

**Project No. 102148PR  
December 2010**

**D'APPOLONIA**

**EXPRESSION OF INTEREST  
CARTRIGHT BRANCH REFUSE PILE DESIGN  
LOGAN COUNTY, WV**

**REQUISITION NO. DEP15232**

**PREPARED FOR**

**WEST VIRGINIA DEP  
OFFICE OF ABANDONED MINE  
LANDS & RECLAMATION  
CHARLESTON, WEST VIRGINIA**

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WV PURCHASING  
DIVISION

# D'APPOLONIA

275 CENTER ROAD  
MONROEVILLE, PENNSYLVANIA 15146-1451  
(412) 856-9440 FAX (412) 856-9535

December 3, 2010

Project No. 102048PR/11

State of West Virginia  
Department of Administration  
Purchasing Division  
2019 Washington Street, East  
Charleston, WV 25305-0130

**Expression of Interest  
Cartright Branch Refuse Pile  
Requisition # DEP 15232**

Gentlemen:

We appreciate the opportunity to submit this Expression of Interest (EOI) for the subject project. Enclosed please find the AML Consultant Confidential Qualification Questionnaire, and the AML and Related Project Experience Matrix (RPEM). The RPEM makes reference to additional information summarized for selected projects relating to the required work on the subject site and also described on Project Profiles, which are provided in Appendix A.

D'Appolonia's design office is located in Monroeville, Pennsylvania, a suburb of Pittsburgh and within a short drive to West Virginia. From this office, we serve clients throughout the Appalachian coal fields with both field and design engineering services. We have 20 engineers (10 who are registered professional engineers) who serve the mining industry with design of mine and reclamation projects. Our engineering staff averages over 15 years of experience, and is supported by geologists, scientists, CAD operators, surveyor and technicians. We could assemble four AML Design Teams, if necessary.

D'Appolonia has provided services to the mining industry since the late 1950s, and performed AML design projects in West Virginia, Pennsylvania, Ohio, Virginia, Illinois and Indiana. These projects have included regrading of and reclamation of surface mine and refuse disposal sites, stabilization by grouting of underground mines, control and treatment of acid mine drainage, backfilling and sealing of mine portals and shafts, and demolition and clearing of former mine structures. Additionally, several of our projects have involved stabilization of landslides, control of refuse fines, and stream bank restoration.

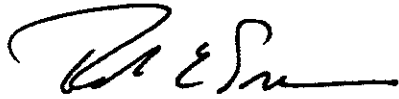
Our proposed project teams have worked together on reclamation plans requiring the following features:

- **Regrade/Remove Gob and Cover with Soil** – The Clyde Mine Blackdog Hollow reclamation project included the reclamation of about 72 acres of mine spoil and refuse, using limited available site soils and incorporating biosolids as a topsoil substitute. Most of the cited projects included reclamation of mine spoil, refuse or gob, ranging from a few acres to relatively large tracts.
- **Provide Access** – The Pangburn Site required construction of access for reclamation and removal of waste materials, and other referenced projects have included varying measures of access improvements and security controls.
- **Construct Drainage Channels and Culverts** – The Alpha Emerald site as well as most of the projects described include design of diversions, drainage channels and culverts to convey storm runoff from reclaimed areas.
- **Provide Streambank Protection** – At the Hopedale Mine site, gabions and riprap were utilized along the streambank to protect a water intake and provide erosion protection against flood levels. Other projects required similar streambank protection plans to be employed.
- **Construct Wet Seals** – The Blackwood Shaft Sealing project included sealing a vertical shaft while maintaining drainage from a connected outcrop entry. Other projects include the sealing of mine entries and coal seams as part of refuse disposal plans and reclamation.
- **Removal/Demolition of Abandoned Structures** – The Capstone Lamira project included the salvage/demolition of steel and concrete mine structures, including scale, stacker-reclaimer, preparation plant, etc., as part of the mine site reclamation.
- **Cover Disturbed Areas and Condition and Revegetate** – The Clyde Mine Blackdog Hollow reclamation project, as well as most of the cited mine reclamation projects included covering disturbed materials and revegetating, considering use of available site soils and where necessary topsoil substitutes.

D'Appolonia completed the update of the Mine Safety and Health Administration's Coal Refuse Design Manual in 2009. In addition to the engineering and design methods presented for coal refuse facilities, the manual includes sections on evaluating blow out potential of abandoned mines, mine seals and barriers, AMD mitigation and treatment, and reclamation. Personnel responsible for preparing the manual are part of the proposed project team.

We trust the enclosed information supports our qualification for design of AML projects, and we look forward to the opportunity to interview with the Office of Abandoned Mine Lands and Reclamation.

Very truly yours,

A handwritten signature in black ink, appearing to read "R. E. Snow". The signature is fluid and cursive, with a long horizontal stroke at the end.

Robert E. Snow, P.E.  
Principal

RES:msw  
Enclosures

**WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION  
AML CONSULTANT QUALIFICATION QUESTIONNAIRE**

PROJECT NAME CARTRIGHT BRANCH REFUSE PILE DESIGN	DATE (DAY, MONTH, YEAR) 03 December 2010	FEIN 25-1564895
1. FIRM NAME D'Appolonia Engineering Division of Ground Technology, Inc.	2. HOME OFFICE BUSINESS ADDRESS 275 Center Road Monroeville, PA 15146	3. FORMER FIRM NAME E. D'Appolonia Consulting Engineers STS-D'Appolonia
4. HOME OFFICE TELEPHONE  (412) 856-9440	5. ESTABLISHED (YEAR)  1956	6. TYPE OWNERSHIP  Corporation
7. PRIMARY AML DESIGN OFFICE: ADDRESS/TELEPHONE/PERSON IN CHARGE/NO. AML DESIGN PERSONNEL EACH OFFICE 275 Center Road, Monroeville, PA 15146 / (412) 856-9440 / Robert E. Snow / 16		

8. NAMES OF PRINCIPAL OFFICERS OR MEMBERS OF FIRM  
 Robert E. Snow, P.E.  
 James L. Withiam  
 Edward P. Voytko, P.E.  
 William J. Johnson, P.G.

9. PERSONNEL BY DISCIPLINE (Bold Lettering Indicates Minimum Design Team Members)

3 ADMINISTRATIVE	ECOLOGISTS	LANDSCAPE ARCHITECTS	1	STRUCTURAL ENGINEERS
ARCHITECTS	ECONOMISTS	MECHANICAL ENGINEERS	1	<b>SURVEYORS</b>
BIOLOGIST	ELECTRICAL ENGINEERS	<b>MINING ENGINEERS</b>		TRAFFIC ENGINEERS
3 CADD OPERATORS	ENVIRONMENTALISTS	PHOTOGRAMMETRISTS	1	HYDRAULIC ENGINEERS
CHEMICAL ENGINEERS	ESTIMATORS	PLANNERS: URBAN/REGIONAL	2	WORD PROCESSORS
8 CIVIL ENGINEERS	<b>GEOLOGISTS</b>	SANITARY ENGINEERS	1	TECHNICIANS
3 CONSTRUCTION INSPECTORS	HISTORIANS	SOILS ENGINEERS		
1 DESIGNERS	2 HYDROLOGISTS	SPECIFICATION WRITERS	37	TOTAL PERSONNEL
DRAFTSMEN				

TOTAL NUMBER OF WV REGISTERED PROFESSIONAL ENGINEERS IN PRIMARY OFFICE: 3  
 \*RPES other than Civil and Mining must provide supporting documentation that qualifies them to supervise and perform this type of work.

10. HAS THIS JOINT-VENTURE WORKED TOGETHER BEFORE? NOT A JOINT-VENTURE

11. OUTSIDE KEY CONSULTANTS/SUB-CONSULTANTS ANTICIPATED TO BE USED. Attach "AML Consultant Qualification Questionnaire" for each if copy is not on file with AML.

NAME AND ADDRESS:	SPECIALTY:	WORKED WITH BEFORE Yes _____ No _____
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<p>12. A. Is your firm experienced in Abandoned Mine Lands remediation/Mine Reclamation Engineering?</p> <p>YES</p>	<p>D'Appolonia has completed more than 75 projects related to AML remediation and mine reclamation engineering. A summary list of projects indicating various types of experience is provided in Attachment C. Of these projects, 28 were sites located in West Virginia and these successfully completed projects cover the full spectrum of experience that would be required for the work described in the RFQ.</p>
<p>B. Is your firm experienced in Soil Analysis?</p> <p>YES</p>	<p>D'Appolonia, which was founded in 1956, has always been known as one of the top geotechnical firms in the country. Geotechnical engineering continues to be a mainstay of our business. During our existence, we have completed thousands of geotechnical engineering projects, including many located in West Virginia. Our project history includes all types of projects including settlement analysis, slope stability analysis and remedial design, bearing capacity analysis and foundation design, deep foundations, and subsidence. We are experienced in performing geotechnical analyses and designs associated with mine lands remediation and mine reclamation. Our geotechnical engineers are experienced in the classification of soils and the development of laboratory testing programs. In addition to our geotechnical capabilities, D'Appolonia's engineers have evaluated site soils and topsoil substitutes and amendments in preparation of mine reclamation designs and specifications.</p>
<p>C. Is your firm experienced in hydrology and hydraulics?</p> <p>YES</p>	<p>Hydrology and hydraulic engineering are a mainstay of our business. Much of our work related to mining, dams and reservoirs and industrial site development has components related to hydrology and hydraulic engineering. We have completed hundreds of projects with such components. We are experienced in the development of design basis storms for watersheds including the 100-year frequency event and the Probable Maximum Flood (PMF). We have analyzed flows resulting from these storms and we have designed channels and other hydraulic structures to accommodate these flows. Our experience includes the development of erosion and sedimentation control plans associated with new and remedial construction. Our engineers are familiar with TR-55, HEC-1, HEC-2, HEC-FAS and other commonly used software.</p>
<p>D. Does your firm produce its own Aerial Photography and Develop Contour Mapping?</p> <p>NO/YES</p>	<p>We typically subcontract aerial mapping or purchase available data. We prepare contour mapping based on our own surveys or from available project information, and work with site surveyors as necessary.</p>
<p>E. Is your firm experienced in domestic waterline design? (Include any experience your firm has in evaluation of aquifer degradation as a result of mining.)</p> <p>YES</p>	<p>D'Appolonia has prepared water distribution line designs for a variety of commercial and industrial uses, ranging from 3-inch to 12-inch lines. We frequently address aquifer degradation due to mining, both in terms of water quality and quantity.</p>
<p>F. Is your firm experienced in Acid Mine Drainage Evaluation and Abatement Design?</p> <p>YES</p>	<p>D'Appolonia has completed more than 25 projects relating to acid mine drainage (AMD) evaluation and abatement design (several are identified in Attachment C and are illustrated in project profiles presented in Appendix A). Our projects have included the evaluation of the source of AMD impacts to receiving waters and methods to mitigate such impacts and treat the AMD source. Our design plans have included sealing of mines and mine entries to control drainage and AMD quantities, alkaline flooding of underground mines to address acid generation, chemical treatment plants for large AMD flows, passive treatment systems for small AMD flows, and isolation/neutralization of acid mine rock for source control.</p>

