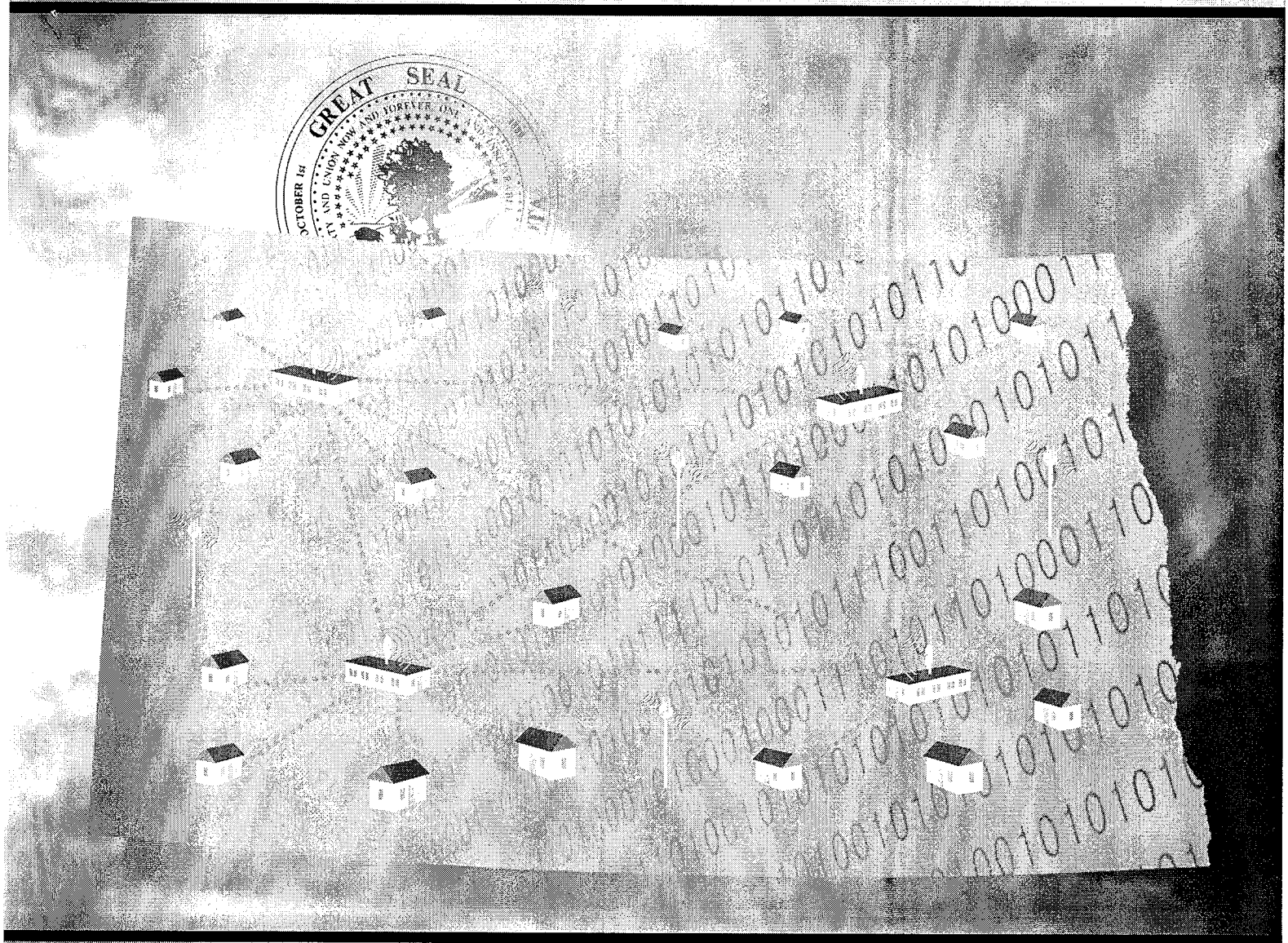
Cost Proposal



State of North Dakota • Information Technology Department

Broadband Mapping Services

RFP Number: 112-0913

September 25, 2009

TETRA TECH EC, INC.

COST PROPOSAL
for
Broadband Mapping Services

STATE OF NORTH DAKOTA

Information Technology Department

RFP Number: 112-0913

Prepared by:

TETRA TECH

Tetra Tech EC, Inc,
19802 North Creek Parkway
Bothell, WA 98011

September 25, 2009

1. Cost Proposal

The Tetra Tech Team has carefully evaluated the project scope and is presenting our cost to perform the scope of work we have outlined in our Technical Proposal (see Table 1).

Tetra Tech's bid to provide the services outlined in our proposal is **$1,264,154**. We have provided a detailed itemized budget for all tasks in Table 1 below. The itemized budget depicts level of effort as well as costs for all tasks in our proposal. Costs are broken out for labor, direct costs, and travel for each task.

Assumptions

Our bid to complete this work is predicated on the following assumptions:

- Invoicing will be monthly based on percentage of work complete.
- The project is to be awarded on a lump sum basis for all execution of all project tasks identified in Tetra Tech's proposal.
- The project will be completed by November of 2010. Any change to the overall project duration requested by the State may impact project costs.
- The State and Tetra Tech mutually agree to all terms, conditions, and project requirements.
- The State will make staff available in a timely manner to meet with Tetra Tech on technical, management, and administrative matters related to this project.

Table 1. Detailed Costs—North Dakota Proposal For Broadband Mapping

		Staff Hours	Lead Staff Hours	Senior Staff/ Manager Hours	Labor Budget	Direct Expenses	Travel	Task Totals
Planning								
Task 1 - Kickoff Meeting and Meeting Round 1								**$84,880**
	Kick-off meeting with State		16		$2,080		$2,000	
	Organize teams		80		$10,400			
	Identify participants				$0			
	Select meeting site				$0			
	Send out invitations				$0			
	Press releases, contact local media				$0			
	Prepare Meeting 1 presentation		224		$29,120			
	Outline of planning process				$0			
	Review of mapping data				$0			
	Discussion of regional infrastructure				$0			
	Discussion of local barriers to adoption				$0			
	Discussion/identification of applications				$0			
	Conduct Meeting 1		256		$33,280		$8,000	
Task 2 - Infrastructure\Demand Assessment and Meeting Round 2								**$124,480**
	Prepare, distribute meeting minutes		16		$2,080			
	Develop demand estimate from application analysis, mapping data		120		$15,600			
	Assess existing infrastructure vs. demand estimate		120		$15,600			
	Define infrastructure gaps, capacity issues		144		$18,720			
	Identify policy, technology and funding options		80		$10,400			
	Prepare Meeting 2 Presentation		160		$20,800			
	Recap of Meeting 1				$0			
	Demand vs. existing infrastructure analysis				$0			
	Recommend infrastructure priorities				$0			
	Discuss policy, technology, funding options				$0			
	Conduct Meeting 2		256		$33,280		$8,000	
Task 3 - Draft Plan Development and Meeting Round 3					$0			**$157,760**
	Prepare, distribute Meeting 2 minutes		16		$2,080			
	Coordinate infrastructure needs, priorities with other regions		80		$10,400			
	Identify and coordinate with other State initiatives		80		$10,400			
	Identify preferred policy, technology, funding options		80		$10,400			
	Develop Plan maintenance process		40		$5,200			
	Write Draft Plan		480		$62,400			
	Prepare Meeting 3 Presentation		120		$15,600			
	Review coordination with other regions				$0			
	Review coordination with other State initiatives				$0			
	Review draft plan				$0			
	Review Plan maintenance process				$0			
	Conduct Meeting 3		256		$33,280		$8,000	
Task 4 - Final Plan Development and Meeting Round 4					$0			**$155,680**
	Incorporate comments into Plan		160		$20,800			
	Prepare Final Plan		264		$34,320			
	Develop Meeting 4 Presentation		120		$15,600			
	Final Plan Review				$0			
	Transition of Plan Maintenance from Consultant to Regional Team				$0			
	Conduct Meeting 4		256		$33,280		$8,000	
	Prepare, distribute Meeting 4 minutes		16		$2,080			
	Incorporate Meeting 4 comments into Plan, publish and distribute		320		$41,600			

Development		Staff Hours	Lead Staff Hours	Senior Staff/ Manager Hours	Labor Budget	Direct Expenses	Travel	Task Totals
Task 1 - Interactive Broadband Web Map Application								
	Data prep and conditioning (SDE)	120	80	40	$27,600		$1,500	**$79,380**
	Design web map service(s) to support project needs		40	24	$6,040			
	Develop web viewing tool		75	50	$11,750			
	Develop web update tools		90	34	$11,890			
	Integrate follow-up monitoring tools		80		$8,000			
	Tech Transfer and Application Setup on State Servers		60	60	$11,100		$1,500	
Task 2 - Preliminary Modeling of Broadband Infrastructure and Coverage								
	Wireless tower radio propagation models							**$38,404**
	Gather data							
	Digital elevation models		4		$520			
	Forest /non-forest data		4		$520			
	Central office locations and other primary infrastructure	8	8	2	$2,132	$50		
	Consolidate composite transportation layer as surrogate for fiber and copper infrastructure (all public roads - over estimate)		8		$1,040			
	Eliminate public land and census blocks with 0 population	6			$585			
	Cable							
	Open public published coverage local government records		36		$4,680			
	Wireless tower radio propagation models							
	Develop radio tower propagation modeling methods		8	1	$925			
	Implement coverage models for published locations		40		$4,000			
	Attribute models by provider	14	2		$1,250			
	Compare to publicly available wireless coverage maps (estimate 46 providers)	52	17		$5,600			
	Wired infrastructure and proximity cost surface modeling							
	DSL							
	Central office locations and other primary infrastructure	8	8	2	$1,650			
	Consolidate composite transportation layer as surrogate for fiber and copper infrastructure (all public roads - over estimate)		8		$800			
	Prepare cost surface using transportation network		6		$600			
	Calculate proximity maximum coverage area for DSL from estimated infrastructure		4		$400			
	Eliminate public land and census blocks with 0 population	6			$450			
	Cable							
	Open public published coverage?		24		$2,400			
	Consolidate ancillary layers as surrogate for cable infrastructure or local government actual coverage	16	16		$2,800			
	Prepare theoretical area of influence (best guess) using incorporated areas with known cable coverage		4	2	$650			
	Calculate proximity maximum coverage area for cable		8		$800			
	Demographic and economic analysis							
	Pre - inventory							
	Census blocks less than and greater than 2 sq miles	8			$780			
	User category - NTIA published specifications - rural, underserved, etc.		3		$390			
	ESRI BA Consumer expenditures by block group apportioned to census blocks with block centroid methods							
	Cable TV		1		$130			
	Broadband off site		1		$130			
	Information Services and Computer IT Expenditures		1		$130			
	Others - get remainder of expenditure record types		8		$1,040			
	Demographic classifications							
	Low income economically disadvantaged		12		$1,560			
	Other demographic and economic and market		16	2	$2,392			
Task 3 - Anchor Institution Rural Broadband Infrastructure Assessment								**$61,738**
	Initial assessment of North Dakota Critical Infrastructure							
	Review Existing ND data and identify any missing anchor institutions by Type	16			$1,560			

		Staff Hours	Lead Staff Hours	Senior Staff/ Manager Hours	Labor Budget	Direct Expenses	Travel	Task Totals
	Compare to ESRI BA info USA SIC/NAICS coded businesses - update state's work from 2006		8		$1,040			
	Develop master database list by type and provide for Traceroute	8			$780		$750	
	Data acquisition							
	Review Results from TraceRoute Call-in			8	$1,248			
	Follow up contact - email and phone				$1,248			
	Develop planning and logistics master plan - anchor institution meetings or surveys			8	$1,248			
	Develop interview and questionnaire forms			8	$1,248			
	Database procedures and logistics for information gathered			8	$1,248			
	Interview targeted anchor institutions			100	$15,600			
	Populate Anchor Infrastructure Characteristics		60		$7,800			
	Develop web service for supporting anchor infrastructure data collection		80		$8,000			
	Prepare infrastructure map from collected information			24	$3,744			
	Provide analysis of how broadband can be used to compliment or integrate existing and planned interoperable communications initiatives							
	Prepare section on coordinating with law enforcement and public safety officials in the state			40	$6,240			
	Prepare section on coordinating with local municipalities and counties throughout the state to identify joint purposes			24	$3,744			
	Prepare section on developing plans for cooperation among state agencies and other data uses and provide a workable, sustainable framework for maintenance of the mapping data.			40	$6,240			
Task 4 - Map Broadband Infrastructure Coverage Polygons and Develop Database								**$64,981**
	Database Collection / Running Results by Providers for confirmation/Comparing independent measurements to providers							
	Broadband Service Availability in Provider's Service Area							
	Prepare Availability by coverage polygon	160	102		$28,860			
	Broadband Service Infrastructure in Provider's Service Area							
	Middle-Mile and Backbone Interconnection Points database entry	135	110		$27,463			
	Run elevation point on polygon to pick up elevation database criteria	4	15		$2,340			
	Overlay broadband coverage map with Category of End User and populate							
	Underserved		15	1	$2,106			
	Un-served		15	1	$2,106			
	Rural area		15	1	$2,106			
Task 5 - Broadband Infrastructure and Coverage NTIA Format								**$55,483**
	Broadband service areas by provider	102	68	2	$19,097	$50		
	Broadband Infrastructure map by provider (point based and statewide)	12	10	2	$2,730			
	Anchor Institutions (statewide)	5	3	1	$1,040			
	Census block by End User (statewide)	4	2	1	$819			
	Address level mapping - Transportation Road Network	30	25		$6,175			
	Address level mapping - Parcel Version				$0			
	Interface with critical infrastructure North Dakota structure mapping and rural addressing				$0			
	Adapt for maintenance component		6	6	$1,716			
	Interface with state master address database structure				$0			
	Composite coverage maps	7	5	1	$1,482			
	Prepare final deliverables							
	DSL	4			$340			
	Cable	4			$340			
	Mobile wireless	4			$340			
	Middle Mile and backbone Interconnection Points	4			$340			
	Anchor Institutions	4			$340			
	Address data by provider (state addresses by parcel and DOR addresses)	4			$340			
	Provider name and users address, advertised rates of transmission, typical rates, user category,	4			$340			
	Maintenance plan	8			$680			
	Coordination with the transfer of data to the NTIA and the Federal Communications Commission (FCC)	14	2		$1,390			
	Summary reports and Submission cover letters for timeframe milestones							

