ATTACHMENT C

RESUMES

MALCOLM PIRNIE

Geosyntec consultants

RUDOLPH BONAPARTE

waste disposal facility design/permitting
geotechnical and geoenvironmental engineering
geosynthetics engineering
soil, sediment, and groundwater remediation
brownfields remediation/engineering

EDUCATION

University of California, Berkeley: Ph.D., Geotechnical Engineering, 1981
University of California, Berkeley: M.S., Geotechnical Engineering, 1978
University of Texas, Austin: B.S., Civil Engineering, 1977

PROFESSIONAL REGISTRATION

Alabama P.E. Number 17793
Arkansas P.E. Number 9175
California P.E. Number 047076
Colorado P.E. Number 27485
Florida P.E. Number 0052202
Georgia P.E. Number 17516
Illinois P.E. Number 054352
Kansas P.E. Number 17542
Maryland P.E. Number 18232
Michigan P.E. Number 47814
Missouri P.E. Number 298461
New Jersey P.E. Number GE44827
New York P.E. Number 067675
North Carolina P.E. Number 030150
Ohio P.E. Number 56679
Pennsylvania P.E. Number 38870
Texas P.E. Number 64329
Virginia P.E. Number 020498

AWARDS AND HONORS

ASCE, Academy of Geo-Professionals – Diplomate, Geotechnical Engineering, by Invitation (2009)
American Academy of Environmental Engineers – Board Certification, by Eminence (2008)
National Academy of Engineering – Elected to Membership (2007)
Georgia Engineering Alliance – Grand Project Award (2007)
University of Texas, Austin – CAEE Academy of Distinguished Alumni (2006)
Georgia Engineering Alliance – Georgia Engineer of the Year (2004)
American Society of Civil Engineers – James R. Croes Medal (2000)
International Geosynthetics Society – IGS Award (1994)
North American Geosynthetics Society – Award of Excellence (1991)
International Geosynthetics Society – Special Finalists Award (1990)
National Science Foundation – Graduate Research Fellow (1977-1980)
University of Texas, Austin, Outstanding Graduate Award (1977)
Academic Honor Societies (Phi Kappa Phi, Tau Beta Pi, Chi Epsilon)

REPRESENTATIVE EXPERIENCE

Geoenvironmental Engineering/Waste Disposal Facility Design and Permitting

Dr. Bonaparte was the project manager and design engineer-of-record for a low-level radioactive waste (LLRW) disposal facility constructed as part of a CERCLA remedial action at the Department of Energy (DOE) Fernald Environmental Management Project (FEMP) in Fernald, Ohio. This project included Title I, II and III design services for a 2.5 million cubic yard facility for the long-term disposal of a variety of impacted materials from the demolition and restoration of the Fernald Feed Materials Plant. The scope of work included preparation of design criteria packages (DCPs), plans, specifications, and calculations, soil-liner test pad program, leachate-geomembrane liner compatibility study, soil-geomembrane-GCL interface shear testing program, vegetative cover study, and preparation of support plans including CQA plan, waste placement plan, stormwater management and erosion control plan, O&M plan, and air monitoring plan. The Fernald project was started in 1995 and successfully completed (i.e., construction, filling, and closure of the facility) in 2006. Presently (2012), Dr. Bonaparte is serving as technical director for Title I and II design services for a similar LLRW disposal facility at the DOE Portsmouth Gaseous Diffusion Plant in Piketon, Ohio.

Dr. Bonaparte is also experienced in the siting, design, permitting, construction, and closure of municipal, industrial, and hazardous waste landfills and liquid impoundments. He has directed, managed, or performed solid-waste projects for a variety of public-sector clients, including Anne Arundel County (Maryland), Town of Babylon (New York), Chester County Solid Waste Authority (Pennsylvania), Delaware Solid Waste Authority (Delaware), City of High Point (North Carolina), and the U.S. Army Rocky Mountain Arsenal (Denver). He has also managed or directed design projects for many private-sector clients, including AlliedSignal, Inc., American Electric Power Service Corporation, Browning-Ferris Industries, Ciba-Geigy Corporation, Highway 36 Land Development Company, Mine Reclamation Corporation, and Waste Management of North America, Inc. Other waste disposal facility clients for which he has worked include Forsyth County (Georgia), Gloucester County (New Jersey), King County (Washington), County Sanitation Districts of Los Angeles County (California), Riverside County (California), Arco Chemical Company, City Management Corporation, Dow Chemical Company, Laidlaw, Rollins Environmental Services, Inc., and USA Waste Services, Inc.

Dr. Bonaparte has worked extensively in a contract research capacity for the U.S. Environmental Protection Agency (EPA) in the evaluation of liner and final cover systems for municipal, industrial, and hazardous waste disposal facilities. He has been a primary author of four research reports published by the agency, most recently for a major multi-year research study to investigate the field performance of double-liner systems and final cover systems designed to current regulatory standards. He was also a contributing author to a state-of-the-art review for the U.S. Navy on the application of subsurface barrier technology for contaminant source control at unlined Navy landfills. He has been an invited lecturer on landfill-related design topics at seminars and short courses offered by EPA, New York State Department of Environmental Conservation, Pennsylvania Department of Environmental Protection, and California Integrated Waste Management Board. He is the lead author of the pending EPA document "*Technical Guidance for RCRA/CERCLA Final Covers.*"

Geotechnical Engineering

Dr. Bonaparte has substantial experience in site investigations for building foundations, embankments, and waste containment facilities. He has extensive experience in laboratory testing of soils and in the use of subsurface exploration techniques such as cone penetrometer testing, pressuremeter testing, rock coring, and borehole geophysics.

Dr. Bonaparte has a nationally-recognized expertise in the design of earth-retaining structures, particularly reinforced-earth structures. His design experience includes several reinforced-soil retaining walls and slopes at the American Electric Power Zimmer Generating Station in Ohio, a 100-ft high reinforced-soil buttress for a hillside in southern California, and large highway embankments for the State of Montana Department of Highways. He has designed unreinforced and reinforced earthen dikes for sludge and industrial waste containment for projects in Alabama, Georgia, and California. Dr. Bonaparte has also provided engineering services to the U.S. Army Corps of Engineers and U.S. Federal Highway Administration (FHWA) on projects involving reinforced soil structures. Currently, he is principal investigator for FHWA for preparation of geotechnical engineering circulars for transportation projects; the first two circulars are entitled *Earth Retaining Systems* and *Geotechnical Design Guidance for Highway Earthquake Engineering*. Dr. Bonaparte is also experienced in earth dam evaluation and design. His experience in this area includes Lake Petit Dam and Martins Landing Dam in Georgia, Park Dam in Colorado, and Tablachaca Dam in Peru.

