure when determining whether the material is potentially toxic.) The texture of one of the samples is clay loam. Three of the other samples, although they have a texture classified as loam, border clay loam. Clayey soils tend to restrict water infiltration and reduce vegetation establishment.

Although the texture of the soils may reduce the amount of vegetation establishment, the Division should not withhold bond release on this basis. The Division's "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" indicate a clay loam texture is "fair" for reclamation. Incomplete soil sampling, however, particularly when the Division is aware of a location of potentially toxic material, is cause for not releasing the bond for backfilling and grading.

Exhibit 3.2-14, an as-built drawing, indicates a variance in the slope of channel SBRD-4 due to coal refuse material in the embankment. It is unknown to what degree coal refuse is buried in this area or just mixed with the spoil, but a fair amount of the surface near the upper parts of SBRD-4 is covered with coal. R645-301-553.250 requires coal refuse to be buried at least four feet deep unless the Division allows less cover based on chemical and physical tests indicating revegetation requirements can be met using less cover. The operator has submitted no information about the nature of refuse materials in the area of SBRD-4 nor has he provided justification for the variances to the originally approved plans for this area.

Plans for removal of the sediment pond and reestablishment of natural drainage channels through this area need to be provided since the originally approved plans have now been altered.

Surface preparation techniques may not have been adequate for vegetation establishment. Although most of the soils were ripped, the Division's soils specialist found highly compacted soil below about twelve to eighteen inches when he was taking samples. Compacted soil has been shown in several studies to reduce plant growth through root growth restriction. In Sowbelly, the soils may not have been ripped deeply enough, or the rippers may have been spaced too widely. In addition, the operator used contour furrowing to both control erosion and help establish vegetation. The Division's experience is that other water harvesting techniques are more effective than contour furrowing.

For permit approval, R645-300-133.700 requires the Division to make a finding that the applicant has demonstrated that reclamation as required by the State Program can be accomplished according to information given in the permit application. While there is good reason to suspect the soil in reclaimed areas of Sowbelly Gulch is overly compacted below twelve to eighteen inches and that the water harvesting methods used will fail to adequately promote vegetation establishment and growth, there is no definitive or empirical evidence to this effect. Therefore, although these techniques may ultimately prove to be unsuccessful for vegetation establishment, there is no regulatory requirement to use different methods.

TECHNICAL FINDINGS ON SOWBELLY RECLAMATION

Slopes

Slopes created in the grading process are not extremely steep, but some very steep cut slopes were not reclaimed. As much as possible, these slopes were seeded, but it is not anticipated that much vegetation will become established on them.

An attempt was made to determine what proportion of the area consists of very steep cut slopes where limited vegetation will become established and where wildlife and livestock will not be able to use vegetation because of the steepness. This is difficult to ascertain because Exhibit 3.2-14 does not show which parts of the area actually disturbed by mining were not regraded. Also, there are discrepancies between Exhibit 3.2-14 and 3.2-5 in the boundary of the disturbed area. Some areas shown on Exhibit 3.2-14 as having been regraded were not.

According to Exhibit 3.2-5, about 1.8 acres were to be left as cut slopes. About 0.28 acres of this area were actually graded and blended in with surrounding topography. However, a few areas, such as the top of the highwall and the top of the cut on the road to the water tank, were not graded. The extent of these areas is probably similar to the area that was actually graded but was not proposed to be graded. This assumption, that 1.8 acres were left as cut slopes, is made for the following discussion.

The area where vegetation will need to meet success standards is approximately 18.2 acres. This figure comes from the area graded according to Exhibit 3.2-14 (16.4 acres) and the area left as cut slopes according to Exhibit 3.2-5 (assumed to be about 1.8 acres). Not all of the remaining cut slopes will be totally unusable for the postmining land use, and limited vegetation will become established on them. However, the majority of the remaining cut slopes are about 1h:1v or steeper. According to guidelines used by the Bureau of Land Management, this precludes use by livestock. Very few wildlife would use these slopes. A worst-case scenario is that there is no usable vegetation on the cut slopes.

