Permanent Impoundment Monitoring.

Two types of permanent impoundments are monitored on Peabody's leasehold - permanent internal impoundments (PII's) and externally draining permanent impoundments (PI's). PII's have been monitored in the pre-law and postlaw (interim program) areas for bond release purposes (30 CFR 816.49b criteria and water quality and quantity representative of pre-July 6, 1990 reclamation) for those areas disturbed prior to July 6, 1990. Fifteen pre-law and interim land PII's representative of those proposed to be left as permanent impoundments in areas disturbed prior to July 6, 1990 have been monitored continuously and/or periodically for water persistence and water quality since 1981 (see Exhibit 85600 for the locations of the 15 PII's that have been monitored). Since more than one monitoring site name has been used for these 15 PII's in the past, Table 7 is presented to cross reference past site ID's with the current database site ID's.

In addition to the above-mentioned 15 PII's, 36 PI's are proposed to be left in the final reclamation. To date, 13 of these 36 proposed PI's have been monitored periodically to obtain a preliminary indication of water level fluctuations and water quality. The locations of the 36 PI's, as well as the previously discussed 15 PII's, are shown on Exhibit 85324 (see Table 8 for the monitoring site ID's for the 36 proposed PI's).

Naming Conventions/Site ID's, Coordinates, and Elevations. Table 8 presents a detailed list of site ID's for the 51 total permanent impoundments proposed to be left in the final reclaimed landscape. Site ID's used by Engineering (Exhibit 85405) and Reclamation (Exhibit 85324) differ from the hydrologic monitoring Site ID's. Table 8 presents a cross referencing of the Site ID's so that Exhibits 85600, 85324, 85405, and 93500 can be correctly interpreted. Some of the impoundments do not exist at the present; however, they are proposed during the course of the entire mining operation. Numbers in parentheses are the Engineering and Reclamation site ID's used. Table 9 presents coordinates and elevations for all impoundments using the hydrology site ID designations.

Monitoring Approach and Frequencies. Sufficient monitoring data exists for the appropriate decisions regarding the inclusion of the PII's (pre-July 6, 1990) in the reclaimed landscape to be made (see Volume 9, Chapter 15; Volume 11, Chapters 16 and 17 of the Permit and the 1986 through 1991 Annual Hydrological Data Reports). The monitoring of the PII's (pre-July 6, 1990) is no longer necessary to achieve the purposes set forth in this monitoring chapter and the areas draining to these ponds are those defined in forthcoming bond release application packages or they exist in prelaw disturbance areas.

TABLE 7

Cross Reference for Current and Historic PII Site ID's

Current Site ID*	Historic Site ID's Used
PII112-P	112, Permanent Internal Impoundment 112, PII112
PII113-P	113, Permanent Internal Impoundment 113, PII113
J27-RC-P	116, Permanent Internal Impoundment 116, PII116
PII117-P	117, Permanent Internal Impoundment 117, PII117
PII118-P	118, Permanent Internal Impoundment 118, PII118
PII119-P	119, Permanent Internal Impoundment 119, PII119
PII120-P	120, Permanent Internal Impoundment 120, PII120
PII121-P	121, Permanent Internal Impoundment 121, PII121
PII122-P	122, Permanent Internal Impoundment 122, PII122
PII123-P	123, Permanent Internal Impoundment 123, PII123
J27-RB-P	124, Permanent Internal Impoundment 124, PII124
N1-RA-P	125, Permanent Internal Impoundment 125, PII125
N2-RA-P	212, Permanent Internal Impoundment 212, PII212, PIIN2-RA
N2-RB-P	206, Permanent Internal Impoundment 206, PII206, PIIN2-RB
N2-RC-P	---, Permanent Internal Impoundment N2-RC, PIIN2-RC