<p>13. PERSONAL HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES data but keep to essentials)</p>	<p>RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete)</p>		
<p>NAME &amp; TITLE (Last, First, Middle Int.)</p> <p>SNOW, ROBERT E. - PROJECT PRINCIPAL</p>	<p>YEARS OF AML DESIGN EXPERIENCE:</p> <p>9</p>	<p>YEARS OF AML RELATED DESIGN EXPERIENCE:</p> <p>20</p>	<p>YEARS OF DOMESTIC WATERLINE DESIGN EXPERIENCE:</p> <p>1</p> <p>Brief Explanation of Responsibilities Since joining D'Appolonia in 1977, Mr. Snow has served as lead engineer, project manager, or project principal for the design of facilities for the power, mining, steel, nuclear, and chemical industries, supervising engineers and environmental scientists in the completion of these projects. For this project, Mr. Snow would serve as project principal and in this capacity would make sure that appropriate staff and firm resources are made available to the project. Mr. Snow will also provide technical guidance and managerial input to the project work scope preparation and planning. He will attend client meetings, as appropriate, and will provide senior technical review for technical reports. Mr. Snow will review project schedules and budgets to verify that the firm provides the required technical products within budget and on schedule. Mr. Snow will coordinate internal QA/QC reviews with the project manager.</p>
<p>EDUCATION (Degree, Year, Specialization)</p> <p>M.S., 1977, Civil Engineering B.S., 1975, Civil Engineering M.B.A., 1993, Business Administration</p>	<p>MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS American Society of Civil Engineers, Society of Mining Engineers</p>		
<p>13. PERSONAL HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete) data but keep to essentials)</p>	<p>RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete)</p>		
<p>NAME &amp; TITLE (Last, First, Middle Int.)</p> <p>MESSMER, DANIEL P. - SR. PROJECT ENGINEER</p>	<p>YEARS OF AML DESIGN EXPERIENCE:</p> <p>5</p>	<p>YEARS OF AML RELATED DESIGN EXPERIENCE:</p> <p>14</p>	<p>YEARS OF DOMESTIC WATERLINE DESIGN EXPERIENCE:</p> <p>1</p> <p>Brief Explanation of Responsibilities Mr. Messmer's experience has included reclamation of abandoned surface and pit mine areas for recreational and commercial use, construction of landfills in abandoned strip mine areas and reclamation of an abandoned strip mine for construction of a penitentiary. These projects have involved storage and treatment of surface and ground water, slope stability, grouting of mine voids, and construction of deep caisson foundations extending below mined areas. His responsibilities have included geotechnical engineering analyses, environmental issues, permitting, engineering design, preparation of plans and specifications, and construction monitoring. For this project it is anticipated that Mr. Messmer would serve as project manager and serve as lead engineer for specific tasks. Mr. Messmer will be responsible for establishing task scopes of work and budgets, scheduling, and coordination with subcontractors. He will provide day-to-day project management and will be responsible for providing project work products in accordance with project schedules and budgets. He will frequently communicate with WVDEP relative to work progress and relevant issues. Mr. Messmer will report to the project principal on a regular basis the project status with respect to completion of project deliverables and schedule and budget issues.</p>
<p>EDUCATION (Degree, Year, Specialization)</p> <p>B.S., 1985, Civil Engineering</p>	<p>MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS American Society of Civil Engineers, National Society of Professional Engineers, American Concrete Institute</p>		
<p>REGISTRATION (Type, Year, State) Civil Engineering, 1990, PA, AL, AZ, CA, CO, CT, FL, HI, ID, ME, MD, MT, NV, NH, NM, OH, OR, UT, VA, WA, WI, WV</p>			



13. PERSONAL HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete data but keep to essentials)

NAME & TITLE (Last, First, Middle Int.)	YEARS OF EXPERIENCE	
	YEARS OF AML DESIGN EXPERIENCE:	YEARS OF DOMESTIC WATERLINE DESIGN EXPERIENCE:
McKELVEY, JOHN A. - PROJECT ENGINEER	4	1

**Brief Explanation of Responsibilities**  
 Mr. McKelvey has extensive experience with respect to mining and subsidence and the design and construction of mine waste disposal facilities. This experience includes subsurface exploration, installation of monitoring instruments, hydrologic and hydraulic analyses, slope stability analyses, and design of internal drainage systems. Field exploration has included surficial reconnaissance, geotechnical drilling and sampling, installation of monitoring wells and piezometers, aquifer performance tests, and installation and monitoring of instrumentation. He has designed surface mine facilities, including surface drainage, sedimentation control, and spoil disposal embankments. He has been responsible for preparation of plans and specifications for mine waste disposal and AML reclamation projects, including mine grouting and sealing. He has also been responsible for construction monitoring on many of these projects. For this project, Mr. McKelvey will be responsible for performing geotechnical engineering tasks, as assigned by the project manager.

**EDUCATION (Degree, Year, Specialization)**  
 B.S., 1980, Civil Engineering

**MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS**  
 REGISTRATION (Type, Year, State)

13. PERSONAL HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete data but keep to essentials)

NAME & TITLE (Last, First, Middle Int.)	YEARS OF EXPERIENCE	
	YEARS OF AML DESIGN EXPERIENCE:	YEARS OF DOMESTIC WATERLINE DESIGN EXPERIENCE:
CAMPBELL, COLLEEN M. - Sr. PROJECT ENGINEER	8	5

**Brief Explanation of Responsibilities**  
 Ms. Campbell's experience related to AML includes site studies, subsurface exploration programs, development of alternatives based on economic analyses, design of surface drainage and sediment control systems, embankment layout, hydrologic analyses, hydraulic analyses of surface drainage facilities and discharge structures associated with impounding facilities, development of site regrading plans, slope stability analyses, and design report and specification preparation. Her experience includes development of AMD treatment systems for mine discharges and coal refuse. She is thoroughly familiar with hydrology and hydraulic software, as well as software for slope stability and other geotechnical analyses. Ms. Campbell will be lead engineer for project tasks related to hydrology and hydraulic engineering, as assigned by the project manager.

**EDUCATION (Degree, Year, Specialization)**  
 B.S., 1980, Civil Engineering

**MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS**  
 REGISTRATION (Type, Year, State)  
 Civil Engineering, 2010 - PA

13. PERS L HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete data but keep to essentials)

NAME & TITLE (Last, First, Middle Int.)	YEARS OF AML DESIGN EXPERIENCE:	YEARS OF AML RELATED DESIGN EXPERIENCE:	YEARS OF DOMESTIC WATERLINE DESIGN EXPERIENCE:
<p>VOYTKO, EDWARD P. - PRINCIPAL ENGINEER</p> <p>Brief Explanation of Responsibilities            Mr. Voytko has managed and been responsible for numerous engineering (civil and geotechnical) and environmental studies related to dams, reservoirs, transportation facilities, structure foundations, retaining walls, soil and rock slopes, and AML reclamation. He has managed long-term contracts with the City of Pittsburgh and Allegheny County related to civil and geotechnical issues. His responsibilities on these projects have included evaluation and design of repair measures for settlement, soil and rock slope stability, sinkholes and subsidence, site exploration and development of design and construction recommendations. His experience includes reclamation plans for abandoned mine lands in West Virginia. This work included slope stability analyses, remedial designs, development of site drainage plans and preparation of associated plans and specifications. For this project it is anticipated that Mr. Voytko would serve as a technical consultant. He would also be available as a task leader, as needed.</p>	7	20	1
<p>EDUCATION (Degree, Year, Specialization)            B.S., 1977, Civil Engineering            M.S., 2004, Civil Engineering</p>			
<p>MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS            American Society of Civil Engineers, United States Society on Dams, Association of State Dam Safety Officials, Deep Foundations Institute</p>			
<p>13. PERSONAL HISTORY STATEMENT OF PRINCIPALS AND ASSOCIATES RESPONSIBLE FOR AML PROJECT DESIGN (Furnish complete data but keep to essentials)</p>			
<p>SHUSKO, ROBERT M. - PRINCIPAL ENGINEER</p> <p>Brief Explanation of Responsibilities            Mr. Shusko has been involved in and responsible for a wide variety of mining and environmental projects involving design and permitting of mine facilities, including mine reclamation plans, along with remedial investigations and feasibility studies of other industrial properties. He has prepared reclamation plans for mine sites ranging from refuse disposal areas to mine portals and shafts, and developed subsidence mitigation plans for active and abandoned mines. Additionally, he has prepared slope stabilization designs for landslides and heavily eroded sites. Mr. Shusko will be responsible for subsidence assessments, entry sealing, and reclamation plans, as assigned by the project manager.</p>	4	8	1
<p>EDUCATION (Degree, Year, Specialization)            B.S., 1995, Environmental Science            B.S., 1994, Civil Engineering</p>			
<p>MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS            American Society of Civil Engineers</p>			

**SOFTWARE****GEOTECHNICAL ENGINEERING**

**SLIDE** Windows based limit equilibrium slope stability software.

**SIGMA/W** Windows based finite element (FE) program for the static analysis of plane strain and axisymmetric soil-structure stress-deformation problems. Compatible with SEEP/W, CTRAN/W and SLOPE/W.

**SLOPE/W** Windows based limit equilibrium slope stability analysis software. Compatible with SEEP/W, CTRAN/W and SLOPE/W.

**CANDE89** Plane strain FE code for the analysis of flexible and rigid culvert systems. Program considers nonlinear soil behavior, relative slip between the culvert and soil backfill, construction and external loading conditions.

**COM624P** One-dimensional (1-D) finite difference (FD) program for the evaluation of laterally-loaded piles and drilled shafts which considers variable degrees of head fixity, loading, and subsurface conditions. Program computes deflections, moments and stresses as a function of depth.

**CONSOL** FD program for the evaluation of 2-D consolidation settlement of soft-compressible soils below circular-, strip- and large-area loading conditions.

**QUAD-4M** 2-D FE program for the evaluation of soil-structure interaction problems in response to dynamic loading conditions.

**FLUSH** 3-D FE program for the evaluation of soil-structure interaction problems in response to dynamic loading conditions.

**GROUP** The programs include a general 2-D and 3-D, FD solution to determine the load-deflection and load-moment relationships for 3DPILE vertical and battered piles in a group subjected to axial, lateral and moment loading. The effects of soil-pile interaction are considered using p-y curves for single piles, as are the effects of ground water conditions, and axial and cyclic loading. The program computes the deflection, bending moment, shear, and soil resistance as a function of depth. Pinned, fixed-head or elastic restraint boundary conditions can be considered to account for the fixity provided by the pile cap.

**MAGSET** Settlement analysis program for evaluation of displacement of multi-layer soil systems due to elastic and consolidation components; relies on SPT or cone penetrometer data and laboratory test results for soil properties.

**SHAKE91** 1-D program for the development of seismic response of horizontally-layered soils to vertically propagating shear waves.

**STABL/G** 2-D limit equilibrium slope stability program using the modified Bishop method of slices or simplified Janbu for generation of circular, wedge and irregular failure surfaces, respectively. The program considers the effects of groundwater, elevated pore pressures, anisotropic soil strength properties, and boundary surcharge and pseudo-static earthquake loading conditions.