Since cut slopes comprise about 10% of the disturbed area, if vegetation is established on all graded areas equal in extent of cover to the reference area and if there is no vegetation on the cut slopes, the total amount of vegetation over the entire disturbed area would be 90% of the reference area vegetation cover. Vegetation should be adequate to control erosion on regraded areas assuming the cover will be the same as at nearby abandoned mines and that vegetation is controlling erosion in these areas. Remaining cut slopes have been in place for many years and should be stable according to information presented in the mining and reclamation plan.

The approved mining and reclamation plan says the diversity index used to compare reference and reclaimed areas will be used to show revegetation success for the parameters of diversity, seasonal characteristics, permanence, and utility for the postmining land use. As

discussed above, soil conditions are probably not optimal, but they are unlikely to vary significantly from conditions at the reference areas. The seed mix used is similar to what was used on the abandoned mines and should give diversity in the reclaimed areas similar to the reference areas. Even with a reduction in vegetative cover of 10% over the entire reclaimed area (since some cut slopes will not be useable and will probably have little/no vegetative cover), Amax should be able to meet its revegetation success standards. However, if there are potentially toxic materials near the surface or if the subsoil is overly compacted, the success standards may not be met.

Findings:

Amax has not met the requirements of its mining and reclamation plan to sample soils in the reclaimed area. At a minimum, three more samples must be taken and analyzed for the parameters listed in the mining and reclamation plan. These samples should be taken from the soil profile to a depth of four feet. Samples taken in 1993 were not analyzed for all parameters listed in the mining and reclamation plan, and sample locations and depths were not documented. Amax needs to supply complete test results for these samples and should also show whether they were taken from the upper four feet of the soil profile.

The operator has submitted no information about the nature of refuse materials in the area of SBRD-4 nor has he provided justification for the variances to the originally approved plans for this area. Plans for removal of the sediment pond and reestablishment of natural drainage channels through this area need to be provided since the originally approved plans have now been significantly altered.

Other problems that could reduce vegetation establishment include soil compaction and the lack of effective water harvesting. The amount of vegetation cover averaged over the entire disturbed area will probably be reduced because some slopes are very steep and not conducive to either vegetation establishment or the postmining land use. However, these areas comprise only about 10% of the total disturbed area. If Amax can establish vegetation on regraded area equal in extent of cover to the reference areas, they should be able to achieve revegetation success standards. These standards include diversity, seasonal characteristics, erosion control, and utility for the postmining land use.

POSTMINING LAND USE

Regulatory Reference: R645-301-412, R645-301-413

Utility for the postmining land use is a revegetation success standard and will be met if Amax achieves diversity similar to the reference areas. This is discussed under "Revegetation Success Standards" above.

TECHNICAL FINDINGS ON SOWBELLY RECLAMATION April 21, 1995

Ancillary road A-2 was built in Phase II reclamation as outlined in the mining and reclamation plan. The plan says this road is considered temporary and that it will be scarified and seeded as part of Phase III reclamation (when runoff control structures are removed). As discussed below, the road is not needed for the postmining land use. In addition to plans to scarify and reseed this road, the operator should take other steps to ensure it is not used. This might include placing large rocks on the road or grading parts or all of it to make it impassable. These are not considered Phase I bond release issues, however, since the plan shows the road is needed to maintain the site until Phase III reclamation.

The county road that leads up Sowbelly Gulch ends just before the substation. Beyond this point, prior to reclamation, it continued though the disturbed area into the two forks above the mine. The portion of the road going up the right fork ends at a drill pad. The road going up the left fork continues to the top of the plateau and apparently connects with other roads there.

It might be considered that a road through the reclaimed area connecting to the road in the left fork would be valuable for the postmining land use. However, the left fork road does not appear to have been used since at least 1992. Rocks and other debris appear to have been blocking the road since the winter of 1992-1993. Since the road above the mine has probably not been used in nearly three years, there does not appear to be a good reason to retain any road through the reclaimed area for the purpose of connecting the Sowbelly Gulch county road to the road to the top of the plateau.