*Site ID's used on Exhibits 85600 and 93500

TABLE 8

Hydrology Site ID's Cross Referenced With

Engineering and Reclamation Site ID's for Permanent

Impoundments to be left in the Final Reclaimed Landscape

Hydrology ID's*	Engr./Recl. ID's**	Hydrology ID's	Engr./Recl. ID's
J1-RA-P	(J1-RA, J1-PI#1)	N1-PII#1-P	(N1-PII#1)
J1-RB-P	(J1-RB, J1-PI#2)	N1-PII#2-P	(N1-PII#2)
J2-A-P	(J2-A)	N1-RA-P	(N1-RA, N1-PI#3)
J3-D-P	(J3-D)	N1-PII#4-P	(N1-PII#4)
J3-E-P	(J3-E)	N1-RB-P	(N1-PII#5)
J3-G-P	(J3-G, J3-G(PI))	N1-PII#6-P	(N1-PII#6)
J3-PII#1-P	(J3-PII#1)	N1-PII#7-P	(N1-PII#7)
J3-PII#2-P	(J3-PII#2)	N2-RA-P	(N2-RA)
J3-PII#3-P	(J3-PII#3)	N2-RB-P	(N2-RB)
J3-PII#4-P	(J3-PII#4)	N2-RC-P	(N2-RC)
J3-PII#5-P	(J3-PII#5)	N5-A-P	(N5-A)
J7-DAM-P	(J7-DAM)	N6-L-P	(N6-L)
J7-JR-P	(J7-JR)	N7-D-P	(N7-D)
J7-R-P	(J7-R)	N7-E-P	(N7-E)
J16-A-P	(J16-A)	N8-RA-P	(N8-RA, N8-PI#1)
J16-G-P	(J16-G)	N10-A1-P	(N10-A1)
J16-L-P	(J16-L)	N10-D-P	(N10-D)
J19-RB-P	(J19-RB)	N10-G-P	(N10-G)
J21-A-P	(J21-A)	N11-A-P	(N11-A)
J21-C-P	(J21-C)	N11-G-P	(N11-G)
J21-I-P	(J21-I)	N12-C-P	(N12-C)
J27-RA-P	(J27-RA)	N14-D-P	(N14-D)
J27-RB-P	(J27-RB)	N14-F-P	(N14-F)
J27-RC-P	(J27-RC)	N14-G-P	(N14-G)
TPF-D-P	(TPF-D, TPF-PI#1)	N14-H-P	(N14-H)
TPF-E-P	(TPF-E)		

*All -P site ID's (not in parentheses) are used in the Hydrology sections and on Exhibits 85600 and 93500

**Corresponding Engineering and Reclamation site ID's in parentheses and are those shown on Exhibits 85324 and 85405

TABLE 9

Elevations and Coordinates for Existing

And Proposed Permanent Impoundments

		UTM		Peabody	
Site I.D.	Surface Elevation	Northing Coordinate	Easting Coordinate	Northing Coordinate	Easting Coordinate
J1-RA-P	6698.00	4039606.13	555728.81	-15650	33920
J1-RB-P	6644.50	4038568.00	554886.39	-19050	31140
J2-A-P	6348.30	4037593.09	550995.64	-22240	18380
J3-D-P	6469.10	4036079.80	553752.68	-27200	27376
J3-E-P	6533.00	4037179.89	554553.17	-23597	30020
J3-G-P	6510.00	4035453.49	551934.62	-29250	21410
J3-PII#1-P	6552.00	4037147.92	552751.49	-23700	24120
J3-PII#2-P	6479.50	4036167.94	552418.72	-26910	23010
J3-PII#3-P	6490.50	4035252.10	552201.60	-29910	22280
J3-PII#4-P	6483.00	4035246.07	552458.18	-29930	23120
J3-PII#5-P	6515.00	4034998.73	552200.16	-30740	22270
J7-Dam-P	6368.40	4031256.95	554584.72	-43000	30000
J7-JR-P	6710.00	4032532.00	560083.00	-39875	48140
J7-R-P	6317.00	4028561.00	553756.00	-52800	27300
J16-A-P	6635.00	4039575.68	562262.50	-15756	55313
J16-G-P	6576.00	4038977.39	561291.15	-17715	52120
J16-L-P	6573.40	4037031.24	560866.80	-24090	50690
J19-RB-P	6880.00	4034963.00	563859.00	-31960	60580
J21-A-P	6933.00	4032549.91	567788.25	-38777	73260
J21-C-P	6894.50	4031787.04	566644.78	-41275	69500
J21-I-P	6804.90	4028460.00	563497.00	-53300	59280
J27-RA-P	6541.00	4054545.29	534980.42	-33890	33500
J27-RB-P	6562.00	4054643.89	534623.53	-35060	33830
J27-RC-P	6467.00	4054225.26	534939.49	-34030	32450
N1-PII#1-P	6980.00	4044862.08	553609.49	1570	27090
N1-PII#2-P	6645.50	4043921.10	552835.70	-1750	24500
N1-RA-P	6600.00	4043610.36	553095.21	-2530	25380
N1-PII#4-P	6630.00	4043494.09	552143.09	-2910	22260
N1-RB-P	6620.00	4043341.66	552843.43	-3410	24550
N1-PII#6-P	6618.00	4043185.74	552025.94	-3920	21870
N1-PII#7-P	6580.00	4042975.20	552326.58	-4610	22850
N2-RA-P	6556.50	4043661.03	554136.31	-2365	28790
N2-RB-P	6664.50	4045173.65	554312.99	2590	29400
N2-RC-P	6820.00	4046374.18	555191.33	6522	32301
N5-A-P	6461.20	4041772.19	552404.47	-8551	23080
N6-L-P	6512.00	4043213.00	553761.00	-4699	27572
N7-D-P	6611.20	4043997.45	551048.07	-1260	18685
N7-E-P	6562.40	4043979.21	551339.85	-1320	19640
N8-RA-P	6724.00	4046301.00	550281.00	5500	16200

TABLE 9 (Con't)