14. PROVIDED A LIST OF SOFTWARE AND EQUIPMENT AVAILABLE IN THE PRIMARY OFFICE WHICH WILL BE USED TO COMPLETE AMPLIFIED DESIGN SERVICES

STABL6	Revision to original STABL software including optional reinforcing layer within soil.
STIFF1	Structural analysis of various pile types providing pile stiffness as a function of axial load and moment.
REWARD	Advanced retaining wall design and analysis.
RESLOPE	Slope stability software incorporating mechanically stabilized earth option.
MGRSW	MIRAFI mechanically stabilized soil wall analysis software.
MRSS	MIRAFI slope stability software incorporating mechanically stabilized earth option.
UTEXAS2	DOS-based limit equilibrium slope stability software.
TENSWAL	TENSAR program for analysis of reinforced walls.
TENSLO1	TENSAR program for analysis of reinforced slope.
GRLWEAP86	Wave equation analysis of pile driving and capacity.
CBEAR	FHWA software for bearing capacity analysis of shallow foundations.
EMBANK	FHWA software for determination of one-dimensional compression settlement due to embankment loads.
SPILE	FHWA software for prediction of pile vertical, static capacity.
CPGA	US Army Corps of Engineers pile group analysis program.
PILENEG	DOS based, menu-driven analysis of downdrag effects on pile settlement and capacity.
SNAIL	DOS based analysis of soil nailed slopes.

## MINING AND SUBSIDENCE ENGINEERING

- ARMPS 16 Software for analysis of retreat mining pillar stability.
- CISPM Subsidence prediction software.
- SDPS Subsidence surface deformation prediction software.

## HYDROLOGY AND HYDRAULIC ENGINEERING

- AdICPR The Advanced Interconnected Channel and Pond Routing Model (AdICPR), is an interactive hydrology/hydraulics model for analyzing the storm-water management systems. A node/reach model, AdICPR automatically computes the hydrographs the various subbasins (nodes) of a drainage basin, then flood-routes them through storage in lakes or detention basins in the subbasins out through pipes or channels (reaches) by the modified Plus method. The model takes into consideration storage in the pipes or channels, tailwater conditions at pipe or channel outlets, reverse flow conditions if water surfaces at reach outlets are higher than reach inlets, and time-varying elevations (i.e., tidal action).
- DMBRK Program for computer simulation of the influence of a dam related to upstream and downstream flow. The model is used to predict flow profiles in the event of dam failure.
- HEC-1 Program for simulation of surface water runoff response in a river basin to precipitation to permit computation of streamflow hydrographs at desired locations within the river basin.
- HEC-2 Model for calculation of water surface profiles in channels for subcritical and supercritical flow conditions. The effects of bridges, weirs, culverts and other channel restrictions can be considered in the program.
- HEC-RAS Multi-purpose software for modeling hydraulic performance of channels, culverts and bridges.
- STORM Program for analysis of the quantity and quality of runoff from urban and nonurban environments. The model is used as an aid in sizing storage and treatment of runoff control facilities and considers rainfall and snowmelt, runoff, dry weather flow, pollutant accumulation and washoff erosion.
- STREMR Numerical model that generates discrete solutions of the incompressible Navier-Stokes equations for depth- or width-averaged, 2-D flow. The program computes the mutual interactions between sidewalls, obstacles and bathymetry to predict depth-averaged flow in channels of arbitrary shape. A k-e turbulence model is used to generate an eddy viscosity from the computed primary flow and 3-D secondary flow correction accounts for the interaction between lateral curvature and vertical nonuniformity, which causes high velocities to migrate toward the outside of channel bends.

**SWMM** Storm Water Management Modeling (SWMM) computer program developed by the EPA to simulate urban runoff quantity and quality in both storm and combined sewer systems. The program incorporates surface and subsurface runoff, transport through drainage system networks, storage and treatment estimate runoff quantity and quality.

**TR55** Project for evaluation of the hydrologic impacts of urbanization of small watersheds. This program was developed by the Soil Conservation Service and is used to estimate quantities of stormwater runoff from watershed areas. It is widely accepted method of comparing pre- and post-development runoff conditions. It will also provide an estimate of the storage capacity required to maintain pre-development discharge rates.

**FLOWMASTER1** Open channel flow analysis software.

### **GROUND WATER ENGINEERING**

**SEEP/W** Windows-based finite element program for the analysis of seepage modeling. Compatible with SEEP/W, CTRAN/W and SLOPE/W.

**CTRAN/W** Windows -based finite element program for the analysis of subsurface contaminant transport. Compatible with SEEP/W, CTRAN/W and SLOPE/W.

**HELP** The Hydrologic Evaluation of Landfill Performance (HELP) computer program is a quasi 2-D hydrologic model of water movement across, into, through and out of landfills. The model accepts climatologic, soil and design data and utilizes a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, evapotranspiration, soil moisture storage and lateral drainage. Landfill systems including various combinations of vegetation, cover soils, waste cells, special drainage layers and relatively impermeable barrier soils, as well as synthetic membrane covers and liners, may be modeled. The program was developed to facilitate rapid estimation of the amounts of runoff, drainage and leachate that may be expected to results from the operation of a wide variety of landfill designs. The model is applicable to open, partially closed and fully closed site.

### **IN-SITU TESTING/INSTRUMENTATION**

**PC SLIN** Data analysis program for evaluation and graphical presentation of inclinometer field measurements.

**KECKES** Program for evaluation of resistivity survey data using Wenner array to determine location of ground water contamination.

**PRESSURE-METER** Data analysis program for evaluation and graphical presentation of pressuremeter test results.

**RESIST** Program for analysis of geophysical resistivity survey data to permit evaluation of apparent resistivity as a function of electrode spacing for Schlumberger, Wenner and bipole arrays.

**SLUG** Program for analysis of slug tests in single wells to evaluate in-situ permeability.

**GENERAL APPLICATIONS**

**CONCRETE** Windows based analysis of bending, shear and torsion in concrete UTILITIES beam and column elements based on ACI code recommendations.

**SURFER** Multipurpose graphing and surface modeling software.

**EXCEL** Windows based spreadsheet software.

**COPLOT** Multipurpose graphing and surface modeling software.

**POWERPOINT** Presentation development software.

**PRIMAVERA** Project scheduling and management software.

**DRAFTING**

**AUTOCAD** PC-based, interactive computer-aided drafting (Release 14) software for preparation of engineering drawings with a variety of text fonts, symbols, and shading controls. Includes IGES translator for transfer of text and graphic files to other CAD systems.

**MICROSTATION** PC-based, interactive computer-aided drafting software for preparation of engineering drawings with a variety of text fonts, symbols, and shading controls.

**WORD PROCESSING**

**MS WORD, WORDPERFECT** The two most comprehensive and widely-used word processors available.

## EQUIPMENT

D'Appolonia maintains a wide array of field equipment suited for geotechnical and environmental application. Additional equipment may be rented on an as-needed basis. The following list identifies available D'Appolonia's equipment:

- Field Vane Shear Equipment
- Field Chemical Screening Devices
- M-Scopes
- PH/Specific Conductance Meter
- Photoionization (H-Nu) Meters
- CO<sub>2</sub>/O<sub>2</sub>/LEL Meters
- Dye Kits
- Nuclear Density Test Equipment
- Concrete Sampling & Testing Equipment
- Pneumatic Pressure Readout Device (Sinco)
- Peak Vibration Monitor (Sinco)
- Digitilt Indicator (Sinco)
- Tape Extensometer (Sinco)
- Digitilt Datamate System (Sinco)
- Surveying and GPS Equipment
- Downhole Nuclear Gauge
- Customary Geotechnical Field Devices
- Syscal Kid Multi-Electrode DC Resistivity
- RAMAC Ground Penetrating Radar
- Scintrex Cesium Magnetic Gradiometer
- Geonics EM61 Time-Domain Deep Metal Detector
- Vibrattech Three-Component Vibration Monitoring and General Purpose Seismic Equipment



15. CURR. ACTIVITIES ON WHICH YOUR FIRM IS THE DESIGNATED FINDER OF RECORD

PROJECT NAME, TYPE AND LOCATION	NAME AND ADDRESS OF OWNER	NATURE OF YOUR FIRM'S RESPONSIBILITY	ESTIMATED CONSTRUCTION COST	PERCENT COMPLETE
Cumberland Mine Refuse Area No. 2; Coal Refuse Disposal Facilities Greene County, PA	Cumberland Coal Resources Waynesburg, PA	Construction Engineering and Monitoring – <b>Coal Refuse</b> Embankment Grading, <b>Stability, Drainage Control, and Reclamation</b>	\$8,000,000	60
Pangburn Site Reclamation Waste Remediation at Former Surface Mine Allegheny County, PA	CONSOL Energy Pittsburgh, PA	Design, Permitting, Construction Monitoring, Post Remediation Monitoring – <b>Hazardous Waste Removal, Drainage, Highway Elimination, and Reclamation</b>	\$800,000	95
Emerald Mine Refuse Area Nos. 1 & 2 Monitoring; Coal Refuse Disposal Facilities Greene County, PA	Emerald Coal Resources Waynesburg, PA	Design, Permitting, Construction Monitoring – <b>Coal Refuse</b> Embankment Grading, <b>Stabilization, Drainage Control and Reclamation</b>	\$5,000,000	Ongoing
Mason Dixon Mine Coal Refuse Disposal Facility Monongalia County, WV	CONSOL Energy Monongah, WV	Exploration, Design and Permitting – <b>Coal Refuse</b> Embankment Grading, <b>Stability, Drainage Control, Reclamation</b>	\$15,000,000	10
Iselin Coal Refuse Disposal Facility Indiana County, PA	Homer City Processing Homer City, PA	Design, Permitting, and Construction Monitoring – <b>Coal Refuse/Combustion Ash Stabilization, Grading, Drainage Control, Reclamation</b>	\$5,000,000	Ongoing
Mine Spoil Embankment Stabilization, Clarksburg, WV	Lowes Clarksburg, WV	Construction Engineering and Monitoring – <b>Drainage Control, Slope Stabilization, Grouting, Instrumentation</b>	\$800,000	10
Viper Mine Coal Refuse Disposal Facility Logan County, IL	ICG Illinois Williamsville, IL	Design, Permitting, Construction Monitoring – <b>Coal Refuse</b> Embankment Grading, <b>Combustion Ash Stabilization, Drainage Control, Reclamation</b>	\$3,000,000	70
TOTAL NUMBER OF PROJECTS: 25			TOTAL ESTIMATED CONSTRUCTION COSTS: \$80,000,000	

16. CURR. ACTIVITIES ON WHICH YOUR FIRM IS SERVING AS A SU		CONSULTANT TO OTHERS			
PROJECT NAME, TYPE AND LOCATIONS	NATURE OF FIRMS RESPONSIBILITY	NAME AND ADDRESS OF OWNER	ESTIMATED COMPLETION DATE	ESTIMATED CONSTRUCTION COST	
				ENTIRE PROJECT	YOUR FIRMS RESPONSIBILITY
Mine Stabilization Grouting Program Edwardsport, IN	Exploration, Engineering, Subsidence Assessment, Grout Design, and Construction Monitoring	Duke Energy Plainfield, IN	2011	\$23,000,000	\$1,500,000
Bear Run Surface Mine Spoil Stabilization, Kendall Mine, Dugger, IN	Foundation Engineering	Peabody Energy St. Louis, MO	2011	\$50,000,000	\$4,000,000
Island Creek Bridge Replacement, Logan County, WV	Geotechnical Engineering and Foundation Design for Concrete Bridge Replacement	Corps of Engineers Huntington District Huntington, WV	2011	\$500,000	\$50,000
Bluwell Dam Spillway Rehabilitation, Mercer County, WV	Hydrology and Hydraulic Engineering for Storm Runoff and Routing	Mercer County, WV	2011	TBD	TBD
Ohio River Navigational Locks & Dams Improvements Emsworth, PA	Foundation Engineering	Corps of Engineers Pittsburgh District Pittsburgh, PA	2012	\$80,000,000	\$2,000,000
Gas Well Pad Site Development, Westmoreland County, PA	Site Engineering including Mine Void Detection and Grouting, Mine Spoil Stabilization, Impoundment Siting	Williams E&P Canonsburg, PA	2012	\$1,500,000	\$100,000
Kingston Ash Impoundment Remediation, Kingston, TN	Independent Review of Ash Pond Failure Study, Geotechnical Engineering, Remediation Plan Recommendations	TVA Kingston, TN	2011	TBD	NA