A problem that needs to be addressed before the Division can consider Phase I bond release is that neither portal was adequately backfilled. Both of them were covered, but they have reappeared, probably as a result of settling and water piping into them. Air coming from the fan portal probably resulted in the deaths of two birds. These portals present dangers if left in their current condition, and the Division cannot release Phase I bond until they have been adequately sealed and backfilled.

A hole was found above pond 16 that appeared to connect to mine workings. However, the contractor that did the grading work said the hole was only about four feet deep and that it was probably for a utility pole. The hole has been backfilled, but it needs to be watched for signs of redeveloping.

Findings:

Amax proposes to reclaim ancillary road A-2. This road does not appear to be needed for the postmining land use.

Before the Division can release bond for grading, Amax will need to properly backfill the No. 5 mine portals.

BACKFILLING AND GRADING

Regulatory Reference: 30 CFR Sec. 785.15, 817.102, 817.107

Analysis:

Portions of the highwalls east of the lower portal still exist contrary to the approved reclamation plan. The highwalls will be reclaimed before bond release.

The area where the highwalls exist was disturbed before the enactment of SMCRA. In such case the elimination of highwalls is not required if the Operator demonstrates that there is not enough reasonably available fill. The Operator has not demonstrated that there is not enough reasonably available fill to eliminate the highwalls.

Once the Operator has demonstrated the lack of readily available fill then he must revise the reclamation plan to show that highwalls will be retained. Since highwall retention constitutes a significant revision the Operator must advertise the revision and have a public comment period before the Division approves the proposal.

Part of the channel west of Pond 016 slopes to the north instead of the south. The slope reversal creates a depression that has not been approved.

Findings:

The Operator has failed to eliminate all highwalls as stated in the reclamation plan. The Operator has created a depression in the channel west of Pond 016 that has not been approved.

MINE OPENINGS

Regulatory Reference: 30 CFR Sec. 817.13, 817.14, 817.15
513.500 817.15

Analysis:

On March 31, 1995 the Division inspected the two portals listed as reclaimed and shown on Exhibit 3.2-14. The Division noticed that neither portal had been adequately sealed. Both portals are open. Due to safety concerns the Division was not able to determine how far back into the portals the voids extended. According to the approved closure plan a seal will be placed 25 feet from the opening and then backfilled.

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Near pond 016 the Division's inspection team members saw a hole that they believe is connected to the mine workings. Members of the inspection team noticed a musky mine smell around the opening. The opening is most likely caused by surface water flowing through natural cracks that connect to the mine workings. As water flows through the cracks soil is transported into the mine workings and a sinkhole is created.

Findings:

The Operator has failed to seal the portals and sinkhole. Both people and wildlife will have access to the portals, although to what extent is unknown. While access to the mine working may not be possible through the sinkhole at this time the size of the opening will increase with time. The Operator must seal the sinkhole to prevent future access to the mine working.

HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

Analysis:**Acid and toxic-forming materials.**

The soil will be sampled for acid and toxic-forming material. Data from this sampling has not yet been received by the Division. The effect on the hydrologic balance will be addressed after this data is received.

Diversions.

As-builts diversions designs are presented in Table 3.2-20 and Table 3.2-21 and shown on Exhibits 3.2-13 and 14. The hand worked and computer generated design calculations are found in Appendix 3.2I. Appendix 3.2I is stamped and signed by a professional engineer. The summary of the channel designs (Table 3.2-20) shows that all evaluated channels were sized to allow the design flow depth and freeboard which range from 0.02-feet to 1.53-feet. Riprap ranges from 3-inches to 18-inches in diameter. The two berm diversions which route water away from SBRD-1 and into the sediment ponds are not included in the appendix calculation and summary table but they are not shown on the exhibits.