Elevations and Coordinates for Existing

And Proposed Permanent Impoundments

		UTM		Peabody	
Site I.D.	Surface Elevation	Northing Coordinate	Easting Coordinate	Northing Coordinate	Easting Coordinate
N10-A1-P	6628.00	4044338.91	555857.53	-146	34440
N10-D-P	6581.50	4043746.76	555011.97	-2085	31659
N10-G-P	6735.00	4045885.00	556938.00	-4020	38050
N11-A-P	6588.00	4043969.00	555145.00	-2240	32130
N11-G-P	6746.00	4044120.00	557146.00	-1780	38700
N12-C-P	6584.60	4043384.70	554912.57	-3271	31326
N14-D-P	6653.30	4039958.50	560255.71	-14500	48750
N14-F-P	6659.70	4040340.58	562009.35	-13250	54500
N14-G-P	6661.00	4040508.63	562542.73	-12700	56250
N14-H-P	6719.00	4041226.31	563622.35	-10350	59800
TPF-D-P	6719.31	4043389.53	549498.96	-3250	13600
TPF-E-P	6528.10	4043100.00	550296.00	-4615	17012

The emphasis on permanent impoundment monitoring will shift to focusing on the externally draining permanent impoundments adjacent to all current and proposed future mining. Exceptions to this will be the continued monitoring of PIIs J1-RA-P and J1-RB-P until the bond release application for the parcel draining to these ponds is submitted. Also, PII J19-RB-P when completed and its watershed stabilized, and PII J3-G-P will eventually be monitored.

Since bond release will be accomplished through a series of applications over a range of years, there is no need to monitor all externally draining permanent impoundments and the one proposed permanent internal impoundment (J19-RB-P) simultaneously.

The approach will be to focus on monitoring groups of ponds in time frames that correspond to proposed bond release and/or permanent impoundment design submittal and construction schedules. Bond release submittals are proposed to be made approximately 10 to 12 years following the conclusion of mining in a particular mining area or portion of a mining area that drains to a discrete group of ponds. Typically, final permanent impoundment design submittals are proposed to occur approximately one year prior to final design construction work which in turn is scheduled to occur approximately one to two years prior to the respective bond release submittal (refer to Drawing 85406 (Volume 22), and Table 4 in Chapter 6 (Volume 1) for proposed permanent construction dates). These dates must be qualified as proposed only. Mine plan and reclamation changes may significantly affect these dates. Until revisions occur, these are the dates when PWCC anticipates design and construction activities to occur.

Hydrologic monitoring for the permanent impoundment criteria specified in 30 CFR 816.49b will be conducted once the disturbed areas have been stabilized. Stabilization of the disturbed areas involves regrading and the successful re-establishment of vegetation. These two activities normally require five to six years. This leaves a period of approximately six years within which hydrologic monitoring for permanent impoundment and bond release criteria can be conducted on stabilized watersheds prior to anticipated bond release submittals. The permanent impoundment hydrologic monitoring will be conducted during at least four of the six years. Table 10 summarizes the proposed pond monitoring periods (six-year intervals) and the proposed permanent impoundments to be monitored during each six-year monitoring interval. Permanent impoundment monitoring frequencies within a given year and parameters monitored are specified in Table 4. The permanent

monitoring plan employed to monitor the extent and magnitude of any mining impacts is discussed in detail in Chapter 19. The mining operation is being conducted to minimize disturbances to the ground water portion of the hydrologic balance within the permit area and prevent material damage to the ground water portion of the hydrologic balance outside the permit area (see Chapter 18, Probable Hydrologic Consequences). The shallow Wepo and alluvial aquifer water quantity and quality is marginally suitable to unsuitable for use as livestock water. The Navajo aquifer water is suitable for both domestic and livestock purposes and is being provided. An evaluation of the effects of Peabody's pumping of the N-aquifer indicate hundreds of feet of available water remain above the production zones in local and regional Navajo wells. The local wells and springs removed by mining have been replaced by the water impounded in dams and permanent impoundments, and the two public water stands (drinking quality water from the N-aquifer). Seasonal variations in water levels and chemical concentrations have been adequately defined. The ground-water monitoring program as installed will identify the extent and magnitude of any measurable mining impacts.

Reporting of ground-water data from 1980 through 1984 was done on an annual basis (see annual Hydrological Data Reports). Data reporting in 1985 was done on a quarterly basis. Peabody shall report future ground water data according to the reporting frequencies specified in Chapter 16, Hydrological Monitoring Program.

The ground-water monitors will be maintained for the life of the mining operation or until such time as OSM may agree that they are no longer necessary. All off-lease ground water monitoring sites shall be reclaimed in accordance with the Reclamation Plan. The reclamation liability for the ground water monitoring sites (including the off-lease sites) is included in Chapter 24, Bonding.