17. COMP. ED WORK WITHIN LAST 5 YEARS ON WHICH YOUR FIRM W. THE DESIGNATED ENGINEER OF RECORD

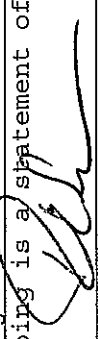
PROJECT NAME, TYPE AND LOCATION	NAME AND ADDRESS OF OWNER	ESTIMATED CONSTRUCTION COST	YEAR	CONSTRUCTED (YES OR NO)
Blackdog Hollow Reclamation Mine Structures and Refuse Facility (refuse grading, drainage control, impoundment stabilization, bin/conveyor demolition, waste removal, reclamation) Washington County, PA	Utica Insurance Co. c/o Stites & Harbison Lexington, KY	\$900,000	2005	Yes
Coal Refuse Facility Expansion and Shaft Seal Design (concrete bulkhead and cap design for mine entry) Elkhart, IL	Turris Coal Co./ICG Illinois Elkhart, IL	\$1,000,000+	2005	Yes
Coal Refuse Facility No. 1 Impoundment Design Greene County, PA	RAG Emerald Resources Waynesburg, PA	\$2,000,000	2006	Yes
Coal Refuse Slurry Injection System Abandoned Underground Mine Clymer, PA	Alpha Natural Resources Latrobe, PA	\$500,000	2009	Yes
New Kiln and Plant Foundation Design and Void Stabilization Program Martinsburg, WV	Capitol Cement/Essroc Martinsburg, WV	\$50,000,000	2009	Yes
Lamira Site Reclamation Surface Mine Refuse Area and Coal Preparation Plant Reclamation Belmont County, OH	R&F Coal Co./Capstone Holding Co. Cadiz, OH	\$1,500,000	2005	Partially complete
Mine Void Detection Demonstration at Impoundment, Pine Ridge Prenter Mine Prenter, WV	Pine Ridge Coal Company Prenter, WV	NA	2005	Yes
Mine Subsidence Evaluation and Grouting Program Washington County, PA	Burgettstown Area School District Burgettstown, PA	\$600,000	2008	Yes

18. COMPLETED WORK WITHIN LAST 5 YEARS ON WHICH YOUR FIRM HAS BEEN A SUB-CONSULTANT TO OTHER FIRMS (INDICATE PHASE OF WORK FOR WHICH YOUR FIRM WAS RESPONSIBLE)

PROJECT NAME, TYPE AND LOCATION	NAME AND ADDRESS OF OWNER	ESTIMATED CONSTRUCTION COST OF YOUR FIRM'S PORTION	YEAR	CONSTRUCTED (YES OR NO)	FIRM ASSOCIATED WITH
Millcreek Site Remediation Waste Dump Cleanup Millcreek, PA Design, Permitting and Construction Management	Millcreek PRP Group Erie, PA	\$3,000,000	2005	Yes	demaximis, inc. Knoxville, TN
Krayn Wind Project Foundation Exploration and Design on Surface Mine Spoil and Abandoned Underground Mines Cambria County, PA	EverPower Renewables LLC New York, NY	\$2,000,000	2007	Yes	GZA Geoenvironmental Buffalo, NY
Bluestone Dam Rehabilitation Anchor Design for Penstocks Load Transfer, Hinton, WV	Corps of Engineers Huntington District, Huntington, WV	\$6,000,000	2008	Yes	Brayman Construction Saxonburg, PA
Jonathan Lark Reservoir Dam Blasting Impact Evaluation and Monitoring Putnam County, WV	South Putnam Public Service District Scott Depot, WV	\$1,200,000	2006	Yes	H.K. Bell Engineering Lexington, KY
Drainage and Water Treatment System, Coal Refuse Area Charleroi, PA Environmental Assessment, Design, Permitting	Corps of Engineers Pittsburgh District Pittsburgh, PA	\$1,500,000	2008	Yes	Bergmann Associates Rochester, NY
Mine Grouting Program Abandoned Underground Mine Edwardsport, IN	Duke Energy Plainfield, IN	\$23,000,000	2009	Yes	Bechtel Engineering Baltimore, MD

19. Use this space to provide any additional information or description of resources supporting your firm's qualifications to perform work for the West Virginia Abandoned Mine Lands Program. D'Appolonia maintains a complete array of geophysical and field sampling equipment to explore and evaluate AML sites. Additionally, our in-house computer system is networked with six CAD stations for preparation of design drawings and permit submittals. We can assemble 4 AML Project Teams consisting of Project Engineers and CAD Specialists, and have a support staff of engineers, geologists, and scientists with significant mining experience to address reclamation, stability, drainage control, water supply and mine sealing.

20. The foregoing is a statement of facts.

Signature:  Title: Principal Date: December 3, 2010

Printed Name: Robert E. Snow

## **SECTION A RELATED PROJECT EXPERIENCE**

### **PADEP Blackwood Shaft Sealing Schuylkill County, PA**

D'Appolonia prepared a plan to backfill and abandon an open shaft entry into abandoned mine workings on a 7,000 acre mine site containing mine portals, abandoned equipment and structures, ponds, spoil and refuse piles. The site and design consisted of the following features:

- 180-foot deep, 14-foot diameter shaft entry into abandoned, multilevel mine workings, interconnected with an outcrop entry with approximately 100 gallon per minute mine discharge
- Deteriorating, cracked concrete cover (partially securing entry) and walls of shaft limited access and precluded structural bearing
- Mine discharge rate varies and must be maintained
- Reclamation design objectives:
  1. Backfill shaft without interrupting mine drainage from outcrop entry
  2. Avoid loading deteriorated concrete until shaft was backfilled
  3. Reclaim shaft area
  4. Restore security around abandoned shaft.
- Design features:
  1. Aggregate backfill design to provide for drainage, support of shaft walls, and economics
  2. Develop access and implementation plan to avoid loading concrete structure
  3. Prepare reclamation plan

### **Utica Insurance Clyde Mine Greene County, PA**

D'Appolonia prepared reclamation plans for an abandoned 72 acre mine refuse and spoil site, including stabilizing of a slurry impoundment and restoration of a sediment pond within available bonding amounts. The site and design consisted of the following features:

- Poor drainage control and significant erosion resulted in deep gullies in spoil and refuse piles, and clogging of the primary spillway (42-inch concrete pipe and riser) of the main sediment pond
- Unreclaimed 17 acre slurry impoundment with significant water pool
- No topsoil or subsoils available for reclamation
- Abandoned mine equipment and structures, and accumulation of trash
- Unrestricted access from township road without security
- Reclamation objectives and design:
  1. Control drainage and repair sediment pond primary spillway and modify dam to reduce height and pool surface area
  2. Regrade refuse and spoil piles to acceptable slopes
  3. Stabilize slurry impoundment by draining water and covering by grading embankment berms over fine refuse

- 4. Apply biosolids as topsoil substitute as part of reclamation plan
- Reclamation project received the ACEC Diamond Award Certificate

**CONSOL Pangburn Site  
Allegheny County, PA**

D'Appolonia performed exploration and sampling, prepared remediation and reclamation designs, and provided construction monitoring for a 12 acre unreclaimed strip mine site impacted by industrial disposal. The site and design consisted of the following features:

- Several hundred feet of unreclaimed highwalls, ranging from a few feet to 35 feet, eroded spoil piles, mine pools on the surface mine bench, and abandoned equipment.
- Seepage from spoil and highwall segments with impacts from industrial waste
- Reclamation and remediation design objects:
  1. Address seepage quality through removal of industrial waste
  2. Removal of abandoned equipment
  3. Control drainage, erosion and sedimentation
  4. Reclaim affected strip mine area
  5. Improve security
- Design features:
  1. Removal of industrial waste from 2 acre area, exposing partially buried highwall
  2. Collection and control of drainage on site
  3. Backfill and reclamation of strip mine and elimination of highwalls
  4. Development of wetlands replacement area
  5. Installation of gates and security features

**Wyomac Mining  
Welch, WV**

D'Appolonia prepared a mine water control plan to collect and convey AMD from a shaft entry for abandoned, flooded underground workings to alleviate discharges to an adjacent stream. The site and design consisted of the following features:

- Pumping of mine water from the shaft to lower the mine pool level at rates of 2,500 gallons per minute
- Installation of low level pipes within the shaft to allow gravity drainage to nearby treatment ponds
- Upon lowering of pool levels, seepage emanating into the adjacent stream was mitigated

**Alpha Emerald Mine  
Washington County, PA**

D'Appolonia prepared coal refuse disposal facility plans, including reclamation plans, for a 140 acre site and provided construction monitoring during site development, operation, and reclamation of completed slopes and areas. The site and design consisted of two main impoundments and embankments, with associated drainage control features. The reclamation plan included the following:

- Placement of soil and topsoil over approximately 20 acres of slopes and completed areas
- Establishing drainage channels, including use of riprap and fabric-formed linings for erosion protection
- Protection of stream banks using riprap materials
- Protection of underdrain discharge outlets and sediment control ponds

### **Laurel Run Mining Grant County, WV**

D'Appolonia prepared design plans for an AMD treatment system consisting of lime neutralization, aeration and settling for a 4 million gallon per day facility. As part of the plans, measures to collect and control the volume of AMD were developed, as well as disposal of sludge.

### **Waste Management Greenridge Reclamation Landfill Westmoreland County, PA**

D'Appolonia performed engineering services to address the stability of an 80-foot high highwall, prepared designs to address mine entries exposed at the base of the highwall, evaluated potential mine subsidence of adjacent underground workings, and prepared a mine backfilling program. The site and design consisted of the following features:

- As part of a municipal landfill operating plan, approximately 2,500 feet of highwall with exposed underground mine entries were to be developed, with expansion of waste disposal adjacent and over the highwall area.
- Cracking of the highwall and adjacent ground surface raised stability and subsidence concerns and limited operations immediately adjacent the highwall.
- Rubble backfill of exposed entries and support of the highwall was prepared and incorporated into the disposal facility liner system.
- Highwall grading procedure was developed to address stability for the site development.
- Mine grouting program of underground entries was developed to address potential subsidence impacts with future expansion of the landfill.