		Staff Hours	Lead Staff Hours	Senior Staff/ Manager Hours	Labor Budget	Direct Expenses	Travel	Task Totals
	Substantially complete available data by 11/01/2009	4			$340			
	Substantially complete set of all broadband mapping data by 02/01/2010	4			$340			
	Complete such data collection by 3/01/2010	4			$340			
	Ensure all data provided by the first collection is accurate as of 06/30/2009	8			$680			
	Prepare section on coordinating with local municipalities and counties throughout the state to identify joint purposes			40	$6,240			
	Prepare section on developing plans for cooperation among state agencies and other data uses and provide a workable, sustainable framework for maintenance of the mapping data.			24	$3,744			
	Review and finalize all reports			40	$6,240			
Data Collection								
Task 1 - Broadband Provider Data Collection								**$37,757**
	Identify list of broadband providers (Based on estimate of 50)	18			$1,755			
	Initial data request to broadband providers		55	2	$7,462	$100		
	Develop and process provider non-disclosure agreements (assume 75%)		55	4	$7,774			
	Detailed request and negotiations with broadband providers (assume 20% success)		92	4	$12,584	$100		
	Mapping and analysis of provider data responses (assume 20% success)	68	8	2	$7,982			
Task 2 - Broadband Infrastructure Inventory of Available Public Data								**$44,142**
	Collect and analyze components							
	Network plans - coarse mapping of market areas		6		$780			
	Internet access facilities	8			$780			
	Government records	8			$780			
	PSC Records - Central offices and Remote terminals / subscriber data and lines	0			$0			
	Web Research	32		2	$3,432			
	PSC Office Research	0			$0			
	Using FCC data and other public sources - Form 477 by providers, zip code data	180			$17,550			
	Reapportion (Zip code or census track) data to census blocks using Business Analyst Block Centroid methods		6	2	$1,092			
	FAA records	8		1	$936			
	Local / tribal government records (Only for Cable- requirement for public bldg leases not addressed)	32			$3,120			
	Analysis of Initial Inventory of Broadband Inventory	12	4	2	$2,002			
	Develop internal geodatabase model for inventory and analysis	24	24	2	$5,772			
	Geographic analysis and mapping - Initial Broadband Inventory	45	15		$6,338			
	First draft broadband coverage maps by provider		8		$1,040			
	Aggregate dissolved broadband coverage predictions by provider		4		$520			
Task 3 - Independent Infrastructure Measurements Using Web-based TeleTraceRouting								**$212,500**
	Design and install web site						$2,000	
	Document and review website specifications		40.0	10	$5,250			
	Design and install web site	125			$9,375			
	Verify website data integrity and accuracy		20.0	10	$3,250			
	Plan and Organize TraceRoute call-in campaign						$4,000	
	Project Kick-off - Coordinate with State Staff		25.0	4	$3,000			
	Develop Informational Materials and Presentations to Recruit Trace-Route Participants		20.0	3	$2,375			
	Set-up List Serve and compile e-mails and contact info for trace-route participants		25.0	4	$3,000			
	ID Key Officials in Each County and Each Tribe work with on Trace-Route Exercise		25.0	4	$3,000			
	Coordinate with Team on sampling methodology for trace-route call-in.		20.0	3	$2,375			
	Set-up informational web site explaining trace-route exercises		20.0	3	$2,375			
	Execute TraceRoute call-in campaign.						$5,000	
	Send Out Press Releases		20.0	3	$2,375			
	Coordinate Trace-Route mailing		20.0	3	$2,375			
	Organize Telephone Tree for call-in Day		20.0	3	$2,375			
	Test call-in procedures, monitor call-in		20.0	3	$2,375			
	Debriefing - Follow-up to Call-in Day		20.0	3	$2,375			

		Staff Hours	Lead Staff Hours	Senior Staff/ Manager Hours	Labor Budget	Direct Expenses	Travel	Task Totals
	Survey print cost				$0	$6,000		
	Postage - Printing				$0	$6,000		
	Contract with survey research lab and mailing center				$0	$8,000		
	Design and Implement TraceRoute Methods and Procedures						$14,000	
	Design TraceRoute analytical procedure		160.00	160	$36,000			
	Implement TraceRoute-based network infrastructure mapping procedure		480.00	63	$55,875			
	Develop DSL-based network coverage and performance estimation			40	$5,000			
	Develop wireless coverage and performance estimation		40.00	6	$4,750			
	Develop cable-based network coverage and performance estimation			80	$10,000			
	Prepare Infrastructure Report			80	$10,000			
Task 4 - Survey Research across Four North Dakota Rural Strata								
	Postage (1st class, 4 mailings of 4 strata, with 1,200 initial sampling size per strata and postage paid return in each)							**$76,570**
	First mailing				$0			
	Second mailing				$0	$4,224		
	Third mailing				$0	$3,379		
	Fourth mailing				$0	$2,702		
	Printing				$0	$2,165		
	Office supplies				$0	$7,100		
	Electronic survey form software (Adobe Acrobat) and email service				$0	$500		
	Study design, survey, electronic form and assist with sample development				$0	$500		
	GIS sampling for each stratification	20	60		$7,800			
	Info USA mailing lists purchase per zip code	8			$780			
	Researching and correcting incorrect contact information	40			$3,900	$9,720		
	Mailing up to three copies of the survey along with hand-signed cover letters	40			$3,120			
	Mailing hand-signed postcard reminder/thank you cards to all contacts	120			$9,360			
	Data entry for surveys	40			$3,120			
	Data clean-up, error checking	40			$3,120			
	Miscellaneous correspondence with study participants		20		$2,080			
	Non-response bias check	20			$1,560			
	Statistical analysis	80	10		$7,280			
Management			40		$4,160			
Task 1 - Project Management, Reporting and Project Administration								
	2009							
	October							**$70,400**
	November	20		20	$4,400	$200	$1,500	
	December	20		20	$4,400	$200		
	2010	20		20	$4,400	$200		
	January							
	February	20		20	$4,400	$200	$1,500	
	March	20		20	$4,400	$200		
	April	20		20	$4,400	$200		
	May	20		20	$4,400	$200	$1,500	
	June	20		20	$4,400	$200		
	July	20		20	$4,400	$200		
	August	20		20	$4,400	$200		
	September	20		20	$4,400	$200		
	October	20		20	$4,400	$200	$1,500	
	November	20		20	$4,400	$200		
Grand Total Costs					**$1,142,014**	**$53,390**	**$68,750**	**$1,264,154**

TETRA TECH EC, INC.

David Highness

SENIOR GIS PROGRAMMER

Summary of Qualifications

- Fifteen years of experience as a professional GIS analyst and cartographer for Tetra Tech, the State of Montana, University of Montana, and as a private consultant.
- GIS project leader for a large economics research project and several large environmental modeling projects.
- Completed many large-scale cartography, GIS and programming projects, including creation of the official Montana highway map, the Idaho Transportation Department District 6 environmental planning GIS database, the Montana Water Quality Web Site, USFS Generalization Tools ArcMap Extension,and Montana Critical Infrastructure Database Model ArcMap Extension and Web Tools.
- Working knowledge of data management, GIS and cartographic tools and programming languages used by federal and state agencies.

Education

- MA, Geography (Cartography and GIS), University of Montana, 1998
- BA, Anthropology (Archaeology), University of Alaska, 1988

Select Project Experience

GIS Services for Environmental Reports, MT, ID, ND, SD, and AZ – As GIS Programmer/Analyst, assisted with cartography and GIS analyses for environmental assessments (EAs) and environmental impact statements (EISs). Major projects include Bitterroot National Forest Weed EIS, Bureau of Land Management (BLM) Blackleaf Canyon EIS, BLM Butte Field Office Resource Management Plan, Helena National Forest Weed EIS, Western Area Power Authority EAs, Florida Power Windfarm EAs, BLM Yuma Field Office Resource Management Plan, Dewey Conveyor Belt EIS, and USFS Lochsa Land Exchange EIS. Projects for the Idaho Transportation Department Include US 20 Corridor Plan, US 93 Corridor Plan, SH 39 Corridor Environmental Scan, and SH 34 & 36 Corridor Environmental Scan.

GIS in Support of Mining Services and Mine Remediation Services, ID, MT, CO, WY, Africa, and South America – GIS Programmer/Analyst responsible for compiling and analysis of data and maps for mine and mine related projects. Major projects include Aerial Image tile preparation and soils layer preparation for ColoWyo Coal Mine, Assisted with data layer creating and mapping on Newmont Gold Mining Company projects from Africa to South America, Assisted with remediation design for Silver Bow Creek Streamside Tailings, and assisted with site monitoring and remediation design for USDA Forest Service New World Mine. USFS Miscellaneous Mine Remediation Projects include Ontario Mine, Montana; Emerald Creek, Idaho; Carpenter Creek, Montana; Tenmile Creek, Montana; and Upper Blackfoot Mining Complex.

GIS Support and Database Analysis for Pre-Disaster Mitigation and Hazard Assessment Projects, MT – GIS Programmer/Analyst responsible for database preparation, GIS analysis and cartographic services in conjunction with planning projects. Projects include Montana Statewide All Hazards Assessment, Pre-disaster Mitigation plans for 10 jurisdictions, Montana Statewide Predisaster Mitigation Plan Update, and Bonner County Predisaster Mitigation Plan.

Web-enabled Mapping Applications, MT, ID, and MI – As GIS Programmer, assisted with system design, programming and implementation on many interactive web site development projects. Many applications include extensive database query functions, file upload, form submission, and dynamic map query. Application development environments include Microsoft Active Server Pages, Java Server Pages, and Visual Studio ASP.Net. Client formats include HTML, Dynamic HTML, JavaScript, CSS, XML/XSLT, and AJAX. Server environments include Windows Servers, Linux Servers, Internet Information Server, Apache Web Server, Tomcat Servlet Engine, SQL Server, Oracle, ESRI Spatial Database Engine, ESRI ArcIMS, and ESRI ArcServer. Major projects include ArcServer Javascript API Web Application, ArcServer Annotation Export Web Application, Montana Critical Infrastructure Database Model web reports, Montana Department of Environmental Quality Clean Water Act Information Center 2006 303d and 305b water body clearinghouse, Gallatin County Map Engine, Montana, Montana Natural Heritage Program Element Occurrence Portal, Montana Department of Public Health and Human Services Syndromic Surveillance System, New World Mine Sampling and Document Library Database, Ingham County CACVoices Map Portal, and Idaho DEQ Total Maximum Daily Load Water Body Clearinghouse

ESRI ArcObjects ArcGIS Applications, ID and MT – As GIS Programmer, assisted with system design, programming and implementation on many ArcGIS

customization projects including creation of custom ArcGIS Extensions. Application development environments include Microsoft Visual Basic for Application and Microsoft Visual Basic. Major projects include GenTools, Montana Critical Infrastructure Database Model Tools, BioSummatic GIS, Fire Incident Mapping Tool, Automated Lightning Mapping System, and Traffic Survey Station Application.

Large Scale Cartographic and GIS Data Conversion Projects, ID, MT, and WA – As GIS Programmer/ Analyst, assisted with creation of large scale cartographic projects and conversion of data from analog to digital format. Major projects include GIS database and global positioning surveys, Digitized three county soil surveys, Digitized sixth code drainage basins, rectified 150 aerial photos of the Upper Yellowstone River, and digitized range health polygons in the Badger Two Medicine area, Cartographic services for the 2001 Official Montana State Highway Map, Cartographic services, MDEQ Carbon Monoxide Emissions Project, Statewide parcel maps, block management area maps, and general maps, Montana Fish, Wildlife and Parks, and Cartography for Regional Economies Assessment Database, University of Montana.

Social Sciences Research Lab Operations, Missoula, MT – As Research Assistant, set policy, supervised staff, and maintained the 40-station computer lab at the University of Montana. Worked with university instructors and students to schedule classes and study times within the lab. Provided technical support to students and instructors on the use of the university network and a variety of statistical, GIS and mapping programs.