Surface-Water Protection

Surface-Water Quality. The impact of runoff from disturbed and reclaimed areas on stream water chemistry and sediment loads was found to be of minimal signficance (see Chapter 18, Probable Hydrologic Consequences). Based on water quality analyses from permanent internal impoundments (PII's) in non-topsoiled pre-law areas, runoff water quality is not signficantly different from streamflow water chemistry. The potential for acid and toxic runoff from reclaimed areas is negligible because: (1) the spoil material has a high neutralization potential; (2) a post-reclamation sampling program (see Chapter 22) is designed to locate any acid or toxic zones at the surface of the regraded spoil material;

(3) the plant growth medium reconstruction plan (Chapter 22) provides for burial of any toxic materials identified in the graded spoil sampling program; (4) sediment yields predicted from example reclaimed areas using SEDIMOT II (see Chapter 18) are minimal compared to typical stream loads and in-channel erosion (in addition to SEDIMOT II, other surface water models such as SEDCAD and EASI can be used for sediment yield projections and may be used for such in the future); (5) all disturbed areas drain to a series of sediment ponds and dams which are designed to contain at least the 10-year, 24-hour runoff plus an addition volume of sediment; and (6) channel diversions are designed for areas where channel flow could contact spoil material. The design criteria and construction of diversions, sediment ponds, PII's, energy dissipators and dams as they relate to the protection of the hydrologic balance are discussed in detail in Chapter 6, Facilities.

Discharges from sediment ponds and dams bordering disturbed areas will be in compliance with applicable Federal and State water quality laws and regulations. All discharges, monitoring of discharges and reporting of effluent concentrations will be in compliance with the requirements of NPDES Permit No. AZ-0022179 (Chapter 16, Attachment 3).

Surface-Water Quantity. The impact of dams, diversions, sediment ponds, PII's and reclaimed areas on streamflows and downstream users was found in Chapter 18, Probable Hydrologic Consequences, to be minimal.

Flow and sediment yield changes following release of bond for select reclaimed areas in the Coal Mine Wash watershed were simulated using SEDIMOT II and presented in Chapter 15, Hydrologic Description (pages 132-156). Changes in the flow characteristics when these two mining areas were included in the runoff analysis were not determined to be significant. Though no MSHA sized or other PI's (permanent impoundments) are contained in the N1 and N2 mining areas, there are several PII's (permanent internal impoundments) and as such, it is believed this analysis is indicative of the magnitude of the flow changes when all temporary impoundments in other mining areas are removed prior to release from bond.

Stream buffer zones in a proximity to surface mining areas that are not approved for any disturbance will be marked (refer to Drawing Nos. 85360, 85210 and 85640). Where mining must necessarily be close to existing channels, approved diversions are designed and constructed to convey flows with a minimal effect on suspended solids concentrations, channel gradients, and natural flow velocities. Disturbances will not occur in stream buffer zones unless specifically approved by OSM before the disturbances occur, except

those associated with routine stream monitoring site maintenance as required by 30 CFR 816.41c.(4) and e.(4).

Surface-Water Monitoring

Since 1980, Peabody has installed a network of 14 stream monitoring stations at the up and downstream portions of all washes and 22 reclaimed area surface-water monitors which contain a variety of automated samplers and recorders as well as instantaneous samplers and recorders. Current monitoring instrumentation, parameters monitored and monitoring frequencies are described in detail in Chapter 16. This surface-water monitoring plan is discussed in detail in Chapter 19. The mining operation is being conducted to minimize disturbances to the surface water portion of the hydrologic balance within the permit area and prevent material damage to the surface water portion of the hydrologic balance outside the permit area (see Chapter 18, Probable Hydrologic Consequences). Combined impounded drainage areas as of November 2003 amount to less than three percent of the total Moenkopi and Dinnebito watershed areas. The nature of the flows, the terrace heights and the stream-water quality are such that streamflows are not suitable to support the existing and postmining land use. The quality of water in permanent internal impoundments and temporary sediment ponds and dams indicate such structures are supportive of the postmining land use. Finally, seasonal variations in surface-water parameters have been adequately defined (Chapter 15, pages 76-79 and Table 29). Fluctuations in flows, sediment yields, and channel geometries can best be described over a period of years. The surface-water monitoring program as installed will identify the extent and magnitude of any measurable mining impacts.

Reporting of surface-water data from 1980 through 1984 was done on an annual basis (see annual Hydrological Data Reports). Starting in 1985, surface water hydrologic monitoring data was reported on a quarterly basis. Peabody shall report future surface water data according to the reporting frequencies specified in Chapter 16, Hydrological Monitoring Program. The monitoring frequency at any surface water site dictates what data shall be included in each quarterly report. Clearly 30 CFR 816.41e(3), subparts i and ii demonstrates the regulatory authority did not envision quarterly monitoring for all parameters and all surface water monitoring sites ad infinitum. As such, changes to the surface water monitoring frequencies and parameters will be a continually evolving process through bond release.