### **Appalachian Mining Pigeonroost Fork, WV**

D'Appolonia prepared coal refuse disposal facility plans, integrated with surface mining and reclamation plans, for a 200 acre site, addressing auger and highwall miner entries in the coal seam. The coal refuse disposal facility plan included two impoundments and embankments. The surface mining and reclamation features of the plan included the following:

- Backfilling of approximately 6,000 feet of highwall, and the installation of a rock rubble and spoil seal at the coal seam to cover auger and highwall mine workings and collect drainage to downstream discharge locations
- Reclamation plans for the surface mine bench developed as part of site development, and the completed coal refuse disposal slopes during operation and abandonment

**Harrison Mining  
Hopedale, OH**

D'Appolonia prepared the site development plans for a coal preparation and refuse disposal facility, including water supply and reclamation plans, for a 100 acre site, addressing stream bank protection. The coal preparation plant and refuse facility included an emergency settling pond and combined refuse embankment, as well as water supply tank and stream intake, sewage treatment plant, office and warehouse complex and rail siding. The reclamation and water supply features of the plan included the following:

- Stream bank protection to control erosion and address flood levels comprised of riprap and gabion materials with concrete weir and well structure for the water intake.
- Reclamation plans for the coal preparation plant and rail siding areas, and completed surfaces of the refuse disposal area, including removal of structures and equipment, soil and topsoil placement, and vegetation.

**Capstone Holdings Lamira Plant  
Belmont County, OH**

D'Appolonia prepared coal refuse disposal facility plans, including reclamation plans for site surface mining, for an 80-acre site and provided construction monitoring during site development, operation, and reclamation. The coal refuse disposal facility plan included an impoundment and embankment integrated with surface mine reclamation. The reclamation features of the plan included the following:

- Backfilling of approximately 3,000 feet of highwall, up to 90 feet in height
- Design of a mine spoil and clay seal for the coal seam to control subsurface drainage
- AMD treatment of discharges ranging from approximately 5 to 50 gallons per minute, using a variety of passive systems such as limestone drains, and ammonia treatment systems.
- Design of a cap system of clay soil and screened mine spoil to minimize infiltration and mitigate AMD treatment requirements
- Preparation of a soil and topsoil placement plan and revegetation program for the reclaimed mine and refuse disposal areas
- Design of surface runoff channels and diversions
- Demolition of mine structures including bins, scale, and preparation plant structures, and reclamation of associated areas

**Doverspike Brothers Weisner Hollow  
Jefferson County, PA**

D'Appolonia prepared coal refuse disposal facility plans, including reclamation of mine outcrop mine entries, for a 140 acre site and provided construction monitoring during site development and operation. The coal refuse disposal facility plan included an impoundment and embankment, and addressed the sealing of mine entries as well as reclamation of completed refuse pile surfaces. The reclamation features of the plan included the following:



- Sealing of three entries into abandoned mine working by rubble rock fill, followed by graded filters and refuse materials. The location and extent of mine entries and workings were delineated with available maps, geophysical survey, and exploration pits.
- Surface mine spoil was removed from the refuse embankment foundation and the exposed highwall graded and sealed as part of site development activities.
- Completed surfaces were reclaimed using soil and topsoil and revegetated.

### **Helen Coal Refuse Embankment**

#### **Helen, Raleigh County, WV**

D'Appolonia developed reclamation plans for a non-impounding 625-foot high, 1250-foot long coal refuse embankment, which had portions of burning coal refuse and where slope movements threatened a state road at the toe and sediment was impacting a stream below.

- Reclamation design objectives:
  1. Increase long-term stability
  2. Control surface drainage and limit erosion
  3. Provide revegetation plan
  4. Evaluate existing toe wall
- Design features:
  1. 820 feet of road relocation
  2. 1400 feet of stream relocation
  3. Utility relocations
  4. Overexcavation of 110,000 cubic yards of potentially burning refuse
  5. Regrading of 425,000 cubic yards of embankment
  6. Surface drainage system
  7. Sediment control structures
  8. Rock toe buttress
  9. Revegetation

### **Sarah Ann Landslide and Mine Drainage Evaluation**

#### **Sarah Ann, Logan County, WV**

D'Appolonia performed site reconnaissance for a 1500-foot long hillside below abandoned mine openings and threatening houses at the toe. Mine drainage was saturating the hillside leading to slumping of the hillside.

- Remedial plan
  1. Develop surface drainage facilities to divert storm runoff and mine drainage away from the hillside area
  2. Regrade the hillside to improve stability
- Design features
  1. Interception and collection of mine drainage
  2. Drainage diversion channel to rock
  3. Steep conveyance chutes with stilling basins
  4. Removal of potential slide material
  5. Slope regrading and revegetation

**MSHA Engineering and Design Manual for Coal Refuse Disposal Facilities  
2009 Update**

**Mine Safety and Health Administration**

D'Appolonia was project coordinator and lead preparer for a 2009 update of the MSHA manual for coal refuse facilities. This manual includes not only sections on the design of coal refuse disposal facilities, but also sections on:

- Mine entry barriers and bulkheads, including design for blowout potential from abandoned deep mines
- AMD mitigation, including alkaline addition to mitigate acid generation, and passive treatment systems to address impacted drainage and seepage
- Reclamation, including grading, stabilization of soft sediments, soil and topsoil placement, and vegetation

# PROJECT PROFILE

## ENVIRONMENTAL ASSESSMENT OF THE BLACKWOOD MINE SITE

The Pennsylvania Department of the Military Affairs (PADMA) was considering acquisition of all or part of a 7,000-acre site in Schuylkill County, Pennsylvania. D'Appolonia was retained to perform an environmental site assessment according to specifications and directions of PADMA, which generally follow the American Society for Testing and Materials (ASTM), Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (E 1527-93).

The scope of services provided to PADMA by D'Appolonia encompassed five phases performed sequentially in the following order:

- Records Review,
- Interviews,
- Site Reconnaissance,
- Report Preparation, and
- Phase II Recommendations.

Site reconnaissance activities were conducted both on the ground and from a helicopter because of the size of the site and the difficult access conditions associated with large portions of the site.

A substantial portion of the environmental assessment focused on problems associated with past and current mining activities at the site. The topography

had been significantly altered as a result of site activities, with numerous strip mine highwalls, open and water-filled pits, culm piles, discarded or abandoned equipment and buildings, and deep mine openings.

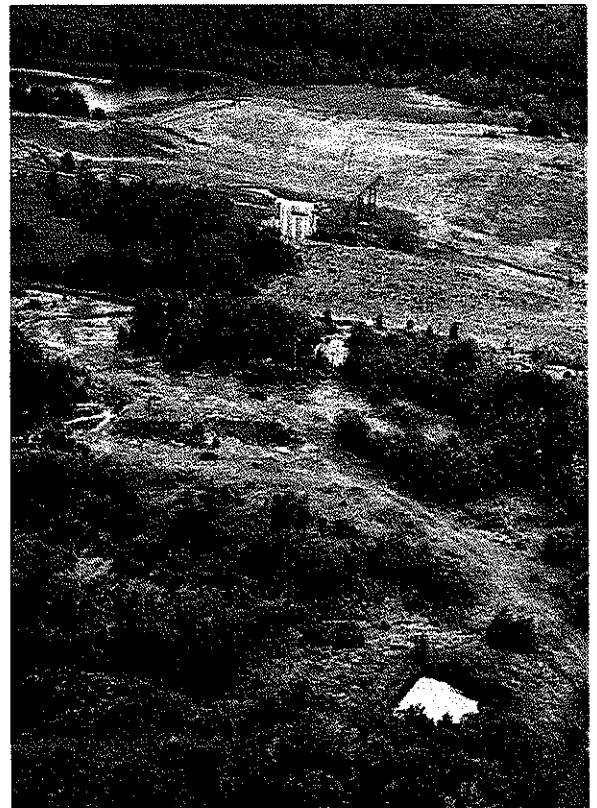
Mine maps associated with permit applications indicated the locations of openings associated with previous mining. Fifteen open shafts were identified on the National Abandoned Lands Inventory System (NALIS) maps, but this list was not believed to be complete.

Acid mine drainage (AMD) was another important environmental issue associated with the Blackwood site. The NALIS database showed 37 AMD locations at the site, but more may have been present. Surface water quality was highly variable.

Although past mining activities were found to be the most significant environmental issue, small areas of soil contaminated with petroleum products

were observed, and other areas were identified for subsequent sampling to evaluate whether there were hazardous substances at the site. Visual evidence of hazardous substance disposal on a scale that would cause this site to be included on the NPL was not observed.

Subsequently, in 2003, D'Appolonia was retained by the Bureau of Abandoned Mine Reclamation (BAMR) of the Pennsylvania Department of Environmental Protection (PADEP) to prepare a reclamation design for the Blackwood property. The scope of work for this project included permanent sealing of the deep ventilation shaft. The reclamation plan has been under regulatory review, and we anticipate that construction work associated with reclamation of the Blackwood property will commence in 2006.



*Aerial view of the Blackwood Mine Site at the time of the study. The building is an abandoned coal breaker. The square concrete pad in the foreground covers a deep ventilation shaft to the mine, but the sides of the pad partially collapsed, requiring further remediation.*



*Organic sludge spilled on the ground surface near the breaker building at the abandoned Blackwood Mine site.*

# PROJECT PROFILE

## RECLAMATION OF COAL REFUSE SITE USING BIO-SOLIDS APPLICATION

After more than 30 years of operation, the Clyde Mine in Greene County in Southwestern Pennsylvania terminated operations and left an estimated 72 acres of unreclaimed waste embankments and ponds in the adjacent Black Dog Hollow. D'Appolonia was retained to prepare a reclamation plan for the site, covering grading, drainage control, top soil restoration, and revegetation. A lack of sufficient soils stockpiled or readily available made traditional reclamation methods impractical without incurring excessive costs and causing substantial disturbance to the previously unaffected valley slopes.



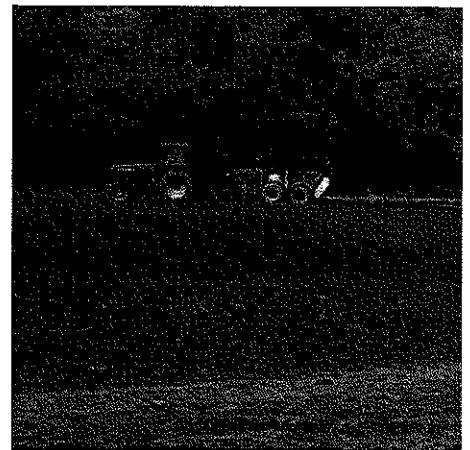
*Black Dog Hollow site slope following regrading and removal of erosion features.*

Prior to reclamation, the site exhibited ungraded slopes steeper than 2:1 (horizontal to vertical) with heights of up to 20 feet; extensive refuse piles at an approximately 2:1 slope; substantial presence of erosion scars, many exceeding 10 feet in depth; a 17-acre fine coal refuse slurry pond with impounded water; an unpermitted 8-acre pond in excess of 20 feet deep without a functional outlet structure; a small sediment pond with no low-level outlet structure; and numerous piles of domestic trash.

D'Appolonia's reclamation plan incorporated innovative measures utilizing bio-solids applied to regraded coal re-

fuse to achieve revegetation. Overall, the reclamation plan included off-site disposal of trash, regrading of erosion features and steep slopes, installation of drainage control structures at the base of slopes and collection points, converting existing site sediment ponds to permanent ponds, eliminating the existing slurry impoundment, and vegetating the final surfaces.