During the early 1980s, Dr. Bonaparte was a member of an engineering team that evaluated the seismic risk potential of a proposed state office complex in Anchorage, Alaska. This evaluation involved detailed back-analyses of slope failures which occurred in Anchorage during the 1964 Good Friday earthquake, as well as an evaluation of the probability of a slope failure at the office complex site due to future seismic events. He was also the lead engineer on a project for the U.S. Army Corps of Engineers involving the interpretation of pile load tests and the development of recommendations on pile load capacities for a lock and dam structure in Louisiana. Other geotechnical assignments include: (i) performing and interpreting static and cyclic pile load tests in soft clays adjacent to San Francisco Bay; (ii) investigation of the loss of soil support for several cracked, large-diameter underground pressure conduits at the Sacramento Regional Wastewater Treatment Plant in California, and the construction monitoring of a remedial grouting program to re-establish support for the pipes; and (iii) design and construction monitoring of stabilization measures for two landslides.

Dr. Bonaparte is very experienced in the geotechnics of industrial by-product materials, dredged materials, and wastes, including specifically chromite ore processing residue (COPR), solvay wastes, ammonia soda ash waste (ASAW), brine muds, sulfate sludges, coal-combustion by-products, and municipal solid wastes. His expertise includes geotechnical material characterization, seepage analysis, slope stability analysis, settlement analysis, and bearing capacity determination.

Contaminated Soil/Sediment/Groundwater Investigation and Remediation

Dr. Bonaparte has been extensively involved in projects involving remedial investigations and remedial designs for soil, sediment, and groundwater contamination. His project experience includes:

- principal-in-charge for remedial investigation and feasibility study (RI/FS) of the Berry's Creek Study Area (BCSA), a 12-square mile side embayment of the Hackensack River Estuary in Bergen County, New Jersey (the "Meadowlands"); the project currently involves investigation of historical contamination to wetlands, Phragmites marshland, sediments, surface water, groundwater, and ecological receptors, and the development of a detailed conceptual site model for the entire study area;

- consultant to industrial client in conceptual development and design of sediment consolidation area (SCA) at Onondaga Lake, New York; SCA will be sited on top of existing 70 ft. thick Solvay waste bed, creating significant geotechnical challenges, and will contain sediments dredged from the lake that are impacted by mercury and other chemicals;

- consultant to industrial client in evaluation of the stability of in-lake waste deposits (ILWD) at Onondaga Lake, New York; project involved evaluation of the geotechnical stability of the ILWD and underlying sediments; related projects involved design of lakefront steel sheet pile subsurface barriers to prevent DNAPL migration into the lake and also provide lake bank geotechnical stability in an area designated for dredging;

- principal-in-charge for evaluation and design of permeable reactive barriers (PRBs) for hexavalent chromium impacted groundwater in Hudson County, New Jersey; reactive media evaluated include zero valent iron (ZVI), peat, and organic amendments;

- consultant to Port of Houston Authority (PHA) for the design of soil, sediment, and groundwater remediation measures for property along Green's Bayou, Houston Ship Channel, Texas; contaminants of concern included DDT, DDE, BHC isomers, chlorobenzene, and arsenic; served on core technical team that assisted client in negotiating financial settlement with an adjacent manufacturer of organochlorine pesticides;

- core member of multi-disciplinary client team to develop in-situ and ex-situ treatment technologies for remediating sites containing chromium-containing industrial process slag in New Jersey and Maryland; the slag material contains high hexavalent chromium concentrations (>3,000 mg/kg), high alkalinity (pH>12), and it is expansive; treatment technologies considered include chemical reduction, pH adjustment, stabilization/solidification, and vitrification; led design and oversight of large-scale pilot tests of chemical treatment using pugmills, shallow soil mixing vertical augers, and horizontal rotary mixers;

- principal-in-charge and engineer-of-record for preparation of a focused feasibility study (FFS), ROD amendment, Explanations of Significant Differences and remedial design for the Bailey Dump NPL site, Orange, Texas; the project involved removal of wastes and tarry sludges from tidal marshlands abutting the Neches River on the Texas/Louisiana border; the project also involved innovative closure of two uncontrolled dumps in the marshland using lightweight RCRA caps and other measures;

- member of external technical review team (focus on in-situ containment and sludge solidification) for the Chevron Port Arthur Refinery remediation project, Port Arthur, Texas;

- consultant to PRP technical committee for negotiation of the Proposed Plan and ROD for the MIG/DeWane NPL site, Belvidere, Illinois;

- technical director for work plan and remediation design development, Yeoman Creek NPL site, Waukegan, Illinois; project involved CERCLA landfill closure, active methane gas extraction system, subsurface barriers, and stream sediment investigation and remediation;

- technical director for remedial design of soft sludge sulfate basins at the Avtex Fibers NPL site, Front Royal, Virginia; design included geotechnical stabilization measures, water management, and capping over the soft sludges;

- principal-in-charge for analysis, conceptual design, and regulatory negotiation for the final cover system for the Operating Industries Inc. (OII) NPL site in Monterey Park, California;

- principal-in-charge for work plan development, preliminary design, and design/build contractor procurement and oversight, Wingate Road NPL Site, Fort Lauderdale, Florida;

- principal-in-charge of site characterization and corrective measures, Eagle No. 2 coal mine site, Shauneetown, Illinois;

- project manager for investigation of groundwater impacts due to treated spent potliner disposal in bauxite mine pit backfill, Bryant, Arkansas;

- project engineer for design of removal actions for the LCP Chemicals NPL site in Brunswick, Georgia;

- technical team member for geotechnical investigation, landslide stabilization design, and remedial design for the Vandale Junkyard NPL site, Marietta, Ohio;

- principal-in-charge of soil and groundwater remedial investigations for CERCLA landfills near Baltimore, Maryland and Mt. Holly, New Jersey;

- project manager for preparation and implementation of a remedial action plan (RAP) for acid-impacted groundwater at a former metal finishing site in Dade County, Florida;

- principal-in-charge and engineer-of-record for design and preparation of construction bid documents for remediation (final cover, subsurface leachate interceptor, and waste slope toe buttress) for a closed municipal/ industrial landfill in Cuyahoga County, Ohio;

- project engineer for investigation of organic solvent contamination of groundwater at three semiconductor manufacturing plants in northern California;

- project engineer for asbestos and asbestos-contaminated soil remediation of a former industrial site in Redwood City, California; and

- project engineer for remedial investigation of an abandoned leather tannery in south San Francisco, California.