The freeboard on SBRD-1A, 1B, 1C, 1D, 9, and 10 all have less than 1.0-feet of freeboard. 1B, 1C, 1D, and 9 are less than 0.5-feet. Three of which are less than an 0.1-foot. These channels will be remeasured to see if they are as marginal as originally thought. Field measurements show that some areas are not adequate to convey the volume for the design storms.

The temporary road was originally designed to follow the Pond 017 diversion berm then go into the main channel up the canyon of Pond 016. This road has been redesigned to stop before it reaches the main channel but after it travels up the berm diversion bottom. The channel, though, has been used as a road during the reclamation work after channel construction was complete. This resulted in compaction of riprap in the channel bottom.

The berms, which route disturbed, flow into the sediment ponds are designed and shown in Appendix 3.2I and summarized on Table 3.2-20. These are not shown on either maps, Exhibits 3.2-13 and 14 as diversion but the contour show the approximate locations.

Many of the diversions were built with larger riprap on the edge. Field examination shows that water will likely be routed outside the riprap causing erosion to the channel banks. Riprap is also poorly graded, leaving large voids for water to flow through.

Permanent diversions are required to provide adequate size to convey the 100-year, 6-hour storm event, and the design capacity of channels for temporary and permanent stream channel diversions will be at least equal to the capacity of the unmodified stream channel immediately upstream and downstream from the diversion (R645-301-742.322). The Division may specify additional design criteria for diversions to meet the requirements of R645-301-742.300 (R645-301-742.314). Typically the Division requires that 6-inches to a one foot of freeboard be built into permanent diversion. The original designs of these diversions was to include this freeboard. However, many of the diversion constructed in Sowbelly Gulch did not have this freeboard in their final construction. The freeboard on SBRD-1A, 1B, 1C, 1D, 9, and 10 all have less than 1.0-feet of freeboard. 1B, 1C, 1D, and 9 are less than 0.5-feet. Three of which are less than an 0.1-foot. Mr. Bill Hendrickson says the he "thinks the measurement method was the problem, but the channels should work."

Field measurements made by the Division show that some areas are not adequate to convey the volume for the design storms. It appears that riprap was place on areas that were to shallow to begin. Then after the riprap was place the effective flow area was diminished even more. See the attached figures (Cross Sections and Rating Curves for SBRD-1C). Areas where flow depth is not adequate will require reconstruction.

The riprapped channel in the area above the road has been damaged by vehicle traffic. The riprap is compacted into the channel bed and the channel has no roughness on the two

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side where the vehicles' wheels traveled. This reach of the channel should be well armored from erosion, but the compacted condition will make it difficult to establish vegetation. Furthermore, the smooth condition of the channel bottom has created a low frictional coefficient which will cause the water to gain much energy in this reach. The extra energy has not been accounted for in designing the riprap in the channel below the compacted area. The increased energy will increase the potential for erosion in the lower reach.

Some culverts are not sized adequately as permanent diversion structures. These culverts must be removed or resized before phase II can be bond released.

The diversion berms that flow to Ponds 016 and 017 should be mapped better. No berms are shown on maps as diversions, though, the topography lines show their approximate locations. However, it is still unclear whether or not the berm will successfully route water into their respective pond. Especially the berm to Pond 016. It appears to breakdown right before the inlet, flowing into the main diversion. If this is the case, a large area is not being treated properly for sediment control. Snow melt in March 1995 showed that water would not be confined by these diversions; rather some water would flow out of the diversions, into the main untreated channel.

Many of the diversions were built with larger riprap on the edge which channellizes water and cause erosion along the ditch side. Riprap should be well graded across the diversion so that water can enter to proper flow paths. Riprap should be well graded to prevent water from undercutting the channel. A Division inspection in March 1995 showed that riprap is thin in many areas of the diversion. Often time the base material is shown though the riprap. The filter fabric in SBRD-1 is shown in some areas.

Stream buffer zones.