Most existing slopes at the site were regraded to 3:1 to facilitate bio-solids application and to sustain the growth media and vegetation through seasonal conditions. The unpermitted 8-acre pond was drained to a depth of about 5



*Application of biosolids to regraded site.*

feet and less than 2 acres in surface area, and the existing culvert was rehabilitated and fitted with an intake riser to provide an outlet structure. The reclaimed pond was incorporated into the reclamation plan to provide sediment control for most of the site. The slurry pond was dewatered and the fine coal refuse was stabilized by sequential covering with embankment materials. Slurry impoundment embankment soils were used for reclamation.

The reclamation plan was successfully implemented within the coverage provided by surety bonds. D'Appolonia received a Diamond Award Certificate for Engineering Excellence from the Consulting Engineers Council of Pennsylvania for its work on the project.



*Refuse area and central silt basin following reclamation.*

# PROJECT PROFILE

## ASSESSMENT AND CLOSURE OF UNCONTROLLED DUMP SITE

D'Appolonia provided environmental services for a waste disposal site encompassing about two acres of land in Allegheny County, Pennsylvania. This site had been used for the disposal of a mixture of industrial and municipal solid waste by the owners of a nearby landfill in the 1960s.



*Typical wastes found at the site.*

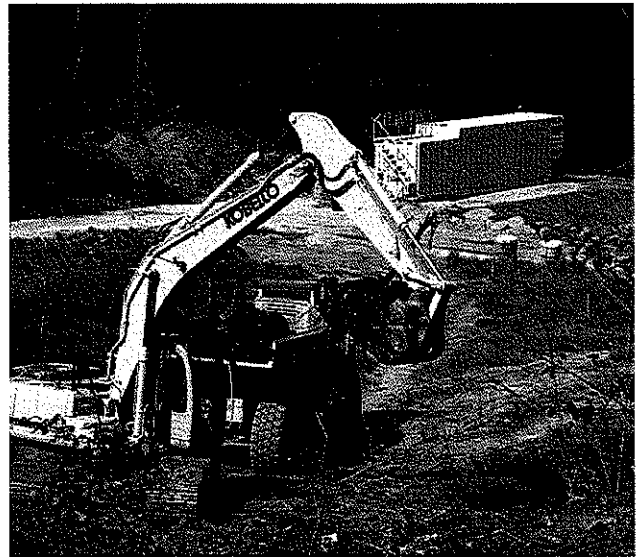
In 1983, the waste disposal site was identified by the USEPA as an abandoned uncontrolled dump containing municipal solid waste and possibly industrial waste. Chemical testing of the

main seep had historically detected the presence of several organic compounds. In 1984, diversion ditches were constructed for the purpose of diverting surface water away from the site and to reduce seepage. At the time the diversion ditches were constructed in 1984, the site area was also graded and vegetated in order to minimize ponding of surface water. In 1996, the Pennsylvania Department of Environmental Protection (PADEP) requested that additional studies for assessing the nature and extent of contamination of the site be performed.

D'Appolonia was retained to conduct these assessment studies consisting of drilling and sampling, geophysical exploration, test pits, and a historical review of past activities. The presence of subsurface contamination in excess of allowable Pennsylvania standards was confirmed by this study.



*Drilling and sampling performed as part of the D'Appolonia field exploration program.*



*Removal of site waste for disposal at a nearby landfill.*

The extent and nature of the subsurface contamination was further evaluated in 1999 with a drilling and sampling program. As a result of these studies, it was determined that the waste and contaminated soils at the site were not hazardous and were suitable for disposal as residual waste. The total volume of waste and contaminated soil was estimated to be approximately 13,000 cubic yards.

After PADEP approval of a Sampling and Analysis Plan, D'Appolonia conducted a comprehensive program of 18 borings with associated chemical sampling and analyses. This effort provided additional validation of the 1999 results and effectively confirmed the suitability of a remedial solution involving the disposal of the contaminated soil and waste as residual waste at a nearby landfill.

D'Appolonia designed the removal operations, managed the bidding process, and monitored the removal of the waste to a nearby landfill under PADEP Act 2 protocols and managed subsequent land reinstatement activities in 2005. A total of 10,800 cubic yards of residual waste (municipal/industrial waste and contaminated soil and mine spoil) were disposed of at the landfill.

**D'APPOLONIA**

# PROJECT PROFILE

## MINE WATER CONTROL, CONVEYANCE AND TREATMENT

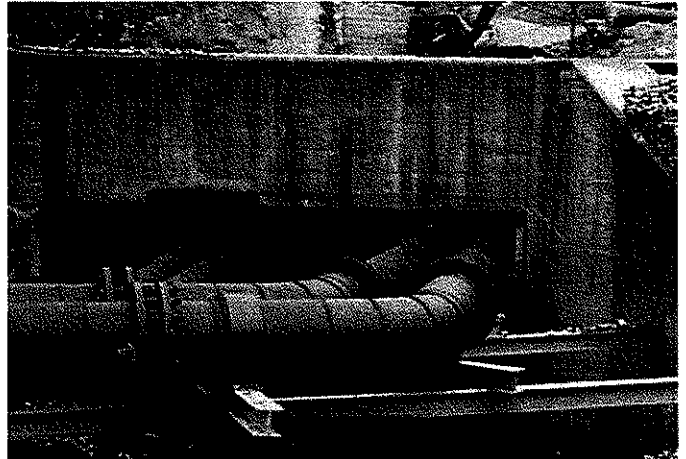
Six separately owned coal mines operating in the same seam were abandoned within a one-year period. The seam dipped uniformly in one direction, and due to hydrologic connections between mines, mine water drainage accumulated in down-dip workings. After the last mine was abandoned and dewatering operations ceased, water began to flow from the mine shaft lowest in elevation in the whole mine complex. The high water level in this shaft caused outflow into the surrounding area, resulting in more than 40 seepage points observed in a six-acre area. The large number of seeps present over a wide area made collection very difficult.

A difference of only 23 feet in elevation between the top of the discharging shaft and a river 250 feet away presented a serious design constraint. The area between the shaft and the river was occupied by several railroad tracks, further constraining the area available for construction of drainage collection, conveyance and treatment facilities. Because of these constraints, other parties had developed designs for remediation using permanent mine water pumps and sophisticated water treatment facilities

that would have cost over \$3 million to build and \$400,000 per year to operate.

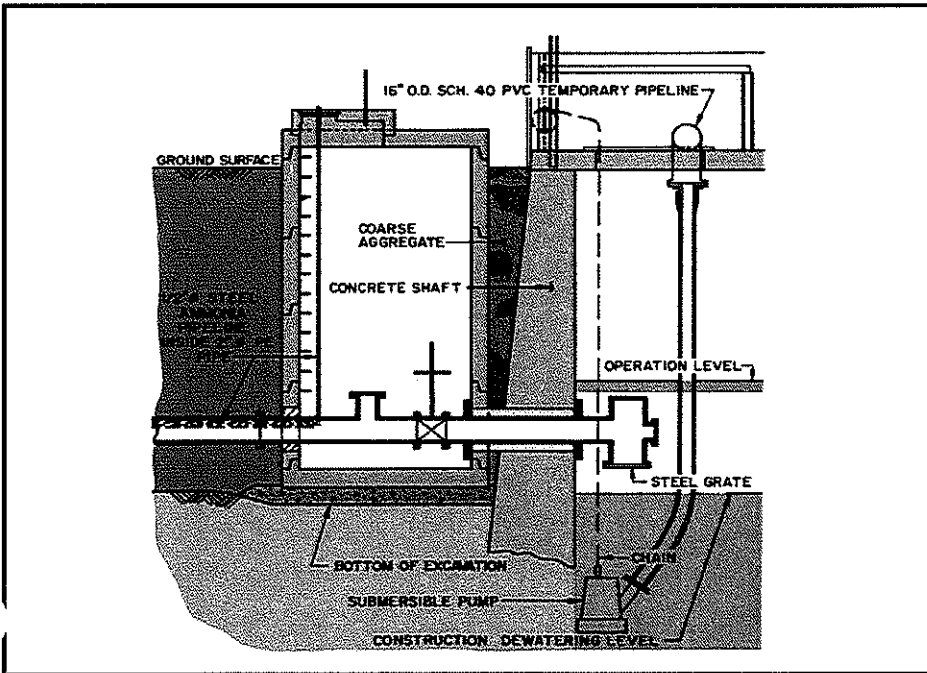
D'Appolonia conducted studies to determine the total drainage flow volume from the shaft area and developed several design concepts. The owner and D'Appolonia jointly evaluated the potential impacts of these various concepts on operations and a concept was then selected for implementation.

D'Appolonia developed a final detailed design for a recommended scheme that eliminated the need for a pumping system and new treatment facility. The design incorporated gravity flow pipes installed 16 feet below the ground surface and extending through the side of the mine shaft that was responsible for the seepage. The gravity flow pipes were designed to convey the mine shaft outflow to the existing treatment ponds.

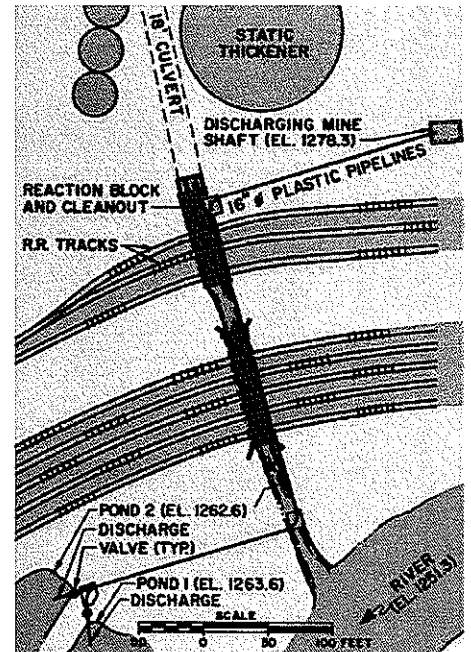


16-inch-diameter drainage pipes designed to convey water from mine shaft to existing treatment ponds.

The D'Appolonia design was implemented, and upon activation of the system, the water level dropped by 12 feet, causing the observed ground seepage to cease entirely and allowing treatment to be conducted at a single location in the nearby treatment ponds. Resulting treatment pond sludges were pumped to a permitted deep well injection facility that was also designed by D'Appolonia. Construction costs of \$2.4 million and more than \$200,000 in annual operating costs were saved through implementation of the D'Appolonia design.



Schematic cross section showing details of valve access and 16-inch-diameter pipe penetrating the mine shaft.



Plan of mine water conveyance system.

# PROJECT PROFILE

## UPSTREAM EXPANSION OF COAL REFUSE DISPOSAL FACILITY

D'Appolonia provided engineering and permitting services for the upstream expansion of the slurry impounding coal refuse disposal facility at Emerald Mine No. 1 in Greene County, PA. The scope of work included field exploration and in situ testing (SPT, SCPT, FVS, borehole permeability), laboratory testing (including conventional and cyclic shear strength testing), engineering analyses, facility design, preparation of plans and specifications, state and federal permitting, preparation of construction cost estimates and reports, and regulatory liaison. The final disposal facility configuration included two dams totaling more than 2000 feet in length, with the main dam exceeding 370 feet in height. Some of the important aspects of this project included seepage control, assessments of seismic hazard and tailings liquefaction susceptibility, seismic slope stability and deformation analyses, evaluations of time-dependent settlement effects on internal drains, potential mine subsidence impacts, and stability analyses for deeply buried HDPE decant piping.