AFFILIATIONS

American Chemical Society
American Society of Civil Engineers
American Society of Civil Engineers: Geo-Institute
American Society of Civil Engineers: Environmental and Water Resources Institute
International Society on Soil Mechanics and Foundation Engineering
International Geosynthetics Society
National Ground Water Association
North American Geosynthetics Society

PROFESSIONAL HISTORY

Geosyntec Consultants, Atlanta, Georgia, President & CEO, 1996-date; Principal, 1988-date; Senior Engineer, 1986-1987
The Tensar Corporation, Morrow, Georgia, Applications Technology Manager, 1984-1986
Woodward-Clyde Consultants, San Francisco, California, Assistant Project Engineer, 1982-1983
University of California, Berkeley, California, National Science Foundation Research Fellow, 1977-1980

SIGNIFICANT INVITED LECTURES, WORKSHOPS, AND COMMITTEES
RUDOLPH BONAPARTE

86-1 American Society of State Highway and Transportation Officials – AASHTO/AGC/ARTBA Task Force 27 on In-Situ Soil Improvement Techniques (1986 – 1990)

87-1 NATO Advanced Study Institute – Invited Lecturer and Participant: "Polymeric Reinforcement in Soil Retaining Structures," Kingston, Canada (1987)

90-1 American Society of Civil Engineers – Member, Soil Improvement and Geosynthetics Committee, Geotechnical Engineering Division (1990 – 1993)

91-1 American Society of Civil Engineers – Chairman, Session Program Committee, Geotechnical Engineering Division (1991 – 1994)

91-2 National Science Foundation – Workshop on Soil Improvement and Foundation Remediation with Emphasis on Seismic Hazards (1991)

92-1 American Society of Civil Engineers – Editorial Board, Journal of Geotechnical Engineering (1991 – 1994)

94-1 National Science Foundation – Workshop on Research Priorities for Seismic Design of Solid Waste Landfills (1994)

94-2 International Geosynthetics Society – Editorial Board, Geosynthetics International Journal (1994 – present)

95-1 NATO Advanced Study Institute – Invited Lecturer and Participant: "Advances in Groundwater Pollution Control and Remediation," Antalya, Turkey (1995)

95-2 American Society of Civil Engineers – Keynote Lecture: "Long-Term Performance of Landfills," Geoenvironment 2000 Conference (1995)

00-1 American Society of Civil Engineers – Member, Geo-Institute Awards Committee (2000 – 2002)

01-1 National Research Council – Workshop on Safeguarding the Future: Assessing the Performance of Engineered Containment Systems for Waste Disposal (2001)

02-1 American Society of Civil Engineers – Geo-Institute Board of Governors (2002)

03-1 U.S. Environmental Protection Agency – Workshop on Bioreactor Landfills (2003)

06-1 Editorial Board – International Journal of Geoengineering Case Histories (2006 – present)

06-2 University of California, Berkeley – CEE Advisory Council (2006 – present), Chair (2008-2012)

07-1 University of California, Berkeley – CEE Geoengineering Distinguished Lecture Series (2007)

07-2 National Research Council – Assessment of the Performance of Engineered Waste Containment Barriers - NRC - invited independent reviewer (2007)

08-1 Global Waste Management Symposium – Technical Committee (2008)

08-2 Virginia Tech – Center for Geotechnical Practice and Research Annual Lecture Series (2008)

08-3 National Research Council – Fourth Report of the Academy of Engineering/National Research Council Committee on New Orleans Regional Hurricane Protection Projects: Review of the IPET Volume III (2008) – NRC-invited independent reviewer (2008)

08-4 University of Texas at Austin – CAEE External Advisory Committee (2008 – 2012), Chair (2011-2012)

08-5 U.S. Department of Energy – Invited Speaker and Participant – Landfill Technology Development Workshop (2008)

09-1 National Research Council – Advice on the Department of Energy's Cleanup Technology Roadmap - NRC invited independent reviewer (2009)

09-2 National Research Council – The New Orleans Hurricane Protection System, Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness - NRC - invited independent reviewer (2009)

10-1 American Society of Civil Engineers, GeoFlorida Conference – Invited Panel Participant on "Research, Teaching, and Practice Interrelationships in Geo-Engineering Development" (2010)

11-1 Texas A&M University – Spencer J. Buchanan Distinguished Lecturer (2011)

11-2 University of Texas at Austin – CAEE Distinguished Young Alumni Committee (2011-2012), Chair (2012)

11-3 National Academy of Engineering – Nominating Committee (2011-2012)

12-1 American Society of Civil Engineers, GeoCongress 2012 Conference – Invited Panel Participant on "Demonstrating the Value Geo-Professionals Provide to Projects" (2012)

12-2 American Society of Civil Engineers, GeoCongress 2012 Conference – Invited Keynote Lecture "The Business of Geotechnical and Geoenvironmental Engineering – State of Practice" (2012)

LIST OF PUBLICATIONS
RUDOLPH BONAPARTE

79-1 Bonaparte, R. and Mitchell, J.K., *Engineering Properties of San Francisco Bay Mud*, Geotechnical Engineering Report, University of California, Berkeley, 1979.

80-1 Bonaparte, R. and Mitchell, J.K., *Evaluation of a General Stress-Deformation-Time Model for Cohesive Soils*, Geotechnical Engineering Report, University of California, Berkeley, 1980.

80-2 Bonaparte, R. and Mitchell, J.K., *Development of Experimental Concepts for Investigating the Strength Behavior of Fine Grained Cohesive Soils in the Spacelab/Space Shuttle Zero-G Environment*, NASA Contract Report 3365, Marshall Space Flight Center, Huntsville, 1980.

80-3 Kavazanjian, E., Mitchell, J.K., and Bonaparte, R., "Stress-Deformation Predictions Using a General Phenomenalogical Model," *Proceedings of the NSF/NSERC Workshop on Plasticity Theories and Stress-Strain Modeling of Soils*, American Society of Civil Engineers, Montreal, 1980.

81-1 Bonaparte, R. and Mitchell, J.K., *Evaluation of Laboratory Characterization of Cohesive Soils*, Geotechnical Engineering Report, University of California, Berkeley, 1981.

81-2 Bonaparte, R., *A General Time-Dependent Constitutive Model for Cohesive Soils*, submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, University of California, Berkeley, 1981.

82-1 Singh, R.D., Bonaparte, R., and Gardner, W.S., *Laboratory Characterization of Soil Properties*, final report, Contract No. DOT-FH-11-9627, Office of Research and Development, Federal Highway Administration, U.S. Department of Transportation, Washington D.C., 1982.

82-2 Bonaparte, R., *Hazardous Waste-Soil Interactions*, report to Woodward-Clyde Consultants, Professional Development Committee, 1982, 54 p.