The surface-water monitors will be maintained until bond release or until such time as OSM may agree they are no longer necessary as allowed for in 30 CFR 816.41e(3) and subparts

(3)i and (3)ii. All surface water monitoring sites shall be reclaimed in accordance with the Reclamation Plan. The reclamation liability for the surface water monitoring sites (including the off-lease sites) is included in Chapter 24, Bonding.

Water Rights and Alternative Water Supplies

The State of Arizona is proceeding with the adjudication of water rights in the Little Colorado River Basin, which includes Black Mesa. This adjudication is still in the process of being finalized. Once the adjudication is final, it is believed Peabody's water use will be a prescribed use based on the allotments to each Tribe. Peabody's use of water on Black Mesa for the mining operations is authorized in the three mining lease agreements (Lease Nos. 14-20-0603-8580, 14-20-0603-9910 and 14-20-0450-5743) with the Tribes. The mining lease agreements clearly state that Peabody may use that amount of water necessary for its mining operations, including the transportation by slurry pipeline of coal mined from the lease areas.

Since surface- and ground-water appropriations on the reservation were not filed with the State of Arizona prior to the present adjudication process, water use data collected by the USGS between 1950 and 1961 was emphasized along with any supplemental data supplied by the Tribes to document water use within and in the region around the Peabody leasehold. Figure 2 shows all wells and springs completed in the Wepo, Toreva and D-aquifer system within and around the Peabody leasehold that have USGS, BIA, Tribal and Peabody field identification numbers.

Pre-existing Wells and Springs

Table 2 lists available information regarding coordinates, well completions, aquifers penetrated by wells, aquifer characteristics and yield and water quality for the 40 wells shown on Figure 2. The outline of the leasehold has been included on Figure 2 to show the relationship of these pre-existing shallow private wells and springs to the mining operation.

Twenty local wells have been identified, or are professed to exist within the Peabody leasehold or within an approximate 2 mile distance of the Peabody leasehold (Figure 2 and Drawing 85322). Those which have been located in the field, have established BIA or Tribal ID numbers or are known to have been removed by mining are shown on Figure 2 (17 wells, 16 of which agree with Drawing 85322). Drawing 85322 includes 4 wells which are not shown on Figure 2 because they could never be found in the field. They have either

been abandoned or never existed. The following text includes a discussion of all 20 wells referenced above.

The eleven local wells on Drawing 85322 which have BIA field numbers are 4T-403, 4T-402, 4T-404, 8T-504, 8T-506, 4K-389, 4T-512, 4K-380, 4T-405, 4M-34 and 4M-190. Of these eleven wells, six are professed to be partly or wholly completed in the Wepo formation. Wells 8T-506, 4T-512 and 4K-380 were completed in both the Wepo and Toreva and most probably derived their yields from the Toreva aquifer. Wells 4K-389 and 4T-405 are reported as being completed in the Wepo aquifer only; however, their completion depths (417 and 436 feet) and perforation zones (370-403 feet and 375-436 feet, respectively) suggest that they may be partially open to the upper Toreva sandstone, especially considering the high degree of intertonguing between the two units. The Wepo formation ranges in thickness from 0 to approximately 350 feet across the Peabody leasehold. Wells 4M-34 and 4M-190 appear to be a dug wells in the Wepo and/or alluvium. Other local wells with BIA field numbers that are located on or near the leasehold are 4T-403, 4T-404, and 8T-504. These wells are completed in the Toreva aquifer only. Well 4T-402, located between the east and west leasehold tracts, is completed in the Dakota aquifer.

Well 8T-506 is the only well reported as partly or largely completed in the Wepo aquifer that is located on the Peabody leasehold. The well (windmill) was dismantled prior to 1979 and abandoned in advance of mining. The status of the offlease local wells completed in the Wepo aquifer is unknown, but it is assumed they are still operable.

Five other local wells that do not have BIA field numbers have been identified on or within 1 mile of the Peabody leasehold. These wells are: 1) Sagebrush Well, located in the alluvium on Yucca Flat Wash; 2) Reed Well, located in the alluvium near the mouth of Reed Valley Wash; 3) 8A-PHS-10 located in the alluvium along Coal Mine Wash near monitoring well #42; 4) 8APHS-15 presumed to be completed in the Wepo and/or Toreva and located along Coal Mine Wash north of the N-5 pit; and 5) Grapevine Well located in the alluvium on Moenkopi Wash approximately 1 mile SW of the leasehold boundary. To the best of Peabody's knowledge, most of these wells appear to not be in use. A majority of the wells probably had low yields, fair to poor water quality, collapsed, or required extensive maintenance and repair in the well bore or with the windmill portion of the wells.