Initially, an evaluation of existing seepage conditions was performed in order to determine a representative range of hydraulic conductivities (both horizontal and vertical) for the refuse, soil, and rock materials and to calibrate the seepage model to existing conditions, as



*Construction of internal drain in upstream embankment at Emerald Mine.*

determined from known piezometric levels, existing internal drain flows, borehole moisture profiles, and other available data.

Additional seepage analyses were conducted for the final facility configuration in order to obtain data for the design of additional internal drains and for static and seismic slope stability analyses. The hydraulic conductivity anisotropy ratio was a significant factor because of interlayering of sandy and clayey fine coal refuse, and the effects of equipment traffic and weathering on the embankment materials. Seepage

was rated based on a comparison to observed conditions. Then the representative ranges in hydraulic conductivity and anisotropy ratio determined from the calibration analyses were applied to modeling of alternative internal drainage systems. Based upon all of these analyses, an integrated internal drainage system, consisting of a horizontal drain and intermittent sand column drains drilled into the horizontal drain, was designed and implemented.

Both probabilistic and deterministic seismic analyses were performed in order to select the Maximum Credible Earthquake (MCE) and Operating Basis Earthquake (OBE) horizontal accelerations for seismic stability and embankment deformation analyses. A horizontal ground acceleration of 0.10g was selected for use in the seismic slope stability analyses. The effect of amplification of the horizontal ground acceleration through the foundation and dam embankments was incorporated into the stability analyses. Slope stability factors of safety for the OBE were within acceptable limits. For the MCE, deformation analyses were performed. These analyses indicated that cumulative seismic deformations associated with the MCE would be tolerable.



*Grading and geotextile placement for internal drain construction.*

simulations were performed using the finite element software SEEP/W. Various combinations of horizontal conductivity and anisotropy ratio were assumed for the embankment materials, and a steady-state phreatic surface was computed. Each computed phreatic surface

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## ACID MINE DRAINAGE TREATMENT

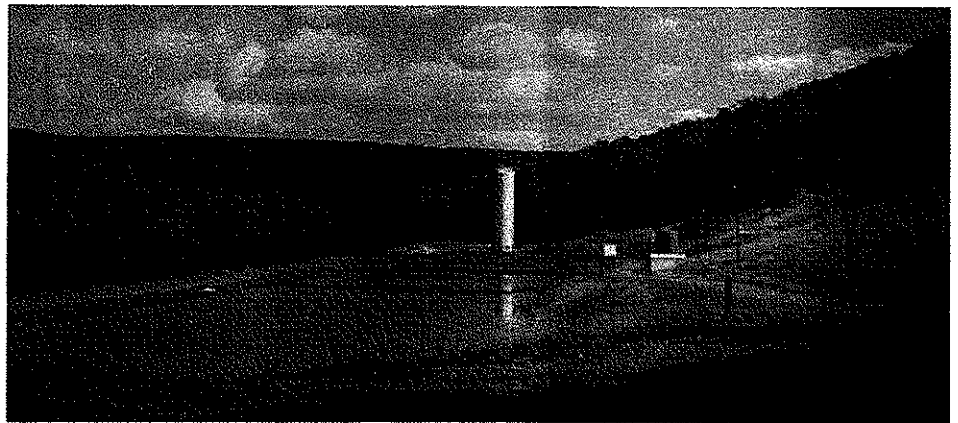
D'Appolonia designed a 4-million-gallon per day (MGD) treatment facility consisting of lime neutralization, aeration and sludge settling systems for acid mine drainage (AMD) from an underground mine and coal refuse disposal site in northern West Virginia. Prior to the time D'Appolonia was retained to design a treatment facility, the owners treated water at isolated discharge locations resulting in extremely high costs for chemicals and operations personnel. Implementation of D'Appolonia's design, which includes mine water collection and conveyance systems (see schematic diagram of plant below), reduced chemical costs by 90 percent.

D'Appolonia was subsequently retained to evaluate current and future AMD generation sources and prepare recommendations for increasing the plant capacity to 6 MGD as part of a mine expansion plan. Based on a comprehensive water quality and flow monitoring program and water budget analysis, design flows from the proposed longwall mine development were established. Design modifications were prepared for the lime storage, slaker and mix systems and to increase the capacity of the discharge channels. An additional settling pond was included in the modification to improve clarification.

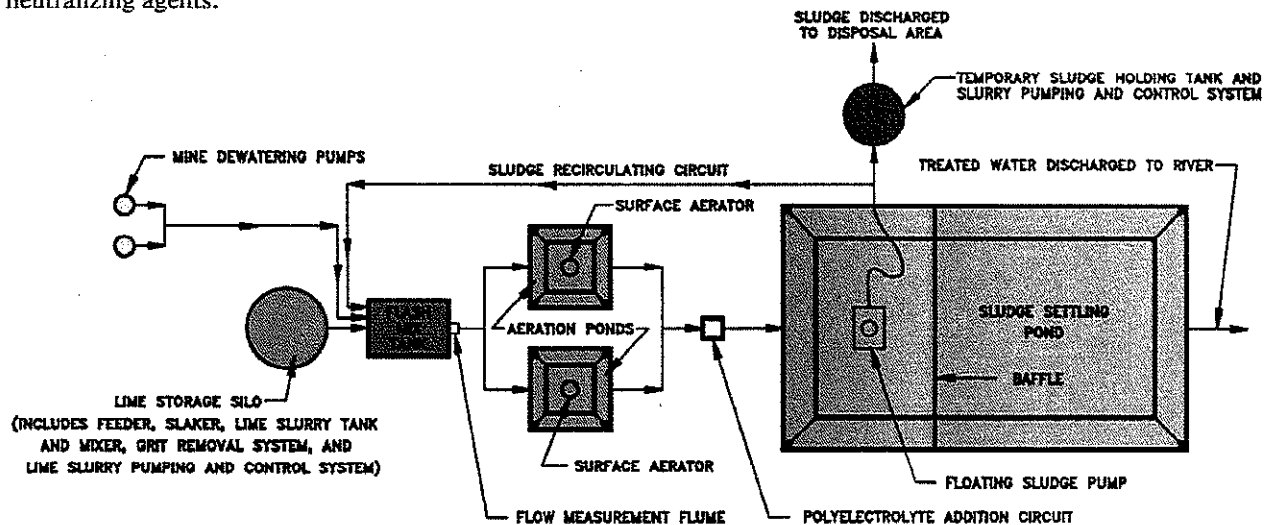
In addition to mine water treatment, D'Appolonia has performed studies in the Appalachian Region and other coal fields to control AMD generation and flow from mines and waste disposal sites using concepts involving isolation, sealing and neutralizing agents.



*Lime storage bin, lime slaker and control unit, flash mix tank, and aeration system for treatment of AMD.*



*AMD Treatment facility: Settling pond with floating baffle and capstan mounted sludge removal system in foreground and lime storage silo in background.*



*Schematic diagram of the 4-million-gallon per day acid mine drainage plant.*



# PROJECT PROFILE

## DESIGN OF 75-ACRE COAL REFUSE SLURRY IMPOUNDMENT

D'Appolonia prepared the design and permitting submittals for the construction and operation of a 75-acre coal refuse slurry impoundment for a two-million-ton-per-year coal preparation plant in Southeastern Ohio. We subsequently prepared reclamation plans for dewatering, regrading, capping and covering the disposal facility after mining operations ceased.

D'Appolonia's scope of work included exploration, testing, and analysis of site soils and mine spoil that would be used for construction of the dikes, as well as fine sediments that would constitute the coal refuse slurry. The coal refuse slurry impoundment comprised more than 4,000 feet of earthen dikes with an approximate height of 25 feet. The design included clay diaphragms for seep-

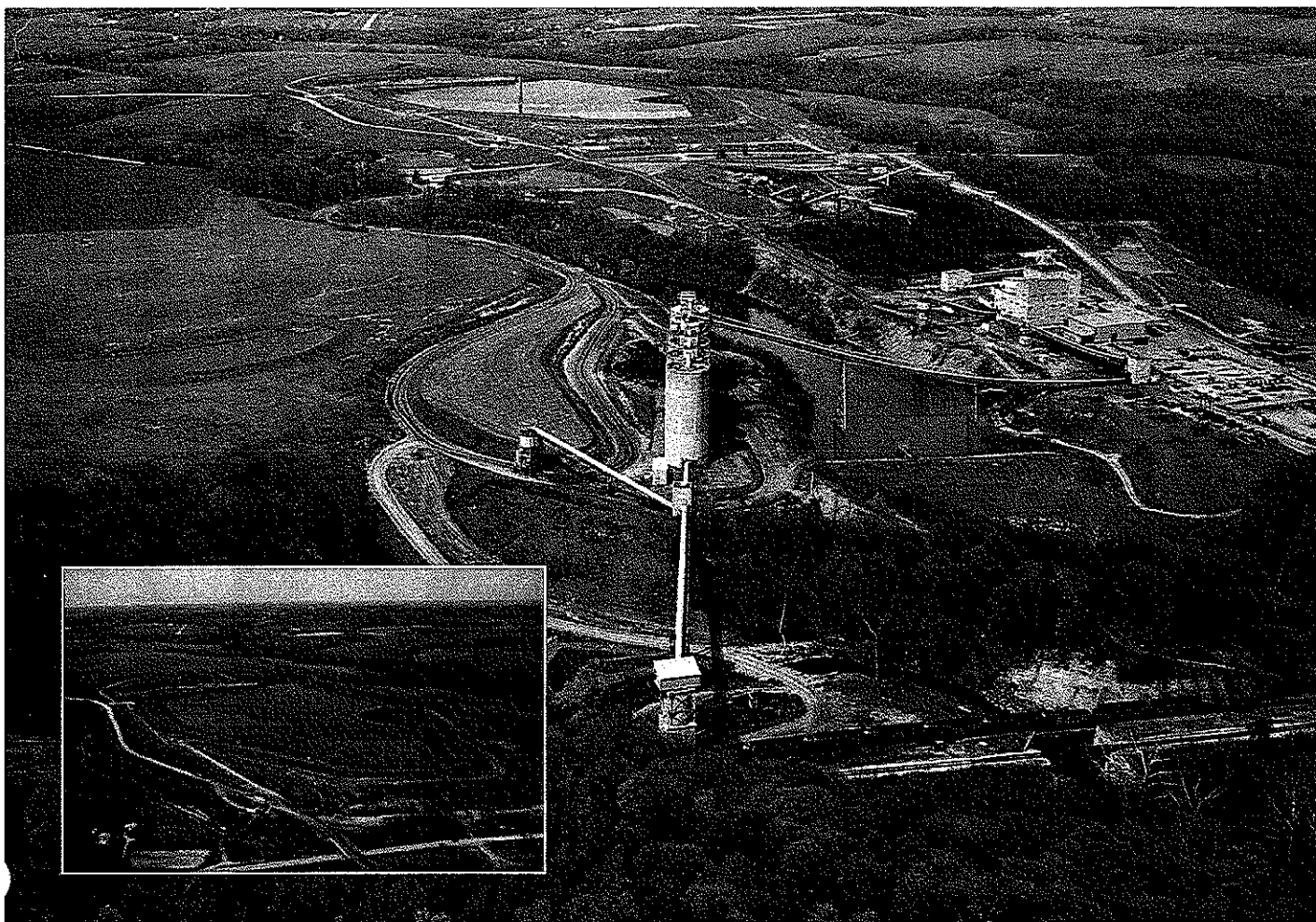
age control that provided a series of cells for settling of the slurry.