Mary Jo Watson

SENIOR GIS ANALYST

Summary of Qualifications

- Eighteen years of experience developing, integrating and maintaining GIS databases for large, multidisciplinary projects for federal, state, and local entities.
- Responsible for data input and export, digitizing, coordinate editing, topology generation, attribute data input, database update and maintenance, habitat and visibility modeling, analytical operations, programming in Arc Macro Language and Avenue, and network systems administration for the GIS network.
- Parcel level address geodatabase development for thousands of parcels across 2 states
- Data preparation for GeoManager system implementation
- Development of Public Involvement maps
- Extensive GIS Modeling and Mapping of over 1400 miles of proposed and alternative routes with over 90 GIS data layers
- Project experience has included large Forest Service NEPA EIS projects.

Education

- BS, Business Administration (Concentration-Computer Info Systems), Menlo College, 1988

Select Project Experience

Idaho Power: Gateway West Transmission Line, ID and WY – Senior GIS Analyst developed parcel level address geodatabase for thousands of parcels across two states. Prepared data for GeoManager Web-based mapping and information management system implementation. Developed public involvement maps, mailing addresses, and databases for multiple states

USDA Forest Service: I-90 Land Exchange EIS, Wenatchee, Gifford Pinchot, and Mt. Baker-Snoqualmie National Forests, WA – GIS analyst for a 100,000+ acre land exchange between three national forests and Plum Creek Timber Company, including EIS production. Project involved extensive coordination with each national forest, Plum Creek, and the U.S. Fish and Wildlife Service and coordination with and evaluation of effects on several Indian tribes. Tasks included extensive data management, map production and overlay analysis.

USDA Forest Service: Upper South Platte Watershed Landscape Assessment, Denver, CO – Lead GIS analyst tasked with data gathering, management, and analysis. Other tasks included developing map products to assist resource team determine watershed restoration concerns, extensive data distribution and general consulting for final map production.

Pacific Fiber Link, LLC: Environmental Permitting, Washington, Oregon, CA – Plotted project route from Mexico to Canada. Accessed data from various sources including cities, counties, the United States Geological Service, and the Internet. Performed habitat analyses associated with city, county, state, and federal permits. Developed spatial overlays and instituted the use of global positioning systems in the field to more efficiently process route information. Generated contours from digital elevation models. Designed a database specific to the needs of the project and maintained and monitored the database.

Ridgeline Airtricity Energy, LLC: Goshen Wind Power Project, ID – GIS analyst on the siting and permitting for Ridgeline Airtricity Energy, LLC's (Ridgeline) proposed 100-megawatt wind farm in southeastern Idaho. Responsibilities included mapping of sensitive areas, development of website for a third party to upload turbine locations, and visual impact analysis.

Altamont Wind Project: Altamont, CA – GIS analyst in support of a wind re-powering project. Duties include data compilation, survey area analysis, and map production.

USDA Forest Service: Green Mountain National Forest, VT – GIS lead in support of delineating roadless areas and recreation opportunity spectrum (ROS) classes with the national forest. Using the guidelines of the Forest Service, roadless areas and ROS classes were identified by locations of roads, trails, harvest, easements, ownership, forest management and existing inventoried roadless areas.

US Navy EFA Northwest: Remedial Action Contract, Data Management and Integration of GIS in support of the UXO Investigation, Adak Island, AK – Tasks included the development of a data management plan that integrates all related project data into a comprehensive project database. The database

stores and manages tabular data, geo-referenced map information, and photographic images. Tabular data consists of raw and processed geophysical data and data describing items evacuated by UXO personnel. Geo-referenced map information includes existing maps of the study area, physical survey data, field positioning or location data collected during geophysical surveys, and intrusive information. Photographic images include scanned photographs of items recovered by UXO personnel and photographs of known ordnance types. This database was developed in Microsoft Access, linked to the digital map information stored in ESRI's ArcView software.

Ketchikan Public Utilities, Swan Lake - Lake Tyee Intertie Project EIS; Ketchikan, AK – Provided GIS support to personnel in defining a 57-mile-long electrical transmission line through a largely unroaded area of the Tongass National Forest. Created field maps and notebooks, projections of data, GPS data retrieval and analysis, surface modeling for Perspective Scene Analysis, orthophoto image manipulation, and extensive habitat modeling.

NW Wind Partners: Goodnoe II (Lower Imrie), Goldendale, WA – Provided GIS support and map production for the wind resource area visual impact analysis. Performed overall viewshed analysis based on turbine layout. Constructed 3-D visual simulations from four key viewing areas.

Goshen Windfarm: Idaho Falls, ID – Performed overall viewshed analysis based on turbine layout. Constructed 3-D visual simulations from four key viewing areas.

Summary of Qualifications

- Seventeen years of experience in GIS data analysis and applications in natural resource management, and rural and urban planning.
- GIS Analyst on projects for more than 200 clients from federal, state, local and tribal governments, private corporations and non-governmental organizations.
- Extensive expertise with the full suite of ESRI GIS programs and modules, including ArcMap, Business Analyst, Spatial Analyst. Experience with extensions to ESRI, including CommunityViz decision support.

Education

- BS, Resource Conservation, 1980, University of Montana

Select Project Experience

Montana Forest Stewardship Program – GIS Analyst for a statewide assessment of forest stewardship potential for non-industrial forest managers and landowners. A model was developed with statewide coverage for vegetation, wildlife, population characteristics, insect and disease, economic variables and other factors, and a regional assessment, supplemented by a weighted average model to a large regional ecosystem analysis. This project was an innovative approach to a White House Initiative for Health Forest Initiatives in the U.S.

DNRC State Trust Lands Division GIS Services and Support for Programmatic EIS for Special Uses – GIS analyst, coordinating with forest economists and economic advisors from the Montana Bureau of Business and Economic Analysis in assisting the DNRC in a geospatial modeling and economic forecasting of potential value of school trust lands in Montana. Geodata provided support with ESRI Business Analyst for demographic and economic analysis and residential growth modeling at a fine filter geographic scale on a statewide basis for all state trust lands in Montana.

GIS Statewide Ownership Data Acquisition – GIS Analyst creating a statewide ownership GIS map for all state trust lands, based on the master list provided by the DNRC lands staff. The scope of Geodata's task was to parse the legal descriptions and construct a process to update and correct the previous public land ownership layer.

Montana Rural Fire Districts Digital Data Creation and Acquisition – GIS Analyst digitizing boundaries of local government fire departments for 24 counties in Montana. The project purpose was to overlay local government fire jurisdictions with U.S. Forest Service lands and commercially viable private forest lands and assess structural fire protection geographic coverage throughout Montana.

Montana Critical Infrastructure Mapping and Geodatabase Design – GIS Analyst for a series of competitive contracts between 2004 and 2006 with the Montana Department of Administration to map critical structures throughout the state of Montana, and design a multi-user geodatabase model for critical infrastructure. Over 1,200 critical structures throughout the state of Montana were mapped and attributed.

Rocky Mountain Elk Foundation M.A.P. Habitat™ – GIS Analyst for RMEF for the last 12 years, supporting national strategic planning efforts with GIS mapping, modeling and collaborative support. Under an indefinite delivery contract with the Rocky Mountain Elk Foundation, Geodata conducted the GIS support for the M.A.P. Habitat™ North American Elk Habitat Project, an expert system wildlife habitat mapping project completed in 1999 throughout North America.

Nebraska Statewide Biomass Energy Assessment – GIS Analyst, working with Camas Creek Enterprises, Inc. to conduct an assessment of biomass energy potential for the state of Nebraska. Using ESRI Business Analyst and other GIS tools, the project surveyed via mailed questionnaires, all the secondary wood processors in Nebraska. Combined with independent research from the Nebraska Forest Service, municipal urban forestry programs and other sources, a complete inventory was conducted of woody biomass potential supply and demand for the state.

US Fish and Wildlife Service Strategic Planning Processes – GIS Analyst, supported USFWS staff for two regional ecosystem plans involving extensive GIS data development and modeling for two large ecosystems in the Northern Rockies and the Great Plains, with the two processes covering Montana, Wyoming, Colorado, Nebraska, Kansas and

Oklahoma. The strategic planning process was developed at a watershed level, and mapped entire multi-state regions analyzing listed species, migratory birds, native habitat, landscape factors, adjoining conservation and protected lands, public/private partnerships and threats for watersheds throughout both regional ecosystems.

Heart of the Rockies Initiative Land Trust Working Group – GIS Analyst, modeling and collaborative mapping workshops since 2002 for a consortium of 24 local, state and national land trusts with a common objective to identify high value private land for conservation and establish shared 10 year conservation goals for the areas surrounding and linking three world class ecosystems in the Northern Rockies of Alberta, British Columbia, Idaho, Montana and Wyoming.

Sonoran Institute Growth Model for the Western US – GIS Analyst, developing a growth planning and allocation model joined with a geospatial statistical model using random choice logic, combining macro and micro economic and demographic analysis with fine scale distance to amenities and services measures to develop an adaptable model and GIS methodology for predicting and allocating residential growth in the urban interface communities throughout the Western US.

American Bird Conservancy Species Habitat Models for Western US – GIS Analyst, in contract to assist in regional bird habitat assessment spanning bird conservation regions 9 and 10 covering an area from the US and Canadian border to Mexico in nine western states. The project included spatial modeling of habitat for 21 bird species, integrating the northwest and southwest regional GAP (REGAP) analysis, conversion and analysis of regional land cover and wetland mapping, integration of National Resource Conservation Service (NRCS) private conservation lands such as EQIP, WHIP, CRP.

Highway Wildlife Linkage Area Mapping, Montana and Idaho – GIS Analyst between 2004-2008 consulting with the US Fish and Wildlife Service, the Idaho Transportation Department and the Idaho Fish and Game to develop highway wildlife linkage areas in western Montana and the entire state of Idaho. Idaho recently was awarded the 2009 Exemplary Human Environment Initiatives and the Exemplary Ecosystem Initiatives by the Federal Highway Administration for these efforts.

Ellen Jackowski

GIS ANALYST

Summary of Qualifications

- More than 5 years of experience as a GIS analyst. Experience includes maintaining and updating GIS database records, and producing a variety of map products for investigative reports for government and commercial energy clients, including Idaho Power, Seattle City Light, Marathon Oil, USDA Forest Service, Blythe Energy LLC, and West Hill Windenergy, LLC.
- Experience with digitizing data and CAD data conversion and manipulation, and coordinating system conversions for a variety of GIS applications.
- Work products have included Lidar-derived maps that include slope, shaded relief, and contours.
- Geography training includes fluvial geomorphology, hydrology, remote sensing, cartography, statistical analysis, geographic theory, and technical writing.

Education

- Various Coursework, Geography and Geomatics, University of Florida, 2002
- BS, Geography and Classical Studies, University of Florida, 2001

Select Project Experience

Verizon Wireless: Cell Tower Siting, OR and WA – Created ½-mile radius survey map and 1:24,000 scale GIS maps for proposed individual cell towers. Initial project included 17 cell tower sites. Converted spot coordinates from degrees, minutes, seconds to decimal degrees and then imported site coordinates from Excel. Manually digitized both spot locations and areas of interest near the cell tower sites. Base map for each site 1:24,000 topographic maps.

Idaho Power: Gateway West Transmission Line, ID and WY – Collect and pre-process datasets to be used in running routing simulations. Obtain County parcel datasets and select parcels within proposed project area for property access agreements. Maintain an updated parcel dataset as the proposed route and alternatives are updated. Acting wildlife GIS specialist responsible for maintaining and responding to wildlife data requests for EIS writers. Create a 75 map series showing affected seasonal constraints along the proposed and alternative routes for special species of interest.

Marathon Oil Company: POD Reconnaissance Investigation, Gillette, WY – Supported engineers and project leads by producing a variety of six 1:2,000 foot scale for investigation reports. Imported well locations from Excel into ArcGIS, creating point shapefiles. Data processing included CAD data conversions and manipulations in ArcGIS, and coordinate system point conversions for proposed and existing coal-bed methane well pits and reservoirs. Produced LIDAR-derived products including slope, shaded relief and 10-foot and 2-foot contours. Digitized site surface geology maps. Specific POD reconnaissance sites included Railroad, Knudson 9, Burgess 30 and Campbell 5.

Confidential Client: California Wind Farm, Solano County, CA – Searched Solano County Property Assessor parcel books on-line property assessor records that would enable the project staff to access privately owned lands. Provided the preliminary records search and methodology for obtaining site records and calculating property acreage.

Idaho Power: Boardman to Hemingway Transmission Line, OR and ID – Collect and pre-process datasets for routing simulations and transmission line use constraints. Collect and compile county parcel datasets for the proposed and alternative route corridors.

Public Utility District No. 1 of Okanogan County: Methow Transmission Project Environmental Impact Statement, Okanogan County, WA – Supported project mapping needs for the Draft EIS report and other figures required for field work and publication. Updated transmission line status layout (1:24,000 scale maps) for Pateros-Twisp, Valley Floor and Loup-Loup routes. Revised DEIS maps. Digitized percent of line survey for all routes and calculated distance by survey type, resulting in a 1:24,000-scale map series. Provided continued project support during the development of the Right-of-Way Grant Application in 2008.

USDA Forest Service: Tongass National Forest Forestry Alternatives, AK – Compiled multiple sources of GIS roads layers and on-screen digitized where imagery was available and roads coverage did not already exist. The extent of this effort was for the entire non-forest service land within the Tongass National Forest. A similar analysis was performed for identifying older and more recent areas of clear cut forest. Provided output in a layer attributed with

each original source. Sources for original data included Sealaska, State of Alaska, Forest Service, and native lands.