In addition to the wells mentioned above, four other local wells are professed to be located on the leasehold (see Drawing 85322). These wells are: 1) WLKRPETRF Well, located east of the confluence of Yellow Water Canyon and Coal Mine Wash; 2) Well DM-19,

presumably located southeast of WLKRPETRF Well; 3) Well DM-10, presumably located in Red Peak Wash above the J-7 pond; and 4) Well DM-11, presumably located in Red Peak Wash below Well DM-10 and flooded by the J-7 pond. Peabody has conducted extensive searches to find these undocumented wells. Excepting WLKRPETRF Well, nothing has been found to indicate these wells exist or existed at or in the vicinity of their presumed locations, and no completion information is available. WLKRPETRF Well was an oil exploration boring which has been abandoned. If any of the other 3 wells existed, they have been abandoned or removed, most probably due to low yields or poor water quality, flood flows, collapse, or would have required extensive renovation to provide a viable water supply.

Wells 8T-506 and 4T-403 were removed in advance of the mining operations in the N-6 and J-7 mining areas, respectively. Well 4T-404 will also have to be removed as mining advances in the J-19 mining area. Peabody will replace these three wells following completion of mining or at such time during mining that PWCC and the Tribes can reach agreement as to suitable replacement locations. These wells will be replaced in the same aquifers as they were completed in or in aquifers of at least the same quality and yield. The replacement wells will be located as proximate to their original locations as is feasible given the currently proposed mining disturbance. In the interim, Peabody is providing these local residents an alternative water supply in the form of standpipes located near the N-6 and N-14 mining areas. The water is of drinking water quality (N-aquifer water) and is available on a 24-hour basis.

Figure 2 shows all springs located within and around the Peabody leasehold that have USGS ID's, BIA ID's, Tribal names or PWCC ID's. Table 3 lists available information regarding coordinates, sources, yields and water quality for the 49 springs shown on Figure 2. Those springs shown on Figure 2 that occur within or immediately adjacent to the Peabody leasehold are shown on Drawing 85322. Since two of these springs are duplicates: Peabody spring site NSPG140 corresponds to spring DM-20; and Peabody spring site NSPG91 corresponds to spring 8A-144, there are actually 23 spring sites shown on Drawing 85322.

Extensive surveys of the water resources within and immediately surrounding the leasehold indicates that several of the springs located on Figure 2 and/or Drawing 85322 do not presently exist, occur only as damp spots, or are indistinguishable in baseflow reaches. This is not surprising as springs are very sensitive to climatic and ground water level fluctuations. Eight persistent, flowing and sampleable springs presently exist on or just outside the leasehold. These springs include Peabody site numbers NSPG140, NSPG91, NSPG92, NSPG111, Sand Spring, Goat Spring #2, Hogan Gulch Spring and Benally Spring (NSPG147). One additional spring, Peabody Site Number 97, was monitored until it was

TABLE 3 (Cont.)

Locations, Source, Yields and Water Quality for All Springs Existing
Within or Adjacent to the Leasehold
Davis et al. 1963, Navajo Nation, 1999 and PWCC, 1999

Spring Number	Location Coordinates* Northing	Easting	Stratigraphic Unit Aquifer	Yield GPM	Water Quality
8A-153	-14416.6	54655.2	Wepo	1.0	-
4M-9	-80357.6	121442.9	Toreva	6.0	Fair
8A-139	4452.5	24855.7	Wepo	1.0	Bad
8A-140	-1070.1	20598.6	Alluvium	-	Bad
8A-143	-3026.1	29688.0	Wepo	1.0	Fair
8A-145	1231.0	37051.6	Wepo	1.0	-
8M-141	-6592.8	24740.6	Alluvium	2.0	-
Forest Lake Spg.	-61873.1	77544.8	-	-	-
Pine Spring	25876.6	45901.5	Wepo	-	-
Great Spring	-33129.6	26933.2	Wepo	-	-
Sand Spring	-50446.8	21412.2	Wepo	-	Good

* Coordinates shown are based on PWCC's coordinate system

destroyed by mining at the N-14 coal resource area.

In the pit inflow and probable hydrologic consequences discussion in Chapter 18, it was concluded that no adverse impacts in the form of contamination or signficant diminution of local wells and springs would occur as a result of mining interception of portions of the Wepo aquifer. Drawdowns as a result of pit pumpage were minimal other than in the immediate area of the pits. Drawdowns in the vicinity of local Wepo wells were only on the order of five feet or less. Only one spring (Monitoring Site No. 97) has been interrupted by mining and an alternative water supply in the form of impounded water around the N-14 mining area or the N-14 public water standpipe has been provided to mitigate this impact.

Pre-existing Ponds

Twenty-five pre-existing surface water structures have been documented or are purported to occur on or near the Black Mesa leasehold (see Drawing 85322). Peabody has conducted extensive field surveys, and thorough reviews of the appropriate aerial photographs and topographic maps in an attempt to locate and describe these structures. This work was initiated in 1980 and intermittent field surveys have been continued. The kinds of structures found, viability for intended uses, and plans for protection and mitigation are discussed below.