84-1 Giroud, J.P., Ah-Line, C., and Bonaparte, R., "Design of Unpaved Roads and Trafficked Areas with Geogrids," *Proceedings of the Conference on Polymer Grid Reinforcement*, Institution of Civil Engineers, London, 1984, pp. 116-127.

84-2 Bonaparte, R. and Margason, E., "Repair of Landslides in the San Francisco Bay Area," *Proceedings of the Conference on Polymer Grid Reinforcement*, Institution of Civil Engineers, London, 1984, pp. 64-68.

84-3 Giroud, J.P., and Bonaparte, R., "Waterproofing and Drainage: Geomembranes and Synthetic Drainage Layers," *Proceedings of the Second International Symposium on Plastic and Rubber Waterproofing in Civil Engineering*, Liege, 1984.

84-4 Williams, N., Giroud, J.P., and Bonaparte, R., "Properties of Plastic Nets for Liquid and Gas Drainage Associated with Geomembranes," *Proceedings of the International Conference on Geomembranes*, Denver, 1984, pp. 399-404.

84-5 Margason, E. and Bonaparte, R., "Landslide Repair in Orinda Claystone Utilizing Geogrid Reinforcement," *Proceedings of the International Symposium on Landslides*, Toronto, 1984.

85-1 Bonaparte, R., Williams, N., and Giroud, J.P., "Innovative Leachate Collection Systems for Hazardous Waste Containment Facilities," *Proceedings of Geotechnical Fabrics Conference '85*, IFAI, Cincinnati, 1985, pp. 9-34.

85-2 Bonaparte, R., Giroud, J.P., and Holtz, R.D., "Soil Reinforcement Design Using Geotextiles and Geogrids," published in ASTM Special Technical Publication #952, *Geotextile Testing and the Design Engineer*, 1985, pp. 69-118.

86-1 Berg, R.R., Bonaparte, R., Anderson, R.P., and Chouery, V.C., "Design, Construction and Performance of Two Reinforced Soil Retaining Walls," *Proceedings of the 3rd International Conference on Geotextiles*, Vienna, 1986, pp. 401-406.

86-2 Bonaparte, R., Schmertmann, G.R., and Williams, N., "Seismic Design of Slopes Reinforced with Geogrids and Geotextiles," *Proceedings of the Third International Conference on Geotextiles*, Vienna, 1986, pp. 273-278.

87-1 Bonaparte, R. and Christopher, B.R., "Design and Construction of Reinforced Embankments Over Weak Foundations," *Transportation Research Record* 1153, Transportation Research Board, Washington, DC, 1987, pp. 26-39.

87-2 Bonaparte, R. and Berg, R.R., "Long-Term Allowable Tension for Geosynthetic Reinforcement," *Proceedings of Geosynthetics '87*, New Orleans, 1987, pp. 181-192.

87-3 Schmertmann, G.R., Bonaparte, R., Chouery, V.C., and Johnson, R.J., "Design Charts for Geogrid Reinforced Slopes," *Proceedings of Geosynthetics '87*, New Orleans, 1987, pp. 108-120.

87-4 Bonaparte, R. and Berg, R.R., "The Use of Polymer Geosynthetics to Support Roadways Over Sinkhole Prone Areas," *Proceedings, 2nd Multidisciplinary Conference on Sinkholes and the Environmental Impacts of Karsts*, Orlando, 1987, pp. 437-445.

87-5 Berg, R.R., Larochelle, P., Bonaparte, R., And Tanguay, L., "Gaspe Peninsula Reinforced Soil Seawall - Case History," *Proceedings of the Symposium on Soil Improvement*, ASCE Geotechnical Special Publication No. 12, Atlantic City, 1987, pp. 309-328.

87-6 Bonaparte, R., "Geosynthetic Earth Reinforcement," *Proceedings of the ASCE-PennDOT Seminar on New Technology in Civil Engineering*, Hershey, Pennsylvania, 1987.

87-7 Bonaparte, R. and Schmertmann, G.R., "Reinforcement Extensibility in Reinforced Soil Wall Design," in *Polymeric Reinforcement in Soil Retaining Structures*, NATO Advanced Study Institute Series, Kluwer Academic Publishers, 1987, pp. 409-458.

87-8 USEPA, "Background Document on Bottom Liner Performance in Double-Lined Landfills and Surface Impoundments," EPA/530-SW-87-103, Apr 280 p. (Dr. Bonaparte was the lead author.)

87-9 USEPA, "Background Document: Proposed Liner and Leak Detection Rule," EPA/530-SW-87-015, 1987, 526 p. (Dr. Bonaparte was the lead author.)

88-1 Bonaparte, R., Ah-Line, C., Charron, R., and Tisinger, L., "Survivability and Durability of a Nonwoven Geotextile," *Proceedings of the Symposium on Geosynthetics for Soil Improvement*, ASCE Geotechnical Special Publication No. 18, Nashville, 1988, pp. 68-91.

88-2 Giroud, J.P., Bonaparte, R., Beech, J.F., and Gross, B.A., "Load-Carrying Capacity of a Soil Layer Supported by a Geosynthetic Overlying a Void," *Proceedings, International Symposium on Theory and Practice of Earth Reinforcement*, Kyushu, 1988, pp. 185-190.

89-1 Peggs, I.D., Tisinger, L.G., and Bonaparte, R., "Durability of a Polypropylene Geotextile in an Unpaved Road Structure," *Transportation Research Record* 1248, Washington D.C., Jan 1989 pp. 1-12.

89-2 Bonaparte, R. and Gross, B.A., "Tensar-Geogrid Reinforced Soil Wall," Experimental Project Program, Experimental Project 1, Ground Modifications Techniques, FHWA-EP-90-001-005, Federal Highway Administration, Washington, D.C., 1989, 119 p.

89-3 Bonaparte, R., Giroud, J.P., and Gross, B.A., "Rates of Leakage Through Landfill Liners," *Proceedings of Geosynthetics '89*, Vol. 1, San Diego, 1989, pp. 18-29.

89-4 Giroud, J.P. and Bonaparte, R., "Leakage Through Liners Constructed with Geomembranes. Part I: Geomembrane Liners," *Geotextiles and Geomembranes*, Vol. 8, No. 1, 1989, pp. 27-67.

89-5 Giroud, J.P. and Bonaparte, R., "Leakage Through Liners Constructed with Geomembranes. Part II: Composite Liners," *Geotextiles and Geomembranes*, Vol. 8, No. 2, 1989, pp. 77-111.

89-6 Bonaparte, R., "Geosynthetic Reinforcement of Embankment Slopes," *Proceedings of the ASCE New York Met Section Seminar, Foundations in Difficult Soils-State of Practice*, 1989, 36 p.