USDA Forest Service: Region 6 Annotation Project, OR and WA – Creating seamless annotation coverage for quadrangles within Region 6 National Forests. Process involves converting annotation coverage from CAD drawing files to coverage, and then importing the coverage annotation and placing each into its respective geographic location. Groups of 15 quadrangles are placed each week, sent to the USDA Forest Service for review, and then returned for additional edits before a final product is delivered. Forests covered to date include Siskiyou, Rogue River, Umpqua, Willamette, Baker-Snoqualmie, Olympic, Mt. Hood and Gifford Pinchot National Forests.

Seattle City Light: Boundary Dam FERC No. 2144, WA – Primary GIS support and analysis for FERC relicensing project for the Boundary Dam in Pend Oreille County, Washington. Base project management includes making sure most recent approved data layers are available to the project team, data and maps are delivered to our clients in a timely fashion. Provide field maps to supporting teams. Obtained and scanned historical aerial photography for Erosion study. Created draft maps and provided field map support for Mainstem Aquatic Habitat Modeling Study. Provided field, draft, and interim report maps for Fish Distribution, Timing and Abundance Study. Created draft and final interim report figures for Large Woody Debris Management Study. Finalized draft and final interim report figures for Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats Study. Provided field, draft and final report maps for seven Botanical and Wildlife Resource studies. Provided field, draft and final report maps for Recreation and Land Use studies. Collate year 2007 interim report datasets and create and produce metadata and data products for the client's data repository.

USDA Forest Service, Updating Administrative Boundaries Pilot Study, Northern CA and SC – Updating administrative boundaries in South Carolina for the calculation of PILT, based on the area of each political boundary that lies within National Forest System land. Updated South Carolina county boundary layer for counties within and adjacent to Sumter and Francis Marion national forests. Updates were made based on updated proclaimed boundaries for the national forests and county legal descriptions. Made similar adjustments to the South Carolina state boundary, South Carolina ranger district boundaries, South Carolina National Forest System administrative boundaries and U.S. Congressional District boundaries. Same process was repeated for forests in northern California.

Horizon Wind, Bedford-Blair Wind Mapping, PA – Obtained data and created three maps utilizing land use, sensitive wildlife habitat, geologic, wetland, and site location maps for Bedford and Blair county potential wind mapping EIS report.

West Hill Windenergy, LLC: West Hill Wind Site, NY – Created maps for location of a local transmission line. Produced aerial photography, wetland, land use/land cover, topographic, national resource, historic and archeological maps of the site for the draft EIS report. Performed orthorectifcation of historic aerial maps to current topographic maps in ArcGIS. Performed on-screen digitizing of the transmission line from scanned PDF maps.

FPL Energy: Sky River Wind Turbines, CA – Provided profile and 3-D viewshed maps for thirteen strings of existing wind turbines to look at the potential for the placement of interest turbine upgrades for 1.5MW turbines using ArcScene. Map layout was then created in ArcGIS displaying a birds' eye view of the turbines in a north-south direction as well as perpendicular profiles of the turbines from an east-west as well as a distance profile.

UPC Wind: Map Portfolio, USA and Canada – Created and updated wind maps for sites throughout the US and Canada, including Hawaii, Alaska, Ontario, Nova Scotia, New Brunswick, New Hampshire, Maine, New York, and other states. Each map featured a topographic or image background, supplied with available project site data, and available NREL wind mapping data. Maps also featured turbine locations, if existing.

Paul DeWolfe, PE

SENIOR TELECOM ANALYST

Summary of Qualifications

- Over 30 years experience in telecommunications consulting, systems analysis and structural engineering providing creative solutions for challenging client needs

Education

- BS, Civil Engineering, 1979, Washington University in St. Louis
- MS, Structural Engineering, 1983, University of Southern California

Select Project Experience

BTOP/BIP Project Certifications – Provided professional engineering reviews of four applications (two in Montana, one each in Idaho and Nebraska) for ARRA BTOP/BIP first round funding. Assessed each design for ability to deliver applicants claimed downstream/ upstream data rates. Assessed each applicant's ability to meet build-out schedule

North Central Idaho Telecom Assessment and Implementation Plan – Developed technical assessment of the broadband needs for 16 unserved and underserved rural communities in four counties. Facilitated over 20 community meetings to identify current internet uses, future demand, and infrastructure deficits. Assessed available technologies to meet infrastructure deficits. Recommended pursuit of funding for region-wide backbone network. Worked with five wired and wireless broadband providers to identify current infrastructure capacity and future capital requirements.

North Central Idaho Wireless Wide Area Network Schematic Design – Based on results of Telecom Assessment and Implementation Plan (above), developed a region-wide schematic design for a wireless WAN providing 200Mbps full-duplex to each community in original study. Expanded design to incorporate needs of underserved communities in a fifth county. Worked with Community Anchor Institutions to identify their requirements for broadband internet and private data circuits. Identified current broadband and WAN expenditures of anchor institutions. Developed WAN design with 5-year payback based on current expenditures.

Elk River, Idaho Wireless Broadband Design and Deployment – Assisted Elk River Library with successful USDA Rural Development Community Connect Grant application. Designed and built wireless mesh broadband network to serve entire town. Worked with local government and fire protection to incorporate their requirements into design. Designed and contracted for wireless broadband backhaul circuit.

LATA Boundary Infrastructure Gap Design and RFP Development – Worked with State of Idaho, Idaho County, and other anchor institutions to define communications requirements for traffic across current LATA boundary gap. Wrote technology-neutral RFP soliciting services from existing providers.

Grand Forks Broadband Business Development Roadmap – Defined current broadband availability in rural communities surrounding Grand Forks Air Force Base. Defined unmet broadband demand through community meetings and one on one interviews with anchor institutions. Identified other unmet community telecommunications needs (cellular voice, public safety radio/mobile data). Worked with wireline, wireless, and cable providers to identify existing infrastructure. Proposed public-private partnership to build common infrastructure to fill unmet telecommunications needs. Identified four potential sites for towers. Provided design specifications for tower sites to support cellular, broadband and public safety services.

Pete Weber

SENIOR TELECOM ANALYST

Summary of Qualifications

- Over 15 years experience in telecommunications design and construction, wireless LAN/WAN engineering and telephony systems

Education

- BA, Psychology, Wheaton College, 1993

Select Project Experience

Elk River, Idaho Wireless Broadband Design and Deployment – Designed and built wireless mesh broadband network to serve entire town. Worked with local government and fire protection to incorporate their requirements into design. Designed and contracted for wireless broadband backhaul circuit.

LATA Boundary Infrastructure Gap Design and RFP Development – Worked with State of Idaho, Idaho County, and other anchor institutions to define communications requirements for traffic across current LATA boundary gap. Wrote technology-neutral RFP soliciting services from existing providers.

Campus Infrastructure Design: Montana Tech, Butte, MT – Designed and managed construction of inside and outside plant cabling for twelve existing buildings on the Tech campus. Provided design and systems integration services for new Petroleum Engineering building. Provided design and construction administration services for new campus data center.

Wireless Backbone Design/Build Projects –

- Designed and installed 23-mile wireless LAN extension for Barrett Minerals, Dillon, MT
- Designed and installed 6-mile wireless LAN extension for Crazy Mountain Ranch, Clyde Park, MT

Helena Public Schools: New Telephone System and WAN, Helena, MT – Designed and administered construction of 19-site wide area network to support broadband and voice services. Designed, managed construction and provided independent test and verification for 19-site, 1,200-handset telephone system.

Flathead County: New Telephone System, Kalispell, MT – Designed and administered construction of new county-owned telephone system. Designed and administered procurement of new telco services that reduced county expenditures by $12,000.

Crazy Mountain Ranch: IT Infrastructure, Clyde Park, MT – Designed and administered construction of voice, data and TV networks for 150-bed corporate retreat center. Designed and built 6-mile wireless LAN extension to deliver broadband service to Crazy Mountain Ranch. Designed and administered procurement of 150-handset distributed telephone system. Designed and administered procurement of broadband WAN link to corporate headquarters in New York. Designed and administered construction of 6-mile buried fiber optic line to replace wireless for increased bandwidth, reliability. Designed buried fiber extension to new staff housing project.

Paws Up Ranch: IT Infrastructure, Potomac, MT – Designed and administered construction of fiber optic network to support TV, internet and voice services for 100-bed guest ranch. Designed and managed procurement of VOIP hospitality telephone system and related telco services. Designed/built wireless LAN extensions to remote buildings. Negotiated placement of cellular tower on property and service agreement between Owner and provider.

APPENDIX C

ADDITIONAL PRODUCTS FROM SIMILAR PROJECTS

(PROVIDED ON CD)

Additional Projects Relevant to the North Dakota Broadband Mapping Project
(Provided on the enclosed CD-ROM)

Filename	Contents
CISDM Data.doc	List of critical structures included in final data model
CISDM_20060615_Schema.pdf	Very large schematic of geodatabase model design
CISDMFunctionalTestAppendix.doc	Technical Appendix – Detailed Results of Functional Tests of Montana Critical Infrastructure and Structures Data Model
CISDMFunctionalTestReport.doc	Montana Multi-User Geodatabase Model for Critical Infrastructure and Structures Functional Testing Report
GatewayWestROEStatusReport.pdf	Gateway West Right of Entry Status Report - Created 9-15-2009
Existing Infrastructure Inventory.pdf	Communities Served by Broadband Providers
Montana_CIS_Data_Model_Report.doc	Multi-user Geodatabase Model for Critical Infrastructure and Structures
Montana_CIS_Data_Model_Report_20060615.doc	Multi-user Geodatabase Model for Critical Infrastructure and Structures Revision 2006.06.15.1
Montana_CIS_Data_Model_Report_20060615.pdf	Multi-user Geodatabase Model for Critical Infrastructure and Structures Revision 2006.06.15.1 (same as previous in pdf form)
Montana_CIS_Data_Model_Resources.doc	Resources for Multi-user Geodatabase Model for Critical Infrastructure and Structures
MR-187 Kenosha County Wireless Plan.pdf	Regional wireless Plan implementation
MT_Emergency_Facilities.mdb	Personal Geodatabase – mapped critical infrastructure points
NorthernExposureFinalReport.doc	Final Report - Testing the Montana Critical Infrastructure Data Model During the Northern Exposure Pandemic Flu Exercise
SEWRPC PR-51 Chapter 6.pdf	Wireless telecommunications Performance inventory findings

APPENDIX D

DUN AND BRADSTREET REPORT

DNBi®
Risk Management

ATTN: Elizabeth Hall
Report Printed: September 22, 2009

Live Report : TETRA TECH EC, INC.

D-U-N-S® Number: 12-897-4271
Trade Names: (SUBSIDIARY OF TETRA TECH, INC., PASADENA, CA)
Endorsement/Billing Reference: Elizabeth.Hall@tteci.com

D&B Address

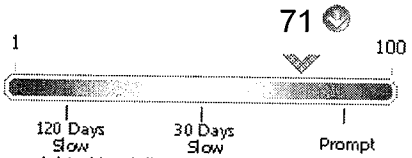
Address 1000 The American Rd
Morris Plains,NJ - 07950
Phone 973 630-8000
Fax

Location Type Headquarters (Subsidiary)
Web www.ttfwi.com

Score Bar

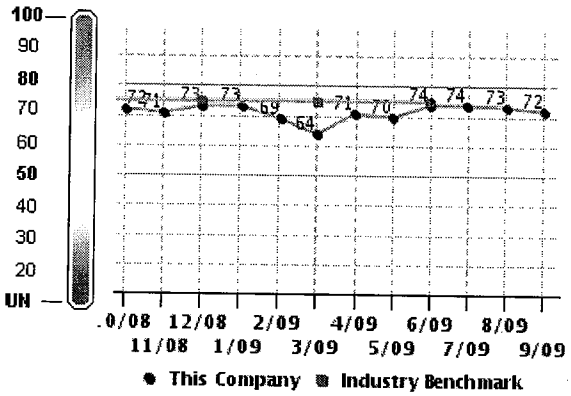
PAYDEX®	72
Commercial Credit Score Class	2
Financial Stress Class	1
Credit Limit - D&B Conservative	$400,000.00
D&B Rating	1R4

D&B 3-month PAYDEX®



When weighted by dollar amount, Payments to suppliers average 14 Days Beyond Terms

PAYDEX® Trend Chart



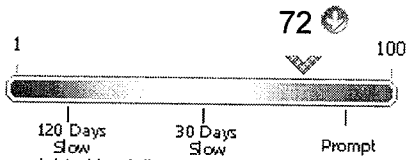
D&B Company Overview

This is a headquarters (subsidiary) location

Branch(es) or Division(s) exist	Y
Chief Executive	DONALD ROGERS , CHB-CEO
Year Started	2003
Employees	1057 (141 Here)
SIC	8748
Line of business	Business environmental consulting services
NAICS	541618
History Status	CLEAR

Commercial Credit Score Class

D&B PAYDEX®



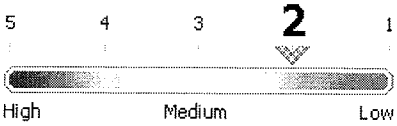
When weighted by dollar amount, Payments to suppliers average 12 days beyond terms

Public Filings

The following data includes both open and closed filings found in D&B's database on this company.