Nine structures identified on Drawing 85322 could not be found or verified through field surveys and review of aerial photographs. These nine (DM-2, DM-8, DM-15, DM-16, 4M-107, 4M-118, 3855-2, 3855-3 and unnamed pond in Yellow Water Canyon Wash) have been noted and plotted as undocumented structures. As such, no protection or mitigation plan for these undocumented structures is proposed.

Two structures (DM-4 and 4M-38) shown on Drawing 85322 appear to be water spreader/erosion control structures with no ability to impound water. Structure DM-4 is completely silted in and non-functional. There is no protection or mitigation plan proposed for these structures.

Two structures (DM-3 and DM-5) shown on Drawing 85322 have breached embankments, appear to have been in this condition for some time and are not capable of impounding water. There is no protection or mitigation plan proposed for these structures.

The remaining 12 surface water structures on Drawing 85322 (DM-1, DM-7, DM-9, DM-12, DM-13, DM-14, 4M-113, 3755-2, 3855-1, two unnamed ponds near windmill 8T-504 and an unnamed pond near Great Spring) presently exist and are reasonably functional or have been documented to have existed. All structures, excepting DM-1, DM-7 and DM-9, exist in areas where there will be no direct mining impacts to the physical structures themselves. In a few cases, very minor portions of the watersheds draining to these structures will be disturbed by mining. Additionally, no measurable mining impacts to the shallow ground water system are projected in Chapter 18 Probable Hydrologic Consequences in the vicinity of the 3 structures (unnamed ponds near Great Spring and windmill 8T-504 and structure DM-12) which may receive some ground water feed. Thus, no special protection or mitigation will be required other than for DM-1, DM-7 and DM-9. DM-1 will be removed by the Reed Valley Wash channel realignment, DM-9 will have a significant portion of its watershed truncated by mining, and DM-7 has been removed during the construction of temporary impoundment KP pond.

No special protection of the three structures that will or have been impacted by mining and associated activities is feasible. The loss of past and existing water supplies provided by these structures as a result of mining will be mitigated during the mining interval by existing sediment ponds. Several sediment ponds, possessing superior embankments and potential for impounding water, exist near the pre-existing structures. Mitigation for the loss of DM-1, DM-7, and DM-9 after mining will be accomplished by retaining permanent impoundments located in close proximity to the original structures in the postmining landscape. Postmining mitigation for these 3 structures is fully discussed in Chapter 18 (Removal of Pre-existing Surface Water Structures).

Peabody N-aquifer pumpage has been shown in Chapter 18 (Impact of Peabody Wellfield Pumpage on Regional Water Levels and Stream and Spring Flows) to have a minimal impact on the total available N-aquifer well water heights at the various Tribal communities within the portion of the N-aquifer influenced by the PWCC wellfield pumpage. Simulated drawdown in the N-aquifer from Peabody and community pumping has been performed using a 3-D numerical flow model (Chapter 18, PHC). Comparisons of these simulations indicate hundreds of feet of available water columns will remain above the top of the N-aquifer or production zones in local and regional community wells. In a letter dated October 17, 2003, the OSM published its most recent review of the USGS monitoring data for 2001 and 2002 (Thomas, 2002), and Peabody's 2002 Annual Hydrologic Data Report. OSM concluded "…that material damage to the hydrologic balance of the N Aquifer outside PWCC's Black Mesa/Kayenta permit area, caused by mining, has not occurred". Thus the quantity and

quality of the N-aquifer water being used by local and regional water users is being protected.

Peabody is providing drinking quality water at two locations on the leasehold (see Chapter 19, Water Rights and Alternative Water Supplies). This water is supplied from the N-aquifer and is available on a 24-hour basis.

Following surface coal mining and reclamation activities, Peabody will seal and properly abandon all monitoring wells in the alluvial and Wepo aquifers and remove the surface installations and instrumentation. Sealing and abandonment procedures are described in Chapter 16. The final disposition of the Navajo Formation wells will be determined after consultation with the Tribes; however, they will be considered temporary structures unless approved by the regulatory authority as an element of the postmining land use plan. All wells will be properly cased, sealed and protected to prevent water quality contamination and to ensure the safety of people, livestock, fish and wildlife and machinery.

Alluvial Valley Floors

Introduction. The mining leases are drained by four main washes, all of which, including some of the larger tributaries to these washes, have alluvial material in and adjacent to the stream channels. Based on OSM's definition for intermittent channels, all tributaries and washes above the confluence of Coal Mine Wash with Moenkopi Wash whose watershed areas are greater than one square mile are intermittent. Below the confluence of Coal Mine and Moenkopi Wash for an approximate 2 mile distance, the channel of Moenkopi Wash intersects the water table and exhibits baseflow for extended periods of each year. This reach of Moenkopi Wash meets the hydrologic definition of intermittent as well as OSM's definition for intermittent which is based solely on watershed area regardless of the location of the water table relative to the channel bottom.