89-7 Bonaparte, R., Schmertmann, G.R., Chu, D., and Chouery-Curtis, V.E., "Reinforced Soil Buttress to Stabilize a High Natural Slope," *Proceedings, XIIth International Conference on Soil Mechanics and Foundation Engineering*, Rio de Janeiro, 1989, pp. 1227-1230.

90-1 Giroud, J.P., Bonaparte, R., Beech, J.F., and Gross, B.A., "Design of Soil Layer-Geosynthetic Systems Overlying Voids," *Geotextiles and Geomembranes*, Vol. 9, No. 1, 1991, pp. 11-20.

90-2 Gross, B.A., Bonaparte, R., and Giroud, J.P., "Evaluation of Flow from Landfill Leakage Detection Layers," *Proceedings, Fourth International Conference on Geotextiles*, Vol. 2, The Hague, 1990, pp. 481-486.

90-3 Bonaparte, R. and Swan, R.H., "Geosynthetic Reinforcement of Embankment Slopes," *Proceedings of the 1990 ASCE Chicago Lecture Series, Geosynthetics in Geotechnics*, Chicago, 1990, 20 p.

90-4 Bonaparte, R. and Gross, B.A., "Field Behavior of Double-Liner Systems," *Proceedings of the Symposium on Waste Containment Systems*, ASCE Geotechnical Special Publication No. 26, San Francisco, 1990, pp. 52-83.

90-5 Bonaparte, R., ed., "Waste Containment Systems: Construction, Regulation, and Performance," Proceedings of a Symposium Sponsored by the American Society of Civil Engineers, ASCE Special Publication No. 26, San Francisco, Nov 1990, 266 p.

90-6 Swan, R.H., Bonaparte, R., Bachus, R.C., Rivette, C.A., and Spikula, D.R., "Effect of Soil Compaction Conditions on Geomembrane-Soil Interface Strength," *Geotextiles and Geomembranes*, Vol. 10, No. 5, 1990, pp. 523-530.

90-7 AASHTO/AGC/ARTBA Task Force 27: "In Situ Soil Improvement Techniques," Washington, D.C., 324 p. (Dr. Bonaparte is a coauthor.)

91-1 Bonaparte, R., Fluet, J.E., Jr., Johnson, R., and Chouery-Curtis, V.E., "Application of Geosynthetics to the W. H. Zimmer Generating Station Project," *Proceedings of Geosynthetics '91*, Vol. 2, Atlanta, 1991, pp. 935-950.

92-1 Giroud, J.P., Badu-Tweneboah, K., and Bonaparte, R., "Rate of Leakage Through a Composite Liner Due to Geomembrane Defects," *Geotextiles and Geomembranes*, Vol. 11, No. 1, 1992, pp. 1-28.

92-2 Seed, R.B. and Bonaparte, R., "Seismic Analysis and Design of Lined Waste Fills: Current Practice," *Proceedings of the Specialty Conference on Stability and Performance of Slopes and Embankments*, Vol. 2, ASCE Geotechnical Special Publication No. 31, Berkeley, 1992, pp. 1521-1545.

93-1 Berg, R.R. and Bonaparte, R., "Long-Term Allowable Tensile Stresses for Polyethylene Geomembranes," *Geotextiles and Geomembranes*, Vol. 12, No. 4, 1992, pp. 287-306.

93-2 Giroud, J.P. and Bonaparte, R., "Geosynthetics in Dam Rehabilitation," *Proceedings of the Specialty Conference on Geotechnical Practice in Dam Rehabilitation*, ASCE Geotechnical Special Publication No. 35, 1993, pp. 1043-1074.

93-3 USEPA, "LDCRS Flows from Double-Lined Landfills and Surface Impoundments," EPA/600/SR-93/070, 1993. (Dr. Bonaparte was the lead author.)

93-4 Bonaparte, R. and Gross, B.A., "Impact of Subtitle D Regulations on Leachate Containment Capabilities of Landfill Liner Systems," *Geotechnical News*, Vol. 11, No. 3, 1993, pp. 46-48.

94-1 Snow, M.S., Bonaparte, R., and Kavazanjian, E., Jr., "Geosynthetic Composite Liner for Subtitle D," *Proceedings, Waste Tech '94*, National Solid Waste Management Association, Charleston, 1994.

94-2 Cargill, K.W., Gross, B.A., North, R.B., and Bonaparte, R., "Subsurface Landfill Barriers," report prepared for the U.S. Navy, Naval Facilities Engineering Command, Port Hueneme, Aug 1994, 136 p.

95-1 Bonaparte, R. "Long-Term Performance of Landfills," *Proceedings of the ASCE Specialty Conference Geoenvironment 2000*, ASCE Geotechnical Special Publication No. 46, Vol. 1, 1995, pp. 515-553.

95-2 Luettich, S.M., Bonaparte, R., Coleman, B.A., and Tomlinson, H.M., "Preconstruction Testing of Two Soil Liners," *Proceedings of the ASCE Specialty Conference Geoenvironment 2000*, ASCE Geotechnical Special Publication No. 46, Vol. 1, 1995, pp. 670-687.

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ARCADIS

Education
Ph.D. Civil Engineering, Pennsylvania State University, 1989
M.S. Environmental Engineering, Pennsylvania State University, 1983
B.S. Environmental Engineering, Pennsylvania State University, 1981

Years of Experience
Total - 28
With ARCADIS – 23

Professional Registrations
Professional Engineer, VA

Professional Qualifications
American Society of Civil Engineers (ASCE)
Society of American Military Engineers (SAME)

Scott T. Potter, PhD, PE

Vice President

Dr. Potter is the Chief Hydrogeologist for ARCADIS and Director of Hydrogeology and Modeling Services within the firm. He has worked for ARCADIS since 1989 and has more than 27 years of experience in groundwater hydrology. In his current role, he provides technical leadership in hydrogeologic assessments and groundwater remediation projects throughout North and South America, and Europe. ARCADIS utilizes Dr. Potter's expertise on numerous of their Guaranteed Remediation Program contracts (GRiP®).

Dr. Potter has specialized experience in groundwater flow and contaminant transport modeling, surface water flow and transport modeling, and quantitative analysis of hydrogeologic systems. He has directed quantitative studies at chemical facilities, petroleum refineries, solid and hazardous waste facilities, manufactured gas plants, manufacturing facilities, well fields, and mines. These studies have involved the migration of organic and inorganic constituents, energetics, radionuclides, management of groundwater resources, monitored natural attenuation, alternative landfill cover design, and hydrologic impact analyses of room and pillar mining, longwall mining and quarry dewatering.