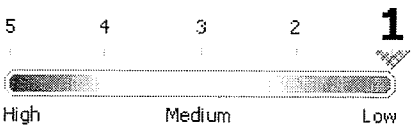
Record Type	Number of Records	Most Recent Filing Date
Bankruptcies	0	-
Judgments	0	-
Liens	7	01/16/08
Suits	1	03/16/05
UCC's	36	07/07/09

The public record items contained herein may have been paid, terminated, vacated or released prior to todays date.



Low To Moderate risk of severe payment delinquency over next 12 months.

Financial Stress Score Class



Low risk of severe financial stress over the next 12 months.

Corporate Linkage

Parent

Company	City , State	D-U-N-S® NUMBER
TETRA TECH, INC.	PASADENA , California	04-522-4250

Subsidiaries (Domestic)

Company	City , State	D-U-N-S® NUMBER
TETRA TECH FACILITIES CONSTRUCTION, LLC	ALEXANDRIA , Virginia	79-252-8692
THE DELANEY GROUP INC	GLOVERSVILLE , New York	79-903-5477

Branches (Domestic)

Company	City , State	D-U-N-S® NUMBER
TETRA TECH EC, INC.	RICHLAND , Washington	11-964-4982
TETRA TECH EC, INC.	OAK RIDGE , Tennessee	12-125-1701
TETRA TECH EC, INC.	DENVER , Colorado	12-928-0421
TETRA TECH EC, INC.	LANGHORNE , Pennsylvania	12-991-4078
TETRA TECH EC, INC.	BOTHELL , Washington	12-930-2597
TETRA TECH EC, INC.	BOSTON , Massachusetts	12-946-8448
TETRA TECH EC, INC.	HUNTSVILLE , Alabama	12-997-0260
TETRA TECH EC, INC.	NORCROSS , Georgia	12-997-0385
TETRA TECH EC, INC.	SANTA ANA , California	12-979-0437
TETRA TECH EC, INC.	SAN DIEGO , California	12-960-8217
TETRA TECH EC, INC.	POULSBO , Washington	12-984-4291
TETRA TECH EC, INC.	RANCHO CORDOVA , California	12-974-9888
TETRA TECH EC, INC.	STUART , Florida	12-979-3662
TETRA TECH EC, INC.	SAN ANTONIO , Texas	60-846-6160
TETRA TECH EC, INC.	LOWELL , Massachusetts	95-678-5604
TETRA TECH EC, INC.	NORFOLK , Virginia	79-698-3893
TETRA TECH EC, INC.	DENVER , Colorado	02-253-0571
TETRA TECH EC, INC.	CAMARILLO , California	00-419-6199
TETRA TECH EC, INC.	PORT LAVACA , Texas	61-848-7545
TETRA TECH EC, INC.	POWDERLY , Texas	60-230-1173

Affiliates (Domestic)

Company	City , State	D-U-N-S® NUMBER
TETRA TECH NUS, INC.	PITTSBURGH , Pennsylvania	00-413-3976
ARD, INC	BURLINGTON , Vermont	00-403-5127
WESTERN UTILITY CONTRACTORS, INC.	PARK FOREST , Illinois	01-518-5234
GEOTRANS, INC.	STERLING , Virginia	03-879-4855
ARDAMAN & ASSOCIATES, INC.	ORLANDO , Florida	06-025-3853
TETRA TECH, INC.	LONGMONT , Colorado	06-274-0667
COSENTINI ASSOCIATES LLP	NEW YORK , New York	06-496-2079
TETRA TECH EXECUTIVE SERVICES, INC.	PASADENA , California	36-263-0480
TESORO CORPORATION	VIRGINIA BEACH , Virginia	11-994-6515
BRYAN A. STIRRAT & ASSOCIATES	DIAMOND BAR , California	12-086-3857
ENGINEERING MANAGEMENT CONCEPTS, INC.	CAMARILLO , California	13-934-1978
ROTHBERG, TAMBURINI & WINSOR, INC.	DENVER , Colorado	14-949-1987
TETRA TECH TECHNICAL SERVICES, INC .	PASADENA , California	17-708-7181
TETRA TECH EM, INC.	CHICAGO , Illinois	17-859-9221
DELANEY CRUSHED STONE PRODUCTS, INC.	GLOVERSVILLE , New York	19-426-4362
TETRA TECH CONSTRUCTION SERVICES, INC.	LITTLETON , Colorado	62-327-5567
ADVANCED MANAGEMENT TECHNOLOGY, INC.	ARLINGTON , Virginia	78-184-1671
SCIENCES INTERNATIONAL, INC	ARLINGTON , Virginia	80-592-1467
EVERGREEN UTILITY CONTRACTORS INC	WOODINVILLE , Washington	14-424-7236
INCA ENGINEERS INC	BELLEVUE , Washington	10-339-2619
THE DELANEY GROUP INC	GLOVERSVILLE , New York	14-450-8983
TETRA TECH INTERNATIONAL, INC.	PASADENA , California	80-121-6065
P L WJA L C	SEATTLE , Washington	14-460-9182
TETRA TECH ALASKA, LLC	JUNEAU , Alaska	82-615-6700
THE INSTITUTE FOR PUBLIC-PRIVATE PARTNERSHIPS, INC.	ARLINGTON , Virginia	87-271-1031

This list is limited to the first 25 affiliates.
For the complete list,Please logon to DNBi and view the Dynamic Family Tree Information.

Affiliates (International)

Company	City , Country	D-U-N-S® NUMBER
Wardrop Engineering Inc	Mississauga , CANADA	20-435-4807

Predictive Scores

Credit Capacity Summary

This credit rating was assigned because of D&B's assessment of the company's financial ratios and its cash flow. For more information, see the " D&B Rating Key".

D&B Rating : 1R4

Number of employees: 1R indicates 10 or more employees
Composite credit appraisal: 4 is limited

The 1R and 2R ratings categories reflect company size based on the total number of employees for the business. They are assigned to business files that do not contain a current financial statement. In 1R and 2R Ratings, the 2, 3, or 4 creditworthiness indicator is based on analysis by D&B of public filings, trade payments, business age and other important factors. 2 is the highest Composite Credit Appraisal a company not supplying D&B with current financial information can receive.

Below is an overview of the company's rating history since 03-15-

Number of Employees 1,057 (141 here)

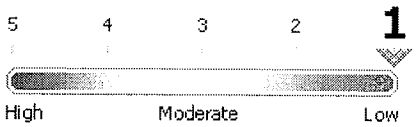
2003	Total:

D&B Rating	Date Ap[illegible]
1R4	04-28-2005
1R3	05-01-2003
--	03-15-2003

Payment Activity:	**(based on 250 experiences)**
Average High Credit:	$8,427
Highest Credit:	$600,000
Total Highest Credit:	$1,708,650

D&B Credit Limit Recommendation

Conservative credit Limit	$400,000
Aggressive credit Limit:	$900,000
Risk category for this business :	**LOW**

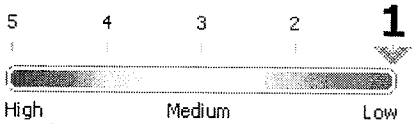


This recommended Credit Limit is based on the company profile and on profiles of other companies with similarities in size, industry, and credit usage. Risk is assessed using D&Bs scoring methodology and is one factor used to create the recommended limits. See Help for details.

Financial Stress Class Summary

The Financial Stress Class Summary Model predicts the likelihood of a firm ceasing business without paying all creditors in full, or reorganization or obtaining relief from creditors under state/federal law over the next 12 months. Scores were calculated using a statistically valid model derived from D&Bs extensive data files.
The Financial Stress Class of 1 for this company shows that firms with this classification had a failure rate of 1.2% (120 per 10,000), which is lower than the average of businesses in D & B's database

Financial Stress Class :



Low risk of severe financial stress, such as bankruptcy, over the next 12 months.

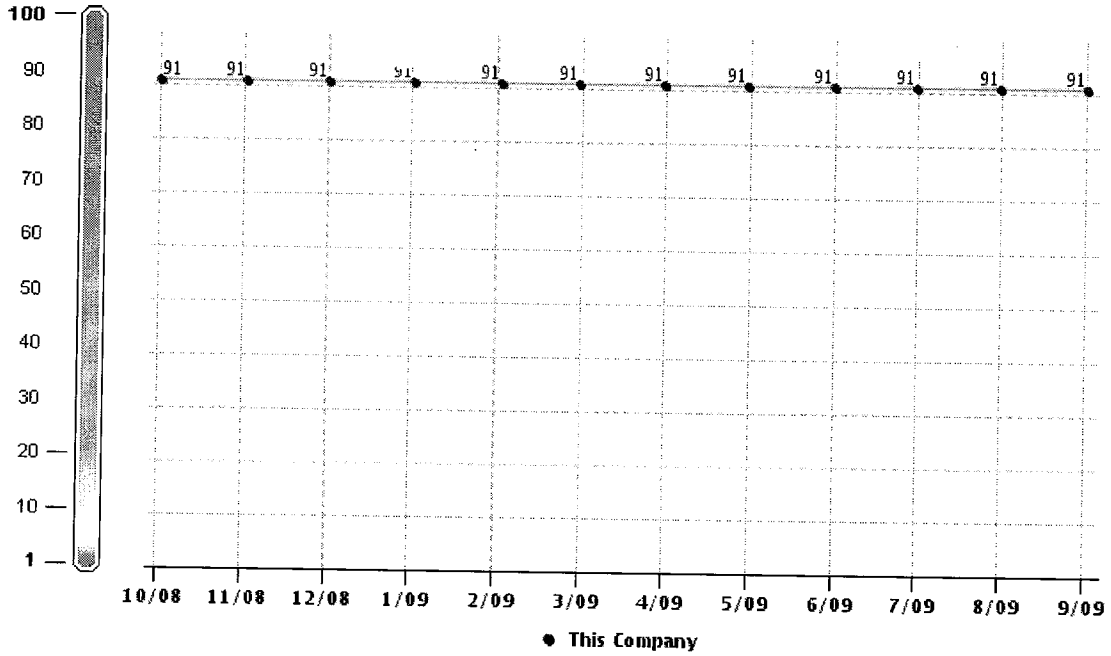
Incidence of Financial Stress:

- Among Businesses with this Classification: **1.20 %** (120 per 10000)
- Average of Businesses in D&Bs database: **2.60 %** (260 per 10000)
- Financial Stress National Percentile : **91** (Highest Risk: 1; Lowest Risk: 100)
- Financial Stress Score : **1468** (Highest Risk: 1001; Lowest Risk: 1875)

The Financial Stress Class of this business is based on the following factors:

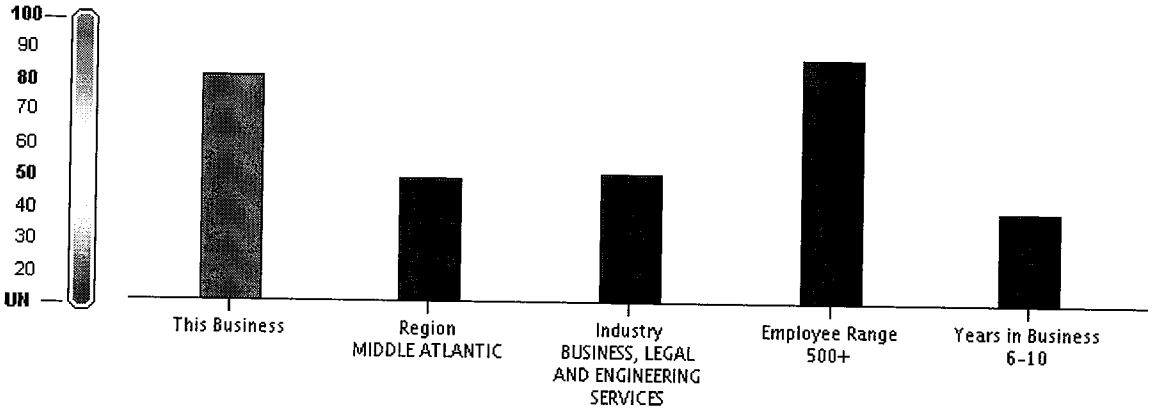
- Control age or date entered in D & B files indicates higher risk.

Financial Stress Percentile Trend:



Notes:

- The Financial Stress Class indicates that this firm shares some of the same business and financial characteristics of other companies with this classification. It does not mean the firm will necessarily experience financial stress.
- The Incidence of Financial Stress shows the percentage of firms in a given Class that discontinued operations over the past year with loss to creditors. The Incidence of Financial Stress - National Average represents the national failure rate and is provided for comparative purposes.
- The Financial Stress National Percentile reflects the relative ranking of a company among all scorable companies in D&Bs file.
- The Financial Stress Score offers a more precise measure of the level of risk than the Class and Percentile. It is especially helpful to customers using a scorecard approach to determining overall business performance.
- All Financial Stress Class, Percentile, Score and Incidence statistics are based on sample data from 2004



Norms	**National %**
This Business	91
Region: MIDDLE ATLANTIC	50
Industry: BUSINESS, LEGAL AND ENGINEERING SERVICES	52
Employee range: 500+	99
Years in Business: 6-10	37

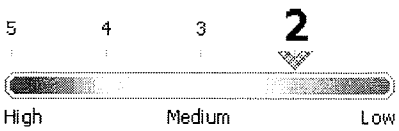
This Business has a Financial Stress Percentile that shows:

Lower risk than other companies in the same region.
Lower risk than other companies in the same industry.
Higher risk than other companies in the same employee size range.
Lower risk than other companies with a comparable number of years in business.