The main reclamation channel is part of an intermittent drainage. All reclamation activities within 100-feet of the main channel are within the buffer zone. The stream is protected from degradation by numerous sediment control measures addressed in the sediment control section of this document.

Sediment control measures.

Sediment is controlled by two ponds and alternate sediment control measures. Sediment pond as-builts are included in Exhibits 3.2-15 and 16 and in Appendix 3.2I. A summary of the constructed ponds inlet and outlet designs are included in Table 3.2-22. Exhibit 3.2-13 shows the areas treated by the sediment ponds. Areas not marked as treated by the sediment ponds are treated by alternate sediment control measures. An amendment approved in January 1995 provides detail into the alternate sediment control measures used in reclamation.

Sedimentation ponds.

Two sediment ponds were constructed in the reclaiming of Sowbelly Canyon. The as-builts for the ponds and the maps showing final grading, do not show identical elevations.

Discharge structures.

The spillways from the sediment ponds are open, therefore, only one spillway is needed per pond. The open spillways are protected from erosion by riprap.

Findings:

The permittee has not conducted all reclamation operations as described in the approved application as required by R645-300-142. Riprap in the reclamation channels must meet the quantity and gradation standards set in the originally approved MRP designs. Many of the diversion constructed in Sowbelly Gulch are not constructed according to the approved design.

Alternate sediment control measure are not well delineated on the as-built maps as required by R645-301-742 and Technical Directive Tech-003A, Section 5, Part B. Each treatment in use should be shown in its location and the contributing area should be noted.

The sediment ponds and discharge structures are adequately sized as temporary structures. The inlets and outlets to the sediment ponds are adequately protected from erosion by riprap. The outlet of Pond 016 has a larger D50 riprap size than originally designed but the existing riprap should perform well because smaller rock was added to the large rock.

REQUIREMENTS

The following requirements must be met prior to Division approval of the reclamation activities and phase I reclamation bond release.

1. The operator must show that the soil surface is devoid of coal or other objectionable material in quantities that could hinder achieving the revegetation performance standards. A minimum of three more samples must be taken and analyzed for the parameters listed in the mining and reclamation plan. Samples must be taken from the soil profile to a depth of four feet. Samples taken in 1993 were not analyzed for all parameters listed in the mining and reclamation plan, and sample locations and depths were not documented. Amax needs to supply complete test results for these samples and should also show whether they were taken from the upper four feet of the soil profile.

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2. Amax must submit information about the nature of refuse materials in the area of SBRD-4 and provide justification for the variances to the originally approved plans for this area. Plans for final reclamation and removal of the sediment pond and reestablishment of natural drainage channels through this area also need to be provided since the originally approved plans have now been altered.
3. Amax must reclaim ancillary road A-2 because it is not needed for the postmining land use.
4. The Operator must eliminate all high walls or provide justification for their retention.
5. The Operator must correct a depression in the channel west of Pond 016.
6. The Operator must re-seal the two portals and the sinkhole that has formed east of Pond 016.
7. All diversions must include, at a minimum, 6-inches of freeboard above the size requirements which pass the design (100-year, 24-hour) storm event. Areas that do not have adequate flow depth to contain the 100-year, 24-hour storm runoff will need to be modified or reconstructed to the original design size.
8. SBRD-1D should be repaired from damage caused by vehicle traffic during reclamation activities. The channel below the compacted area must be protected from the increase energy caused by the compacted riprap.
9. The berm diversions which feed the two ponds must be shown on maps as diversions. The maps should show sufficient contours to determine whether flow will reach its intended pond.
10. The berm diversions must be repaired and modified to ensure flow will reach its proper destination.
11. Riprap in the reclamation channels must meet the quantity and gradation standards set forth in the originally approved MRP designs.

12. Alternate sediment control measures must be shown on appropriate maps. A brief description of the measure and the area that reports to each measure should be shown.
13. Sediment pond maps and the reclamation as-built maps must be made to reflect the actual elevations. These elevations should be the same on all maps.

SOWASBLT.REP