Dr. Potter's responsibilities at ARCADIS include technical review of hydrogeologic assessments and groundwater modeling projects, project direction of advanced hydrologic studies, and providing internal technical training. He has recently co-authored the text *Remediation Hydraulics* focusing on the importance of understanding aquifer heterogeneities to predict and control contaminant and fluid movement in the subsurface.

Large Diffuse Plumes

Joliet Army Ammunitions Plant (JOAAP)
Confidential Client, Joliet, Illinois
Responsible for the Development and calibration of a multi-layer numerical groundwater flow and solute transport models in a limestone aquifer. The model was used to assess the impacts of future site development on groundwater flow and constituent transport. Performed an extensive review of site data to redefine the site conceptual model from previous interpretations to understand surface water and groundwater interactions. The model was used to evaluate the migration of large TNT, DNT, NT, and RDX plumes under predevelopment and post-development flow conditions to minimize impacts on endangered species.

Lake City Army Ammunitions Plant (LCAAP)
US Army AEC, Lake City, Missouri
Groundwater and soils beneath an active ammunition facility have been impacted by spent chlorinated solvent waste generated by cleaning munitions generating multiple groundwater plumes. Responsible for the development and calibration of groundwater flow and solute transport models to evaluate the effects of remedial alternatives and onsite water supply wells on the movement of groundwater flow and chlorinated solvents.

Milan Army Ammunitions Plant (MAAP)
US Army AEC, Milan, Tennessee
The manufacture of RDX and HMX has resulted in multiple groundwater plumes greater than 2 miles long cover. The plumes are being remediated using a several groundwater pump and treatment systems pumping more than 3000 gallons per minute. Directed the development of a groundwater flow and solute transport model to optimize pump and treatment strategies as well as monitored natural attenuation to remediate groundwater impacts.

Former Reese Air Force Base
Tulsa COE, Lubbock, Texas
A release of TCE from the former base has resulted in a 3 miles by 1 mile TCE plume in the Ogallala Aquifer. Technical director for development of the remedial strategy to remediate the TCE plume to drinking water standards by 2012. The remediation includes one of the largest IRZs in the world, continuously delivering reagents dissolved in water at 200 gallons per minute. Concurrently, groundwater is pumped, treated, and reinjected at several hundred gallons a minute. The combined strategy ensures control of plume movement and restoration of groundwater. Optimization of the groundwater pumping and treatment system has reduced withdrawls by 50% and reduced life-cycle costs by $1 MM.

Sierra Army Depot (SIAD)
US Army AEC, California
A release of TCE has resulted in a groundwater plumes greater than 1.5 miles long and approximately 1 mile wide. The plume is being remediated using in-situ reductive dechlorination. Directed the development of a groundwater flow and solute transport model to support the remedial design as well as evaluate groundwater conditions in the conceptual site model. Interpretation of groundwater conditions at the site are challenging due to very flat ambient hydraulic gradients and complex aquifer heterogeneities.

Natural Gas Compressor Station
Confidential Client, CA
A release of hexavalent chromium used as a corrosion inhibitor in the facility cooling system, has resulted in a 7,000 by 2000 foot plume. Interim remedial measures have been in progress for decades while stakeholder concerns have been addressed. Current responsibilities include directing the development of a groundwater flow and transport model to complete the FS. The final remedy will include a large pump and treat system for hydraulic containment, fresh water injections to contain the plume and protect potential groundwater receptors, and in situ treatment of most of the chromium.

Former Waste Oil Refinery
Confidential Client, Westville, IN
Directed the development of a groundwater flow and transport model to support a supplemental RI/FS. Near the completion of the initial RI/FS, 1,4-dioxane was identified in groundwater beneath and down gradient from the former refinery. The numerical modeling was used to direct the placement of monitoring wells 6000 feet down-gradient from the site to define the limits of the plume, and to evaluate remedial alternatives at the Site.

Radionuclide Experience

Uranium Extrusion Facility
Confidential Client, Ashtabula, OH
A fabrication facility in northern Ohio produced fuel rods from uranium ingots. Uranium dust from the milling process contaminated the soils adjacent to the plant. As part of the decommissioning for the site, the soils are being washed, the uranium extracted, and the soil placed back on the site. Modeling was performed to evaluate the migration of residual uranium via erosion and leaching considering impacts to groundwater and surface waters. The modeling determined that while soil concentrations met regulatory standards, future dissolved concentrations would exceed the MCL by two-orders of magnitude. Soil additives have since been added to the soil washing process to stabilize the uranium in-situ thereby maintaining soil and groundwater concentrations below MCLs.

Brookhaven National Laboratory
Department of Energy, New York
Performed modeling oversight at Brookhaven National Laboratory (BNL) to evaluate the observed distribution of a tritium plume located in the vicinity of the High Flux Beam Reactor (HFBR). Steady-state and long term transient model simulations were performed to explain the evolution of the current tritium distribution. The model analyses suggest that the plume has had a complex history due to on-site pumping and recharging. While transport directions in the past were highly variable, the elongate southerly trending plume is generally the result of hydraulic conditions over the past ten years. The special modeling approach and techniques used to

evaluate plume dispersion were reviewed by modeling staff at the Robert S. Kerr Environmental Research Center.

Thorium Contaminated Soils
Confidential Client, MI
Dust from a milling facility contaminated an adjacent property with enriched Thorium. RESRAD modeling of current and future, parent and daughter products determined that the soil would not be suitable as foundation material for structures because of future radon emissions. Final closure for the site will involve a surface layer of clean soils and deed restrictions.

Nuclear Power Plant
Confidential Client, Eastern US
Responsible for the technical direction of a hydrogeologic investigation and remediation of a release of primary water from a commercial nuclear power plant. The project was conducted on an accelerated schedule with close coordination with state and federal officials (NRC). The investigation identified a tritium plume in adjacent groundwater requiring active remediation. A groundwater pump and treatment system was installed, successfully removing 50% of the activity in the first 2 years of operation.

Nuclear Power Plant
Confidential Client, Central US
Responsible for the technical direction of a hydrogeologic investigation and identification of the release of primary water from a commercial nuclear power plant. The project was conducted on an accelerated schedule with close coordination with state and federal officials (NRC). The investigation identified multiple tritium plumes in adjacent groundwater, one from a break in a radiological waste line, and a second associated with refueling operations. The second release point was due to a small discrepancy between designed and as-built operations (6 inches) which permitted a release of primary water from the power block. Facility conditions and site permits have enabled MNA to be the appropriate remedy for impacted groundwater.

Groundwater Flow and Transport

CERCLA, Hipps Road Landfill
US Department of Justice/Waste Management, Jacksonville, FL
Developed a three-dimensional groundwater model in Florida carbonate rocks for a landfill contamination assessment. Performed quantitative analysis, critical data review, data base development, and litigation support for proceedings in Gloria J. Andrews vs. United States of America and Waste Control of Florida.