Credit Score Class Summary

The Credit Score class predicts the likelihood of a firm paying in a severely delinquent manner (90+ Days Past Terms) over the next twelve months. It was calculated using statistically valid models and the most recent payment information in D&Bs files.
The Credit Score class of 2 for this company shows that 4.6% of firms with this classification paid one or more bills severely delinquent, which is lower than the average of businesses in D & B's database.

Credit Score Class :



Moderate risk of severe payment delinquency over next 12 months.

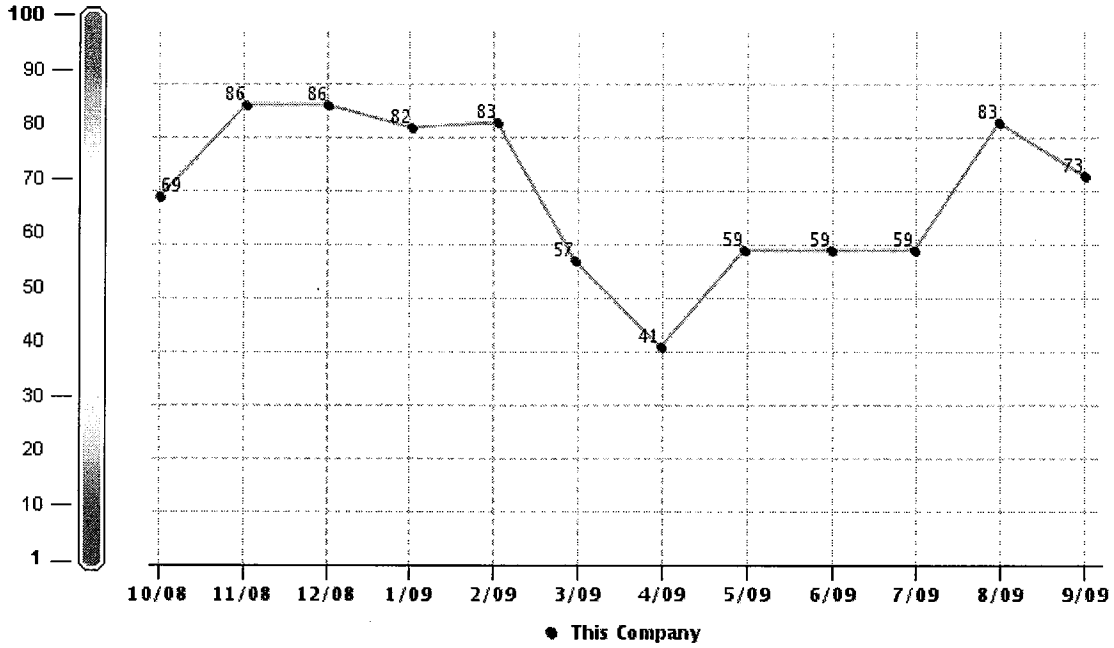
Incidence of Delinquent Payment

- Among Companies with this Classification: **4.60 %**
- Average compared to businesses in D&B's database: **20.10 %**
- Credit Score Percentile : **78** (Highest Risk: 1; Lowest Risk: 100)
- Credit Score : **510** (Highest Risk: 101; Lowest Risk:670)

The Credit Score Class of this business is based on the following factors:

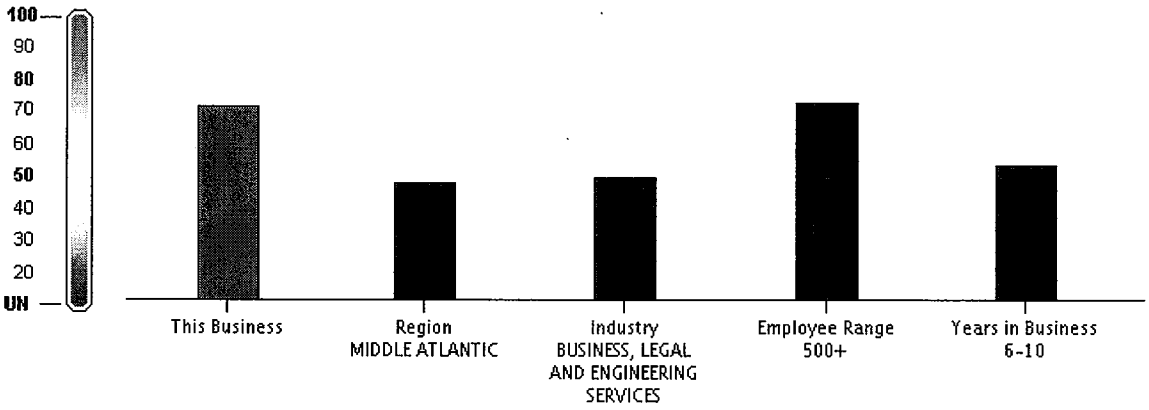
- Payment information indicates negative payment comments.

Credit Score Class Percentile Trend:



Notes:

- The Credit Score Class indicates that this firm shares some of the same business and payment characteristics of other companies with this classification. It does not mean the firm will necessarily experience delinquency.
- The Incidence of Delinquent Payment is the percentage of companies with this classification that were reported 90 days past due or more by creditors. The calculation of this value is based on an inquiry weighted sample.
- The Percentile ranks this firm relative to other businesses. For example, a firm in the 80th percentile has a lower risk of paying in a severely delinquent manner than 79% of all scorable companies in D&Bs files.
- The Credit Score offers a more precise measure of the level of risk than the Class and Percentile. It is especially helpful to customers using a scorecard approach to determining overall business performance.
- All Credit Class, Percentile, Score and Incidence statistics are based on sample data from 2004



Norms **National %**

This Business	78
Region: MIDDLE ATLANTIC	47
Industry: BUSINESS, LEGAL AND ENGINEERING SERVICES	49
Employee range: 500+	79
Years in Business: 6-10	54

This business has a Credit Score Percentile that shows:

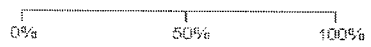
Lower risk than other companies in the same region.
Lower risk than other companies in the same industry.
Higher risk than other companies in the same employee size range.
Lower risk than other companies with a comparable number of years in business.

Trade Payments

Payment Habits

For all payment experiences within a given amount of credit extended, shows the percent that this Business paid within terms. Provides number of experiences to calculate the percentage, and the total credit value of the credit extended.

$ Credit Extended	# Payment Experiences	$ Total Dollar Amount	% of Payments Within Terms
Over 100,000	2	$700,000	100%
50,000-100,000	3	$215,000	34%
15,000-49,999	17	$420,000	65%
5,000-14,999	24	$175,000	63%
1,000-4,999	47	$90,500	74%
Under 1,000	100	$25,950	73%



Based on payments collected over last 12 months.
For all Payment experiences reflect how bills are met in relation to the terms granted. In some instances, payment beyond terms can be the result of disputes over merchandise, skipped invoices etc.

Payment Summary

There are 250 payment experience(s) in D&Bs file for the most recent 12 months, with 135 experience(s) reported during the last three month period.
The highest **Now Owes** on file is $90,000 . The highest **Past Due** on file is $15,000
Below is an overview of the company's dollar-weighted payments, segmented by its suppliers' primary industries:

	Total Revd (#)	Total Dollar Amts ($)	Largest High Credit ($)	Within Terms (%)	Days Slow (%) <31	31-60	61-90	90>
Top Industries								
Telephone communictns	20	15,450	10,000	95	4	1	0	0
Nonclassified	19	78,750	25,000	97	3	0	0	0
Electric services	10	5,500	2,500	73	27	0	0	0
Whol electrical equip	8	136,000	70,000	15	9	35	26	15
Public finance	6	30,900	25,000	100	0	0	0	0
Short-trm busn credit	6	21,600	20,000	99	1	0	0	0
Misc business service	6	16,500	15,000	99	1	0	0	0
Whol furniture	6	13,500	5,000	22	55	19	0	4
Whol durable goods	6	13,550	5,000	91	9	0	0	0
Mfg photograph equip	5	118,500	95,000	54	46	0	0	0
Misc advertising svcs	5	23,600	15,000	0	55	34	11	0
Photocopying service	5	8,300	7,500	100	0	0	0	0
Radiotelephone commun	5	12,500	7,500	96	4	0	0	0
Hvy const eqpt rental	5	22,500	7,500	61	39	0	0	0
Air courier service	5	10,250	2,500	86	0	12	0	2
Help supply service	4	34,500	30,000	95	4	1	0	0
Ret mail-order house	4	35,000	15,000	57	43	0	0	0
Whol industrial suppl	4	6,100	5,000	84	0	0	16	0
Whol computers/softwr	3	608,250	600,000	99	1	0	0	0
Whol office supplies	3	46,750	45,000	100	0	0	0	0
Data processing svcs	3	20,300	20,000	0	99	1	0	0
Whol plumb/hydronics	3	20,250	10,000	50	49	0	1	0
Computer maintenance	3	3,750	2,500	54	33	13	0	0
Employment agency	3	5,250	2,500	29	0	71	0	0
Whol misc profsn eqpt	3	2,000	1,000	100	0	0	0	0
Whol chemicals	3	650	500	23	39	38	0	0
Executive office	3	350	250	100	0	0	0	0
Reg misc coml sector	3	400	250	100	0	0	0	0
Misc publishing	3	100	100	50	50	0	0	0
Mfg computers	2	100,750	100,000	100	0	0	0	0

Whol lumber/millwork	2	25,050	25,000	50	50	0	0	0
Whol nondurable goods	2	10,500	10,000	0	95	5	0	0
Whol const/mine equip	2	10,100	10,000	50	0	0	0	50
Misc business credit	2	7,500	7,500	100	0	0	0	0
Information retrieval	2	600	500	8	84	0	8	0
Personal credit	2	1,000	500	100	0	0	0	0
Whol office equipment	2	350	250	100	0	0	0	0
Mfg glass products	2	300	250	58	42	0	0	0
Truck rental/leasing	2	150	100	100	0	0	0	0
Misc equipment rental	1	50,000	50,000	50	50	0	0	0
Ret-direct selling	1	45,000	45,000	100	0	0	0	0
Limestone mining	1	30,000	30,000	0	100	0	0	0
Scheduled air trans	1	10,000	10,000	0	50	0	50	0
Prepackaged software	1	7,500	7,500	100	0	0	0	0
Ret auto supplies	1	5,000	5,000	50	50	0	0	0
Ret fuel oil dealer	1	2,500	2,500	50	50	0	0	0
Whol tires/tubes	1	2,500	2,500	100	0	0	0	0
Coating/engrave svcs	1	1,000	1,000	100	0	0	0	0
Mfg switchgear-boards	1	1,000	1,000	100	0	0	0	0
Custom programming	1	1,000	1,000	100	0	0	0	0
Mfg signs/ad specltys	1	1,000	1,000	0	0	100	0	0
Mfg measure devices	1	750	750	0	0	100	0	0
Mfg telephone equip	1	750	750	100	0	0	0	0
Mfg surgical supplies	1	500	500	100	0	0	0	0
Whol electronic parts	1	250	250	0	100	0	0	0
Business association	1	100	100	100	0	0	0	0
Whol auto parts	1	50	50	0	0	100	0	0
Gas production/distrb	1	50	50	0	100	0	0	0
Newspaper-print/publ	1	50	50	100	0	0	0	0
Whol petroleum prdts	1	50	50	100	0	0	0	0
Misc general gov't	1	50	50	100	0	0	0	0
Whol metal	1	0	0	0	0	0	0	0
Other payment categories								
Cash experiences	35	8,450	2,500					
Payment record unknown	8	72,000	15,000					
Unfavorable comments	2	1,750	1,000					
Placed for collections:								
With D&B	0	0	0					
Other	0	N/A	0					
Total in D&Bs file	250	1,708,650	600,000					

Accounts are sometimes placed for collection even though the existence or amount of the debt is disputed.

Indications of slowness can be result of dispute over merchandise, skipper invoices etc.