The precipitation events on the Black Mesa are cellular in nature and tend to be quite intense when they do occur. Downstream portions of the washes may flow while upstream reaches are dry. The same holds true for the major tributaries.

Related Studies. During 1980, Peabody Coal Company conducted studies to determine the presence of alluvial valley floors and define their characteristics and limits. The studies focused on: (1) the geomorphic mapping of the alluvium; (2) the surface- and ground-water quantity, quality and availability; and (3) vegetation and soils studies in the alluvial areas. A consultant and geologist with the Museum of Northern Arizona

performed the geomorphic mapping of the Black Mesa leasehold and downstream two-mile border area. Mapping identified the contacts between and areal extent of alluvium, fan deposits and colluvium. The mapping was done using current color aerial photographs.

Soil and vegetation studies in the alluvial areas were performed during 1980 by Espey, Huston and Associates, Inc. (EHA), as part of their baseline studies for the Black Mesa leasehold. Their studies focused on evidence of flood irrigation, farming, and vegetation that would support or disprove classification of these alluvial areas as alluvial valley floors. The EHA work was superceded by the Intermountain Soils study performed in 1985 and referenced later in this discussion.

Peabody also surveyed vegetation in alluvial areas for background information in 1980. The surface- and ground-water hydrology of the alluvium and alluvial aquifer system has and continues to be studied by Peabody personnel as part of the ongoing hydrologic monitoring program. Other than the hydrology monitoring and the aforementioned consulting and PWCC studies, no other studies specific to AVF's have been performed on the leasehold. The results of all the studies are summarized in the following Section (Study Results and Discussions) and the 1985 IMS study results are presented in Attachment 1.

The only comprehensive land survey which has been completed in the vicinity of Peabody's leasehold was published in 1964. In that year, the Branch of Land Operations, Bureau of Indian Affairs, published soils and range inventories for the 1882 Executive Order Area. The survey maps showed the location of cultivated lands as well as range land.

In February, 1979, the Bureau of Indian Affairs, Flagstaff Administrative Office, published a sociocultural assessment of the livestock reduction program in the Navajo-Hopi Joint Use Area. The report was prepared by staff of the Northern Arizona University. The study provides insight as to the importance of rainfall on farming in the area.

Finally, during 1985, Intermountain Soils, Inc. performed a survey of phreatophytes and subirrigation on the Black Mesa leasehold and surrounding area (see Attachment 1). Study objectives included: (1) the location and observation of existing farming practices; (2) determination of irrigation or dryland farming; (3) characterization of irrigation practices; (4) documentation of evidence of any current or past subirrigated cultivation; and (5) characterization of natural vegetation communities in or near major drainages, including alluvial terraces, emphasizing occurrences and distributions of phreatophytes.

Study Results and Discussions.

Geomorphic Mapping. Analysis of the mapping reveals that portions of the material mapped as alluvium do not extend very far onto the first terraces. The greatest continuous amounts of alluvium are between the channel meanders and along Dinnebito Wash. Most of the significant tributaries to the main washes consist of fan deposits. Colluvium comprises most of the material extending from the bordering bedrock units to the alluvium and fan deposits.

The mapping results suggest that the alluvium is not extensive along the principal washes and their tributaries. Dinnebito Wash has the largest amount of alluvium and a quite wide valley for the small degree of meandering it presently exhibits. It is probable that Dinnebito Wash is a remnant part of the ancient San Juan drainage network. The other washes exhibiting substantial alluvium and saturated alluvial cross sectional areas are Reed Valley and lower Coal Mine Washes and Moenkopi Wash, especially in the two-mile zone just downstream from the leasehold (see Attachment 13, Chapter 15). In summary, the alluvium constitutes only small, narrow stretches of land adjacent to the washes. Most of the headwater reaches of all washes and the lesser side tributaries contain little to no alluvial water.

Domestic Farming. In Peabody's 1980 survey, the few existing farm plots were found to be limited primarily to meandering sections of the washes. These locations were chosen to take advantage of the limited availability of cultivatable soils and minimum slopes. The flatter slopes on the terraces allow for greater infiltration and less runoff during the erratic rainfall events experienced on Black Mesa. The potential for farming based strictly on the availability of alluvial material would be limited to thin strips of land adjacent to the channels and isolated meanders.

During 1980, Peabody personnel measured the actual areas of each farm plot (corn and squash fields) and determined that there were 138 acres (see Table 4) out of the 64,858 acres (.2 percent) within the leasehold that were cultivated in some fashion. This is well below the 60 acres out of 1,000 acres suggested by Senator Melcher in 1977 as a criterion for the negligible impact exemption (123 Cong. Rec. §8144, dail. ed. May 20, 1977).

The BIA inventory published in 1964 encompassed 1,822,208 acres of reservation land. The inventory showed 1,815,930 acres to be range land and 6,278 acres or .34 percent of the

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