State of Virginia Voluntary Remediation Program Site
Confidential Client, Portsmouth, Virginia

Developed and calibrated a detailed three-dimensional numerical groundwater flow and solute transport model to evaluate the current nature, extent, and fate of dissolved metals (i.e., zinc, lead, and cadmium) in groundwater beneath the Site and to support the overall assessment of groundwater quality and selection of remediation alternatives. Performed quantitative analysis, critical data review, and database development. Modeling results provided information that was used to quantify environmental conditions and evaluate potential remedial actions. The results of this analysis were also used in the site-wide risk assessment performed by ARCADIS. Model simulations demonstrated the technical impracticability of a conventional pump-and-treat system.

Former Dry Cleaner

Confidential Client, Richardson, Texas

Developed and calibrated numerical groundwater flow and solute transport models to evaluate remedial design alternatives. The transport model simulated multiple constituents of a shallow chlorinated solvent plume (PCE, TCE, DCE, and VC) using MT3D99. The evaluated remediation technologies were: funnel-and-gate, pump-and-treat, enhanced bioremediation (cometabolic reductive dechlorination and bimetallic colloids), and combinations of the three technologies.

Former Production Facility

Confidential Client, Cumberland, Maryland

Developed and calibrated a multi-layer numerical groundwater flow model in a alluvial aquifer. The model was used to determine constituent loading to adjacent surface water bodies and to evaluate the effectiveness of the current remediation system. The model involved both transient and steady-state analysis. The model was also used to evaluate the effects of installing a phyto-cover on site groundwater flow conditions and constituent transport.

Former Industrial Landfill

Confidential Client, North Carolina

Developed and calibrated multi-layer numerical groundwater flow and solute transport models in a fractured rock aquifer within the Piedmont. The model evaluated 1,4 dioxane, biphenyl ether, ethylene glycol, and acetone to determine constituent loading to adjacent surface water bodies and the effectiveness of the existing pump-and-treat system.

CERCLA SITE

Confidential Client, Sagertown, PA

Developed a three-dimensional groundwater flow and transport model in a glacial aquifer. The flow and transport model supported the field data, which indicate that natural attenuation mechanisms are degrading PCE and TCE before migration to down-gradient points-of-compliance. Supplemental modeling to evaluate the benefits of enhanced natural attenuation due to the injection of organic carbon has led to the approval of interim remedial measures.

Manufacturing Facility
Confidential Client, Dallas, TX
Developed a three-dimensional groundwater flow and transport model for use in the development of alternative risk based closure levels for groundwater contaminated with chlorinated VOCs. The TNRCC has accepted the findings of the modeling study in conjunction with monitored natural attenuation and no active remedial measures (groundwater pumping) are needed to address groundwater contamination.

CERCLA, Woodlawn Landfill
Confidential Client, Cecil County, MD
Developed a three-dimensional groundwater flow and transport model in the Maryland Piedmont for a landfill contamination assessment. The calibrated flow and transport models supported the development of a data acquisition strategy and negotiation with federal regulators to demonstrate natural attenuation mechanisms were degrading vinyl chloride. The model demonstrated that vinyl chloride would not affect adjacent properties or supply wells, thus precluding the need for either a pump and treat system or an engineered cap as stipulated in the ROD. The ROD has been opened and the model is being used to support modifications.

RCRA, Manufacturing Facility
Confidential Client, Lisbon, ME
Developed a three-dimensional groundwater flow and transport model in a glacial aquifer in New England. Responsibilities related to model application to support an RI/FS investigation at a circuit board manufacturing facility. The calibrated model supported development of data acquisition strategy and negotiation with regulatory agency regarding responsibility for contamination of a public supply well.

Pesticide Plant
Confidential Client, Houston, TX
Performed three-dimensional modeling for an analysis of groundwater flow and transport conditions to evaluate current remedial activities and supported a site-wide risk assessment. The model provided quantitative assurance needed for successful acceptance of the final remedial design.

Manufactured Gas Plant
Confidential Client, Salisbury, MD
Principal Investigator, variably saturated flow and transport model in Mid-Atlantic coastal sediments. Contamination from buried waste at a turn-of-the-century (1900) MGP facility was moving toward a public supply well. Analytical modeling, numerical modeling, particle tracking, and evaluation of the movement of NAPL contaminant mixtures were done to contain the plume and remediate the aquifer.

Groundwater Supply

Confidential Client, MA
Developed a three-dimensional groundwater flow model of western Cape Cod. The calibrated model was used to determine the Zone II zones-of-capture for 55 major water supply wells, evaluate the impacts of induced infiltration from a large public waste water treatment facility, determine groundwater impacts from an unlined active landfill, and manage water resources in the sole-source aquifer.

Chemical Manufacturing Facility
Confidential Client, Lake Charles, LA
Responsible for the technical review of a three-dimensional groundwater flow and solute transport model at a RCRA facility. State of the art groundwater codes (FRATRANS, FRAC3D, MODFLOWT, MT3D96, and MODFLOW) were used by another consultant to model the migration of dissolved and separate phase chlorinated solvents through fractured clays into a sole source aquifer. The client funded the technical review at the request of the USEPA, who did not have the resources to evaluate the model. The USEPA has used the technical reviews as a basis for accepting the results of the modeling work.

Bulk Hydrocarbon Storage Facility
Confidential Client, Hilo, HI
A multi-phase model was developed to evaluate the movement of floating hydrocarbons on the water table. The model was used to confirm field observations on the impacts of a shallow retaining wall that penetrated the water table. The model showed that while hydrocarbons accumulated behind the wall it was not an effective barrier and hydrocarbons would still flow under the wall. In addition, the orientation of the wall relative to the existing groundwater flow system had only a minor impact on the movement of hydrocarbons. The results were used to help settle a dispute between adjacent property owners.

Bulk Hydrocarbon Storage Facility
Confidential Client, Jacksonville, FL
Developed a three-dimensional groundwater flow & transport model in Florida coastal sediments. Separate phase and dissolved hydrocarbons from tanks had moved beneath a residential neighborhood. Numerical modeling, particle tracking, recovery well design & optimization, and evaluation of NAPL contaminant mixtures were done to contain hydrocarbons and remediate the aquifer. The optimized groundwater recovery system will save the client $19 million over the life of the project as compared to the initial design recommended by another consultant.

Petroleum Refinery
Confidential Client, Houston, TX
Developed a three-dimensional groundwater flow and transport model. Approximately, one million gallons of product were released to a shallow water table aquifer beneath a petroleum refinery. Numerical modeling, particle tracking, recovery well design & optimization, and evaluation of NAPL contaminant mixtures were done to contain the plume and recover the product.