Payment Details

Date Reported (mm/yy)	Paying Record	High Credit ($)	Now Owes ($)	Past Due ($)	Selling Terms	Last Sale Within (month)
09/09	Ppt	5,000	1,000			2-3 mos
	Ppt	2,500	0		0N30	2-3 mos
	Ppt	2,500	2,500			2-3 mos
	Ppt	1,000	100			2-3 mos
	Ppt	750	0		0	4-5 mos
	Ppt	500	0		0N30	4-5 mos
	Ppt-Slow 30	95,000	90,000			2-3 mos
	Slow 30	5,000	0		0 N30	4-5 mos
	Slow 30-60	2,500	0		0 N30	4-5 mos
08/09	Ppt	30,000	0		0	6-12 mos
	Ppt	20,000	10,000		0	1 mo
	Ppt	10,000	0		0	2-3 mos
	Ppt	10,000	10,000		0	1 mo
	Ppt	10,000	0		0	2-3 mos
	Ppt	10,000	0		0	4-5 mos
	Ppt	7,500	0		0	2-3 mos
	Ppt	5,000	100		01 10 N30	1 mo
	Ppt	2,500	0		0	4-5 mos
	Ppt	2,500	0		0	6-12 mos
	Ppt	2,500	0		0N30	6-12 mos
	Ppt	2,500	0		0N30	4-5 mos
	Ppt	2,500	0		N30	6-12 mos
	Ppt	2,500	0		0	1 mo
	Ppt	1,000	250		0	1 mo
	Ppt	1,000	0		0	2-3 mos
	Ppt	1,000	0		0	6-12 mos
	Ppt	1,000	0		0	2-3 mos
	Ppt	1,000	0		0	6-12 mos
	Ppt	750	0		0	1 mo
	Ppt	500	100		0	1 mo
	Ppt	500	0		0	1 mo
	Ppt	500	500		0	1 mo

	Ppt	500	0	0	6-12 mos
	Ppt	500	50	0	1 mo
	Ppt	250	250	0	1 mo
	Ppt	250	0	0	6-12 mos
	Ppt	250	250	0	1 mo
	Ppt	100	100	0	1 mo
	Ppt	100	50	0	1 mo
	Ppt	100	100	0	1 mo
	Ppt	50	0	0	2-3 mos
	Ppt	50	0	0	6-12 mos
	Ppt	50	0	0	6-12 mos
	Ppt	50	0	0	1 mo
	Ppt	50	0	0N30	4-5 mos
	Ppt	50	0	0	4-5 mos
	Ppt	50	0	0	4-5 mos
	Ppt-Slow 5	250	0	0N30	2-3 mos
	Ppt-Slow 30	5,000	0	0N30	2-3 mos
	Ppt-Slow 30	2,500	0	0	6-12 mos
	Ppt-Slow 30	2,500	1,000	0	1 mo
	Ppt-Slow 30	2,500		N15	2-3 mos
	Ppt-Slow 30	250	100	0	1 mo
	Ppt-Slow 60	1,000	500	250	1 mo
	Ppt-Slow 90	100	0	0N30	2-3 mos
	Slow 30	30,000	0	0 N15	4-5 mos
	Slow 30	2,500	0	0	6-12 mos
	Slow 30-60	15,000	0	0	4-5 mos
	Slow 30-60	1,000	500	500	1 mo
	Slow 60-90	70,000	0	0	6-12 mos
	Slow 30-90	100	0	0	4-5 mos
	(062) Bad debt .	1,000	1,000	250	1 mo
	(063) Cash own option .	100		Cash account	1 mo
	(064)	0	0	0Cash account	2-3 mos
07/09	Ppt	2,500	1,000		1 mo
	Ppt	1,000	500	0N30	1 mo
	Ppt	1,000	0	0	4-5 mos
	Ppt	750			1 mo
	Ppt	750	50		1 mo
	Ppt	750	0	0	2-3 mos
	Ppt	250	250		1 mo
	Ppt	100	50		1 mo
	Ppt	50	0	0	6-12 mos
	Ppt	0	0	0N30	1 mo
	Ppt	0	0	0N30	1 mo
	Ppt	0	0	0N30	1 mo
	Slow 30	750	0	0 N30	6-12 mos
	Slow 30	750	0	0 N30	6-12 mos
	(079) Bad debt .	750	750	750	
05/09	Ppt-Slow 120	10,000	2,500	2,500	1 mo

Payments Detail Key: ▩ 30 or more days beyond terms

Payment experiences reflect how bills are met in relation to the terms granted. In some instances payment beyond terms can be the result of disputes over merchandise, skipped invoices etc. Each experience shown is from a separate supplier. Updated trade experiences replace those previously reported.

Public Filings

Summary

The following data includes both open and closed filings found in D&B's database on this company.

Record Type	# of Records	Most Recent Filing Date
Bankruptcy Proceedings	0	-
Judgments	0	-
Liens	7	01/16/08
Suits	1	03/16/05
UCCs	36	07/07/09

The following Public Filing data is for information purposes only and is not the official record. Certified copies can only be obtained from the official source.

Liens

A lien holder can file the same lien in more than one filing location. The appearance of multiple liens filed by the same lien holder against a debtor may be indicative of such an occurrence.

Amount	**$1,250**
Status	**Open**
BOOK/PAGE	1392/3516
Type	State Tax

Filed By	ST OF SOUTH C[illegible]OLINA
Against	TETRA TECH E[illegible]
Where Filed	RICHLAND COUNTY REGISTER OF DEEDS, COLUMBIA, SC
Date Status Attained	01/16/08
Date Filed	01/16/08
Latest Info Received	02/22/08

Amount	**$1,251**
Status	**Open**
BOOK/PAGE	1385/3513
Type	State Tax
Filed By	ST OF SOUTH CAROLINA
Against	TETRA TECH EC INC
Where Filed	RICHLAND COUNTY REGISTER OF DEEDS, COLUMBIA, SC
Date Status Attained	12/20/07
Date Filed	12/20/07
Latest Info Received	02/12/08

Amount	**$1,251**
Status	**Open**
BOOK/PAGE	1379/103
Type	State Tax
Filed By	ST OF SOUTH CAROLINA
Against	TETRA TECH EC INC
Where Filed	RICHLAND COUNTY REGISTER OF DEEDS, COLUMBIA, SC
Date Status Attained	11/28/07
Date Filed	11/28/07
Latest Info Received	02/05/08

Amount	**$208**
Status	**Open**
DOCKET NO.	3576/0125
Type	State Tax
Filed By	STATE OF ALABAMA
Against	TETRA TECH EC INC
Where Filed	MONTGOMERY COUNTY RECORDER OF DEEDS, MONTGOMERY, AL
Date Status Attained	06/13/07
Date Filed	06/13/07
Latest Info Received	06/28/07

Amount	**$1,362**
Status	**Open**
CASE NO.	07-0152210
Type	State Tax
Filed By	CA EMPLOYMENT DEVELOPMENT DEPARTMENT
Against	TETRA TECH EC, INC, SAN DIEGO, CA AND OTHERS
Where Filed	SAN DIEGO COUNTY RECORDERS OFFICE, SAN DIEGO, CA
Date Status Attained	03/06/07
Date Filed	03/06/07
Latest Info Received	08/28/07

Amount	**$889**
Status	**Open**
BOOK/PAGE	3087/0884
Type	State Tax
Filed By	STATE OF ALABAMA
Against	TETRA TECH EC INC
Where Filed	MONTGOMERY COUNTY RECORDER OF DEEDS, MONTGOMERY, AL
Date Status Attained	05/04/05
Date Filed	05/04/05
Latest Info Received	07/28/05

Status	**Released**
DOCKET NO.	06-0569356
Type	State Tax
Filed By	STATE OF ALABAMA
Against	TETRA TECH EC INC
Where Filed	SECRETARY OF STATE/UCC DIVISION, MONTGOMERY, AL
Date Status Attained	06/12/07
Date Filed	04/28/05
Latest Info Received	07/28/08

Suits

Status	**Pendin**
CASE NO.	CV200 323
Plaintiff	JUDITH SMITH
Defendant	FOSTER WHEELER CORPORATION, SAN FRANCISCO,, CA AND OTHERS
Cause	IN STATE DEPOS
Where filed	MARICOPA COUNTY SUPERIOR COURT, PHOENIX, AZ
Date status attained	03/16/05
Date filed	03/16/05
Latest Info Received	03/28/05

If it is indicated that there are defendants other than the report subject, the lawsuit may be an action to clear title to property and does not necessarily imply a claim for money against the subject.

UCC Filings

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.
Filing No.	22763273
Filed With	SECRETARY OF STATE/UCC DIVISION, TRENTON, NJ
Date Filed	2005-01-05
Latest Info Received	02/02/05

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.
Filing No.	22763259
Filed With	SECRETARY OF STATE/UCC DIVISION, TRENTON, NJ
Date Filed	2005-01-05
Latest Info Received	02/02/05

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.
Filing No.	4254533 5
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-09-10
Latest Info Received	10/21/04

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Equipment and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.
Filing No.	4254510 3
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-09-10
Latest Info Received	10/21/04

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.
Filing No.	4235915 8
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-08-20
Latest Info Received	09/09/04

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW, INC.

Filing No.	'?35903 4
Filed With	CRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-08-20
Latest Info Received	09/09/04

Collateral	Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds - General intangibles(s) and proceeds - Leased Vehicles and proceeds
Type	Original
Sec. Party	DEERE CREDIT, INC., JOHNSTON, IA
Debtor	TETRA TECH FW. INC.
Filing No.	4235895 2
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-08-20
Latest Info Received	09/09/04

Collateral	Leased Assets including proceeds and products - Computer equipment - Leased Business machinery/equipment including proceeds and products
Type	Original
Sec. Party	US BANCORP, MARSHALL, MN
Debtor	TETRA TECH EC, INC., COMMERCE CITY, CO
Filing No.	6388713 0
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2006-11-08
Latest Info Received	12/08/06

Collateral	Equipment and proceeds
Type	Original
Sec. Party	BLANCHARD MACHINERY COMPANY, WEST COLUMBIA, SC
Debtor	TETRA TECH, INC., OAK RIDGE, TN
Filing No.	5393095 6
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2005-12-19
Latest Info Received	01/19/06

Collateral	Equipment and proceeds - Vehicles and proceeds
Type	Original
Sec. Party	1ST SOURCE BANK, INDIANAPOLIS, IN
Debtor	TETRA TECH FW, INC.
Filing No.	4144492 8
Filed With	SECRETARY OF STATE/UCC DIVISION, DOVER, DE
Date Filed	2004-05-10
Latest Info Received	06/18/04

There are additional UCCs in D&Bs file on this company available by contacting 1-800-234-3867.
The public record items contained herein may have been paid, terminated, vacated or released prior to today's date.

Government Activity

Activity summary

Borrower (Dir/Guar)	NO
Administrative Debt	NO
Contractor	YES
Grantee	NO
Party excluded from federal program(s)	NO

Possible candidate for socio-economic program consideration

Labour Surplus Area	N/A
Small Business	N/A
8(A) firm	N/A

The details provided in the Government Activity section are as reported to Dun & Bradstreet by the federal government and other sources.

History and Operations

Company Overview

Company Name:	TETRA TECH EC, INC.
Doing Business As :	(SUBSIDIARY OF TETRA TECH, INC., PASADENA, CA)
Street Address:	1000 The American Rd Morris Plains , NJ 07950
Phone:	973 630-8000
URL:	http://www.ttfwi.com
History	Is clear
Present management control	6 years

History

The following information was reported: **08/21/2009**

Officer(s):	SAM W BOX, CHB-CEO DONALD I ROGERS, EXEC V PRES-COO JAMES LEONARD, V PRES-GENERAL COUNSEL
DIRECTOR(S) :	THE OFFICER(S)

This business was registered as a Profit Corporation in the State of Delaware on February 10, 2003.
Business started 2003. 100% of capital stock is owned by Parent Company.
Business started Feb 2003. On Mar 10 2003, Tetra Tech Inc acquired substantially all the assets of Foster Wheeler Environmental Corporation for $80 million in cash, subject to net asset value and other adjustments. This corporation now holds all of the assets purchased in the transaction.
SAM W BOX born 1945. 1994 became Chb, and continues in same position since acquisition by Tetra Tech Inc. Graduated 1968 with a civil/environment engineering degree. 1976-1993 employed by Morrison Knudsen Corporation. 1985-1989 active as senior vice president; 1990-1993 active as executive vice president. 1993-1994 active as executive vice president of Foster Wheeler Environmental Services.
DONALD I ROGERS born 1944. 1994-present active here. 1970 graduated from University of Bridgeport with a BA in Economics. 1980 graduated from New School for Social Research with a MA in Economics. 1978-84 employed by Ebasco Services, Inc. 1984-87 active as vice president project development with Enserch Development Corporation. 1987-90 active as vice president marketing and sales for Ebasco Constructors. 1990-92 active as director with International Technology Corporation. 1992-94 active as senior vice president and chief operating officer of Enserch Environmental Corporation.
JAMES LEONARD born 1947. 1994-present active here. 1970 graduated from Columbia University with a BS in Civil Engineering; a BA from Colgate University and a BS in Electrical Engineering from Carnegie-Mellon University. 1977 graduated from Fordham University School of Law with a JD. 1970-77 employed by Ebasco Construction. 1977-91 employed by Ebasco Services Inc. 1991-93 active as vice president and general counsel of Ebasco Services Environmental Division. 1993-94 active as vice president and general counsel for Enserch Environmental Corporation.

Operations

08/21/2009

	Subsidiary of TETRA TECH, INC., PASADENA, CA which operates as environmental engineers & consultants. Parent company owns 100% of capital stock.
Description:	As noted, parent is Tetra Tech Inc, Pasadena CA (DUNS 04-522-4250) and reference is made to that report for information on the parent and its management.
	Provides business consulting services, specializing in environmental services (100%).
Employees:	1,057 which includes officer(s). 141 employed here.
Facilities:	Leases premises in one story building.
Branches:	BRANCHES: Branches are located at: Rte 130 & Cedar Swamp Road, Bridgeport, NJ; 97 N Outer Rd, Eureka, MO; 143 Union Blvd Ste 777, Lakewood, CO; 921 Providence Highway, Norwood, MA; 470 Atlantic Ave, Boston, MA; 305 Boston Avenue, Stratford, CT, 12100 NE 195th St Ste 200, Bothell, WA and 1050 NE Hostmark St, Ste 202, Poulsbo, WA. Poulsbo, WA (360 598-8100). Richland, WA (509 372-5800). Operates as Branch Location.