A decant system consisting of a graded filter aggregate drain and a separate multilevel decant tower and discharge pipe provided for recovery of process water. The slurry discharge piping allowed multiple deltas to be developed, approximately every 400 feet along the perimeter dikes, thus distributing the fine refuse throughout the impoundment. Expansion of the initial dikes was achieved by upstream construction to increase the facility height and capacity with operation of the coal processing plant.

D'Appolonia also prepared a reclamation plan for implementation upon termination of plant operations. The rec-

lamation plan was designed to accommodate the placement of construction demolition debris, and involved regrading the crest of the perimeter dikes to cover the settled fines, after dewatering of the impoundment. Coal combustion waste would also be used to stabilize the sediments and achieve grades for drainage.

An alternative cap and cover configuration was designed and permitted through the Ohio Environmental Protection Agency, using on-site soils and mine spoil to promote runoff, limit infiltration, and control percolation to minimal levels. Vegetative grass species that had the capacity to resist erosion and to minimize root penetration into the cap materials were specified for use as cover.



*Two million ton-per-year coal processing facility located in southeastern Ohio. The 75-acre coal refuse slurry impoundment designed by D'Appolonia is shown at the rear of the main photograph and in the inset.*

**D'APPOLONIA**

# PROJECT PROFILE

## DESIGN/CONSTRUCTION MONITORING OF COAL REFUSE DISPOSAL FACILITY

D'Appolonia provided engineering and construction monitoring for development of a slurry impounding coal refuse disposal facility, including:

- Geotechnical and environmental exploration and associated field and laboratory testing,
- Preparation of designs for erosion and sediment control, starter dam and disposal construction staging, appurtenant drainage and haul roads,
- Permit preparation and technical liaison with regulatory agencies, and
- Construction monitoring and documentation during site preparation and initial construction.

The coal refuse disposal facility was designed for 15.9 million tons of disposal capacity and a 19-year service life. Upstream construction was employed for the staged raising of the impounding embankment. The coarse coal refuse embankment stages were designed with internal drains for seepage control and sized for projected refuse generation rates. The facility was designed to accommodate storage of watershed runoff from the Probable Maximum Precipitation (PMP) storm event.



Soil starter dam and initial construction of downstream coarse coal refuse embankment.

D'Appolonia designed an impoundment drain to hasten consolidation of impounded fine coal refuse and to address concerns relative to potential liquefaction prompted by the substantial size of the upstream stages incorporated in the design. The impoundment drain was an innovation to coal refuse disposal practices and has performed effectively, resulting in noticeable improvements in foundation conditions for upstream embankment stages.

Construction activities monitored by D'Appolonia included development of a sediment pond and outlet works, the impoundment drain, the starter dam and dam foundation, cutoff and internal drains, the impoundment decant system and lining of drainage ditches.

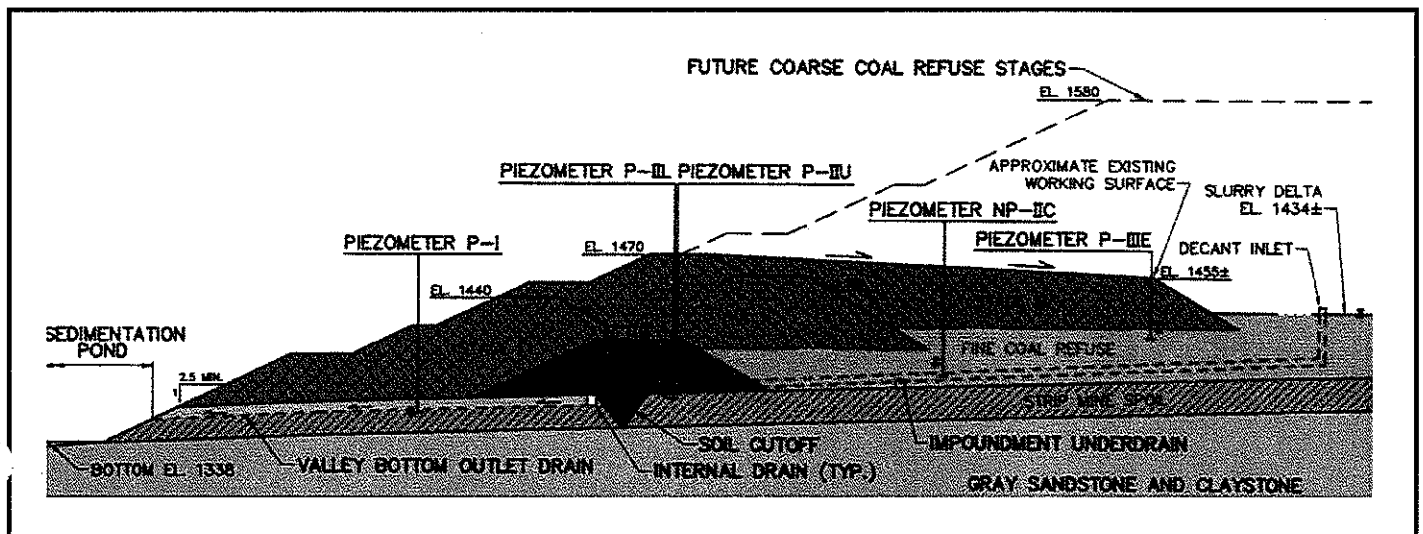
A "vuggie" (extensively solutioned) water-bearing limestone and permeable

shale strata were encountered within the dam abutments, requiring extension of the dam foundation cutoff drain up the valley slopes and construction of spring



Sediment pond and lined emergency spillway channel and decant tower.

collectors in active seepage zones. During site preparation, D'Appolonia was responsible for reviewing construction progress with regulatory agencies.



Slurry impounding coal refuse disposal facility showing embankment construction staging.

# PROJECT PROFILE

## UPDATE OF MSHA MANUAL FOR COAL REFUSE DISPOSAL FACILITIES

The Engineering and Design Manual for Coal Refuse Disposal Facilities, which was originally prepared by D'Appolonia in 1975 for the predecessor

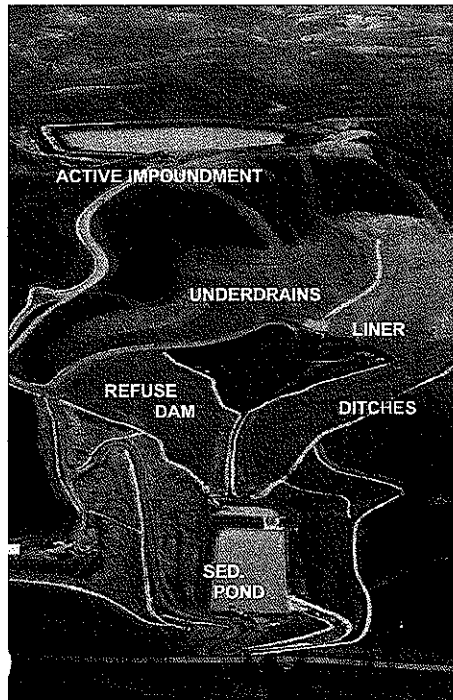
to underground mines and evaluation of potential earthquake impacts on dam safety.

D'Appolonia enlisted the participation of other prominent engineering design firms with substantial industry experience and internationally recognized experts to ensure that the manual reflects a broad base of knowledge and applications.

The project involved solicitation of broad industry review and comment at two stages of the manual development: initially through a survey of design methodology currently in practice and subsequently by providing access to draft sections on critical design issues that were not previously addressed in the original 1975 manual. Some of the additions to the manual include:

- Impounding facility concepts including slurry cells, and combustion ash co-disposal,
- Site exploration methods including surface and borehole geophysics,
- Site mining and foundation issues including evaluation of breakthrough potential,
- Mine entry barriers and bulkheads,
- Stability and seepage analyses including filter compatibility,
- Decant backfilling options,
- Dam safety instrumentation, and
- Preparation of emergency action plans.

In D'Appolonia's 53-year history of serving the mining industry, the firm

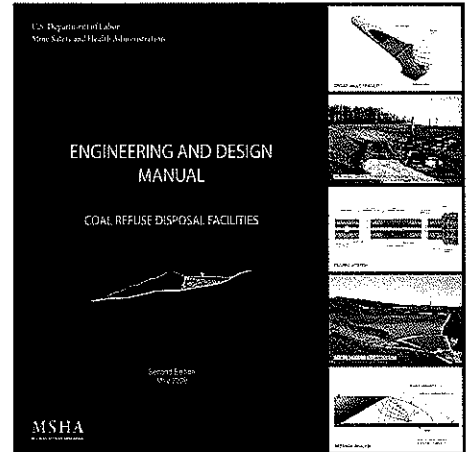


New site development (foreground) and active impoundment operations (background) are addressed.

has provided design, permitting, and construction phase support for more than 200 coal and other mining refuse disposal facilities.

rior to the Mine Safety and Health Administration (MSHA), has been updated. Updates to the manual reflect advances in dam safety and slurry impoundment design, construction, monitoring, inspection and instrumentation in the more than 30 years since publication of the original document.

Specific design guidance added to the manual includes engineering analyses for siting impoundments over or adja-

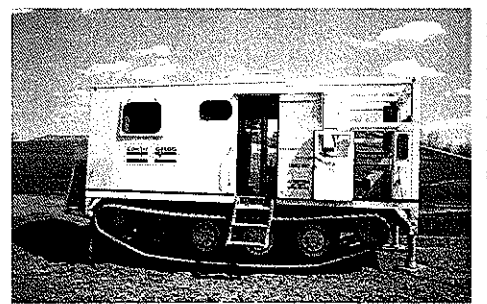
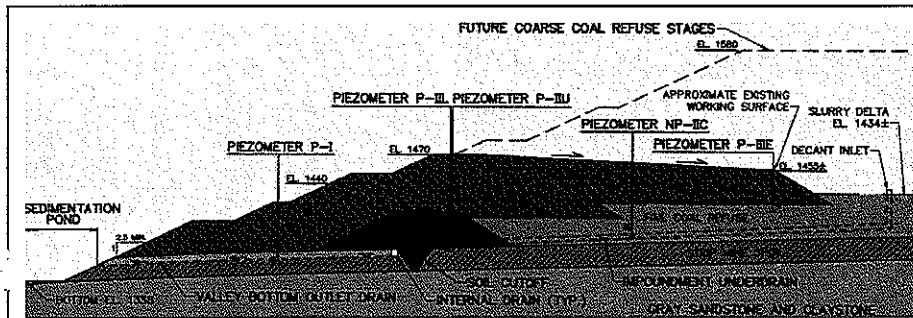


The 2009 Engineering and Design Manual is available for download at MSHA's web site: [www.msha.gov](http://www.msha.gov).

has provided design, permitting, and construction phase support for more than 200 coal and other mining refuse disposal facilities.



Decant backfill and intake options are among the many topics addressed in the new manual.



Cross section of upstream construction design and photograph of seismic piezocone exploration of fine refuse.