Reviewed USEPA's 3MRA Model Developed for the Hazardous Waste Identification Rule
Confidential Client
Participated as part of a team of expert reviewers to evaluate USEPA's multimedia, multipathway, multireceptor risk assessment (3MRA) model and its supporting documentation (64 FR 63382). The review focused on the technical validity of USEPA's approach for calculating exit levels using the 3MRA model. Specific comments were provided for the source, groundwater, and surface water modules, which are six of seventeen that comprise the 3MRA model. The review clearly indicates that the USEPA has incorporated numerous conservatisms in the 3MRA model that limit its usefulness for calculating appropriate exit levels. Comments were presented to the Hazardous Waste Identification Rule Consortium.

Hydrologic Impacts of Mining Activities

Long-Wall Coal Mining
Confidential Client, IN
Conducted a quantitative evaluation of the hydrologic impacts of settlement from long-wall mining at depths less than 200 feet below land surface. An analytical model of groundwater impacts was developed base upon groundwater elevations and soil settlement data collected following the long-wall mining of a 3-acre test panel.

Aggregate Quarry Development
Confidential Client, Asheville, NC
Conducted a quantitative evaluation of the hydrologic impact analysis of a crush aggregate quarry development in the North Carolina Piedmont. The application of numerical modeling and field analyses were used to evaluate the potential impacts of quarry development. The effects of site-specific fracture conditions also investigated.

Confidential Client, Greensboro, NC
Conducted a quantitative evaluation of the hydrologic impact analysis of a crush aggregate quarry development in the North Carolina Piedmont. Provided public testimony at land-use planning proceedings before the county board of supervisors.

Aggregate Quarry Redevelopment
Confidential Client, South Hill, VA
Conducted a quantitative evaluation of the hydrologic impact of quarry dewatering and expansion of expansion of quarrying operations in the Virginia Piedmont. Important issues included the close proximity of adjacent property owner on domestic water supplies and a stream.

Confidential Client, Southern, VA
Conducted a quantitative evaluation of the hydrologic impact of quarry dewatering and expansion of expansion of quarrying operations in the Virginia Piedmont. Important issues included the close proximity of the Triassic Basin, former coal mines, private wells on adjacent properties, and a stream.

Hard Rock Salt Mining
Confidential Client, Southern LA
The ARCADIS representative of a technical group consisting of experts from five consulting firms organized to evaluate groundwater seepage into a hard rock salt mine. Responsible for conducted a quantitative evaluation of the hydrogeology and geochemistry above a salt dome. The hard rock mine in the salt dome has been active for over 100 years and water has begun to infiltrate along natural faults, through more permeable sedimentary intrusions, and via stress fractures caused by long-term plastic deformation of the voids. A long-term infiltration reduction plan has been developed consisting of precipitation grouting and concrete injection.

Alternative Landfill Cover Design

CERCLA, Woodlawn Landfill
Confidential Client, Cecil County, MD
Conducted a focused feasibility study to determine the efficacy of a vegetative cover rather than a single barrier cover system. The results of the study indicated that the long-term percolation through an engineered cover of densely planted trees is equivalent to the leakage through a single barrier cover system. The ROD has been opened and the final design is being completed for construction Spring 1999.

CERCLA, Hastings Landfill
Confidential Client, NE
Conducted a focused feasibility study to determine the efficacy of a vegetative cover rather than a single barrier cover system. The results of the study indicated that the long-term percolation through an engineered cover of native grasses is equivalent to the leakage through a single barrier cover system. The technical analysis was performed using UNSAT-H and traditional water balance methods. The construction of the cover was completed in 2003.

CERCLA, Industrial Excess Landfill

Confidential Client, OH

A phyto-cover has been designed and proposed for an inactive landfill in central Ohio. The approval of the cover is contingent on the results of the natural attenuation study currently being conducted. If groundwater concentrations in 1999 continue to decline or remain constant, construction is anticipated in Spring 2000.

RCRA, Manufacturing Facility

Confidential Client, Williamsburg, VA

Designed a vegetative cover of densely planted trees over an inactive industrial landfill. The phyto-cover is designed to control infiltration thereby reducing the generation on leachate. The first phase of the cover was installed in Spring, 1999 over a 5 acre portion of the study.

Confidential Client, MI

An industrial landfill containing foundry sands has been inactive for approximately 50 years. A phyto-cover has been designed and built to limit infiltration, control leachate seeps on the slopes of the landfill, and transpire the existing water in the landfill. Constructed in the Spring 1998.

MSW, Pigeon Point Landfill

Confidential Client, Wilmington, DE

A pilot study phyto-cover has been constructed on an active landfill to evaluate it use as a final cover alternative. The five-acre cover was constructed in the Spring of 1999. The purpose of the pilot study is to confirm the waste into which the cover will root is compatible with the vegetation and that the low-levels of gas generated by the landfill are also not toxic to the plants. The performance of the cover system was monitored for 4 years and the planting expanded to include the entire facility.

Surface Water / Sediment Transport

Pesticide Manufacturing Facility

Confidential Client, Houston, TX

Performed transport modeling to evaluate the stability of bed sediments in a stream near Houston, Texas. Einstein's bed load equation was used to compute sediment loads. The probability of local precipitation events was used to estimate the frequency and magnitude of sediment loads to adjacent surface water bodies to support risk assessment.

Manufactured Gas Plant

Confidential Client, Baltimore, MD

Performed sediment transport modeling to evaluate the stability of surficial soils. The modeling was used to demonstrate that only a small fraction of the constituents identified in adjacent surface water sediments are the result of on-site activities. The model supports a data acquisition

strategy and negotiation with state regulators to develop a cost-effective remedial plan for adjacent harbor sediments.

MSW Landfill

Confidential Client, Johnstown, PA

Principal Investigator, formal appeal of FEMA - Flood Insurance Study in support of a Phase I Permit Application of a municipal solid waste landfill in Western Pennsylvania. Provided technical analysis and review of hydraulic calculations in existing studies. Additional field data was used to delineate new 100-year base flood elevations.

Urban Watershed

Confidential Client, Nassau Co., NY

The effluent from a groundwater pump and system on Long Island is being proposed to be discharge into the local storm water collection system. A portion of the existing system consisting of a series of 7 storm water basins and draining approximately two square miles was designed and built in the late 1950's. Due to extensive subsequent development and changes in regulatory requirements, State and Local officials were concerned that the system would fail during low return-period rainfall-runoff events. Detailed hydraulic calculations showed that an inexpensive modification to the outlet control structure in one storm water basins will maintain flood flow hydrographs in the storm water system at current levels and that the system currently meets state design criterion.

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