SIC & NAICS

SIC:
Based on information in our file, D& has assigned this company an extended 8-digit SIC. D&'s use of 8-digit SICs enables us to be more specific about a company's operations than if we use the standard 4-digit code.
The 4-digit SIC numbers link to the description on the Occupational Safety & Health Administration (OSHA) Web site. Links open in a new browser window.
8748 0000 Business consulting, nec
NAICS:

541618 Other Management Consulting Services

Financial Statements

Additional Financial Data

The name and address of this business have been confirmed by D & B using available sources.

Request Financial Statements

Request Financial Statements

Requested financials are provided by TETRA TECH EC, INC. and are not DUNSRight certified.

Key Business Ratios

D & B has been unable to obtain sufficient financial information from this company to calculate business ratios. Our check of additional outside sources also found no information available on its financial performance.

To help you in this instance, ratios for other firms in the same industry are provided below to support your analysis of this business.

Based on this Number of Establishments 366

	Industry Norms Based On 366 Establishments		
	This Business	**Industry Median**	**Industry Quartile**
Profitability			
Return on Sales	UN	4.6	UN
Return on Net Worth	UN	30.4	UN
Short-Term Solvency			
Current Ratio	UN	1.9	UN
Quick Ratio	UN	1.6	UN
Efficiency			
Assets/Sales	UN	33.9	UN
Sales / Net Working Capital	UN	7.2	UN
Utilization			
Total Liabilities / Net Worth	UN	82.8	UN

UN = Unavailable

TETRA TECH EC, INC.

North Dakota - Follow-Up Questions / Issues Requiring Clarification

Budget Narrative Supplement:

Per our discussion, we have included an updated budget as well as copies of the vendors proposal and budget. It should be noted that we have chosen not to award the planning component to the vendor and have chosen to conduct planning activities with resources within the State.

1. Vendors budget Proposal - State of ND Broadband Mapping COST PROPOSAL.pdf
2. Vendor Budget Proposal Addendum - State of ND Broadband Mapping COST PROPOSAL MAINTENANCE.pdf
3. Vendors Technical Proposal - State of North Dakota Broadband Mapping TECHNICAL PROPOSAL.pdf
4. Revised state budget – Broadband mapping budget - revised.xls

Data Collection:

Accessibility:

1. Your application mentions state level maps depicting broadband access and "available speeds." How will these maps be accessed by, or provided to the public? Can you provide more detailed information on your proposed plan for accessibility of the data?

   A: Data related to the broadband mapping project will be stored on and accessed from the North Dakota GIS Hub using existing policies and systems. It is the policy of the North Dakota GIS Technical Committee that data distributed from the GIS Hub must have associated metadata and therefore the broadband GIS data will have FGDC-compliant metadata. To help ensure the broadband GIS data is accurate, up to date, and easy to access, the State intends to utilize record-level metadata and the National States Geographic Information Council (NSGIC) broadband data model. Data updates will be done as indicated in the Tetra Tech proposal and additionally, the State desires to utilize the existing Safe Software ETL system that is present on the GIS Hub. Broadband GIS data will be accessible through an interactive map that is based on ESRI's ArcGIS Server technology already in place on the GIS Hub.

Security, Confidentiality and Non-Disclosure:

1. Aside from the use of NDAs, how do you plan to ensure and maintain data security?

   A: The Information Technology Department (ITD) hosts numerous applications and data sets that require a high level of security. Examples include HIPAA compliant data, IRS data, state Tax Data, FERPA protected data, and CJIS data. All of these data sets have stringent data security models in place. ITD is continually audited to ensure compliance with the requirements of these data sets. ITD has extensive

experience and knowledge in processes and infrastructure requirements to meet the needs of secure data. Utilizing those same processes which include confidentiality statements by employees and background check on all contractors and employees we can and will implement sufficient measures to protect the data.

Collaboration and Planning:

Collaboration

1. Can you provide information or detail on the stakeholders you plan to include in this process?

   A: Response below

2. Can you provide additional detail of how you plan to achieve a collaborative process?

   A: Broadband Mapping – Planning Component

   North Dakota's response to providing internet connectivity to government and education entities began with the North Dakota Statewide Technology Access for Government and Education Network (STAGEnet). Created from the 1999 Legislative Session, STAGEnet provides internet and networking services to government and education entities. It provides broadband connectivity, internet access, video conferencing, and other networking services. All state agencies, colleges and universities, local governments, and K-12 public schools are required to participate in STAGEnet.

   The vision of STAGEnet is to provide a secure, reliable, and cost-effective network with the scale and flexibility to support the convergence of data, voice, and video to meet and surpass the business objectives of government and education. This implementation of e-government and e-education brings a wealth of new opportunities to city and rural residents alike by providing a win-win situation to the State, schools, and citizens.

   STAGEnet is governed as a partnership between government and education. The governance structure includes representatives from state and local government and K-12 education, colleges, and universities. These committees aid in planning, prioritizing, approving standards and policies, making service level decisions, coordinating among constituencies, communicating, and identifying and providing resources for STAGEnet. Ultimately, the decision-making authority for STAGEnet belongs to the State of North Dakota's Chief Information Officer, who manages the Information Technology Department (ITD) and oversees the State's technology activities within government and education.

   The success of STAGEnet remains contingent upon and has been a result of many private sector business partnerships developed through the anchor tenant model. ITD, which manages and operates STAGEnet, believes this model maximizes the balance of government investment and private sector opportunities to meet the needs of citizens.

Working together, partners will seek ways to deliver broadband internet access throughout North Dakota so that citizens in rural and metro communities have the same opportunities available to them. This model has allowed the State and private sector businesses to successfully deliver affordable high-speed internet access to schools and citizens in rural communities that would otherwise not have this type of access. The State of North Dakota strives to keep pace with the industry's technological advances to address the business requirements of STAGEnet's consumers.

By leveraging the organizational structure and relationships that are presently in existence for STAGEnet, the State of North Dakota is seeking funding for planning activities to explore how STAGEnet can be utilized either directly or indirectly to assist in the broadband requirements for additional anchor institutions. Specifically, the STAGEnet organization will expand it's focus to work with public safety institutions and healthcare and medical institutions to determine the feasibility of leveraging the organizational structure, relationships with anchor institutions and providers and the network itself in providing both consumer bases with broadband services.

ITD will leverage existing organizational structures to facilitate coordination among the various communities. The CIO has been given the authority by the 2009 legislative session to accept funding for Health IT initiatives and to employ a Health IT coordinator responsible to facilitate and deploy health IT initiatives within the state. The role of the Health IT coordinator is guided by a board, which is comprised of representatives from both government and the health industry. Additionally, ITD has an existing relationship and is a member of the Emergency Services Communications Coordinating Committee. This committee is representative of the public safety community and would be an established and active entity that would represent the public safety community in the area of broadband services.

The process for both public safety and health care will be similar. In both cases we will leverage existing relationships to establish participation and involvement from key stakeholders in both communities. The role of the team would be to perform a needs analysis, evaluate options and to develop a strategic plan to take forward to ensure all the anchor institutions within STAGEnet, the public safety community and healthcare community have the broadband resources available to meet their needs.

The needs analysis phase would start with a review of current usage of broadband services and the applications that are in place today to establish a baseline. The analysis would continue to document current demands as well as attempt to forecast both short term and long term needs within each community. Upon identification of all existing and future requirements, priorities will be placed on the requirements and correlations will be made to achieve those priorities.

Once a thorough needs analysis is completed and documented, the team will research and evaluate potential solutions. The evaluation will entail technology solutions, business models, operational structures and deployment plans. The team would work with current providers as well as research new providers and solutions that may be beneficial to the broadband industry within the State.

Finally, a strategic plan would be created providing a published document that all parties can operate from to implement the goals and objectives identified in the planning process. The plan would be helpful in securing whatever resources are necessary to implement the plan and provide a mechanism to ensure all anchor tenants within the state are aligned with common goals in terms of broadband infrastructure and usage.

The State of North Dakota has been able to achieve a secure, reliable and cost-effective network for use by government and education. By expanding upon the model that has contributed to that success, the anchor tenants would benefit from a broadband infrastructure that would meet the current and future needs of an expanded anchor tenant base which will ultimately result in influencing and improving the level of services available to private sector business and citizens throughout the State.

North Dakota - Follow-Up Questions / Issues Requiring Clarification

General:

We understand that at the time of the application submission, you had not begun vendor procurement. Have you selected a vendor at this time? If so, please provide additional detail in the following categories so both the methodology and work product is clear. This question may also be addressed by submitting the summary of work that the contractor will perform, so long as this includes the elements required in the NOFA and answers the questions described below.

Data Collection:

Methodology:

1. Can you provide detail on how intend to intend to require the contractor to collect and maintain FGDC compliant metadata?

Accuracy & Verification:

1. What methods and processes will you require the contractor to employ to ensure that all collected data are accurate and up to date?
2. What methods or requirements will you place on the contractor to ensure the positional accuracy of data?

Accessibility:

1. Your application mentions state level maps depicting broadband access and "available speeds." How will these maps be accessed by, or provided to the public? Can you provide more detailed information on your proposed plan for accessibility of the data?

Security, Confidentiality and Non-Disclosure:

1. Aside from the use of NDAs, how do you plan to ensure and maintain data security?

Project Feasibility:

Budget:

1. Can you provide a detailed budget spreadsheet used to generate Mapping costs?
2. Can you provide additional detail on a year by year basis for your budget request?
3. For each position assigned to this project, can you provide a description of the position responsibilities, annual salary, and percentage of time dedicated to this project for Year 1 and Year 2.
4. For all contractor activities can you please provide the cost allocation in a format similar to the one listed directly above.

Expedient Data Delivery:

1. Can you please provide detail on how you, or the contractor intend to meet this requirement?

Process for Repeated Data Updating:

1. You have clearly demonstrated an understanding of the importance for data updating, but provide little or no detail on how you intend to meet this requirement. Is it possible to provide additional detail?
2. Can you please provide a clearly defined plan which outlines a process for data updating

Collaboration and Planning:

Collaboration

1. Can you provide information or detail on the stakeholders you plan to include in this process?
2. Can you provide additional detail of how you plan to achieve a collaborative process?

Planning

1. Since the submission of this proposal, have you developed a scope of work for the planning proposal? If so, please detail.

North Dakota
Combined 2 year budget

	In-Kind	Federal	Total
Personnel Salaries	76,827	454,794	531,621
Personnel Fringe	32,926	181,496	214,422
Travel	1,503	36,852	38,354
Equipment	626	8,673	9,299
Supplies	1,879	1,503	3,382
Hosting	0	23,520	23,520
Rent/Other	7,139	17,063	24,202
Base Map Contractor	500,000	0	500,000
GIS Infrastructure	913,233	0	913,233
Broadband Map Contractor	0	889,853	889,853
Total	**1,534,133**	**1,613,754**	**3,147,887**

	Year 1			Year 2			
	In-Kind	Federal	Total	In-Kind	Federal	Total	Grand Total
Broadband Mapping Budget							
Personnel Salaries							
Program Manager		79,584	79,584		79,584	79,584	159,168
Large Project Oversight		5,250	5,250			0	5,250
Executive Overview	18,415		18,415	18,415		18,415	36,830
Administrative Support	19,999		19,999	19,999		19,999	39,998
System Administration		3,528	3,528		3,528	3,528	7,056
Developer/DBA		49,140	49,140		49,140	49,140	98,280
Personnel Salaries Total	38,414	137,502	175,916	38,414	132,252	170,666	346,581
Personnel Fringe	16,463	47,572	64,035	16,463	47,572	64,035	128,070
Travel	751	3,006	3,757	751	3,006	3,757	7,514
Equipment	626	2,505	3,131			0	3,131
Supplies	939	751	1,691	939	751	1,691	3,382
Hosting		4,704	4,704		18,816	18,816	23,520
Rent/Other	3,569	8,532	12,101	3,569	8,532	12,101	24,202
Base Map Contractor	500,000		500,000			0	500,000
GIS Infrastructure	913,233		913,233			0	913,233
Broadband Map Contractor		806,728	806,728		83,125	83,125	889,853
Total Mapping	1,473,997	1,011,300	2,485,296	60,137	294,054	354,191	2,839,487
Total Fed							**1,305,354**

1,613,754

	Year 1			Year 2			
BroadBand Planning	In-Kind	Federal	Total	In-Kind	Federal	Total	Grand Total
Personnel Salaries		92,520	92,520		92,520	92,520	185,040
Personnel Fringe		43,176	43,176		43,176	43,176	86,352
Travel		15,420	15,420		15,420	15,420	30,840
Equipment		3,084	3,084		3,084	3,084	6,168
Supplies			0			0	0
Total Planning	0	154,200	154,200	0	154,200	154,200	308,400

North Dakota revised 2-year budget

	Description	Total	Personnel	Fringe Ben	Travel	Equip	Supplies	Contractual	Other
1	Development	$473,986	$105,336	$45,144	$0	$23,520	$0	$299,986	$0
	Fed	$473,986	$105,336	$45,144	$0	$23,520	$0	$299,986	$0
	In-Kind	$0	$0	$0	$0	$0	$0	$0	$0
2	Data Collection	$904,219	$0	$0	$0	$0	$0	$904,219	$0
	Fed	$404,219	$0	$0	$0	$0	$0	$404,219	$0
	In-Kind	$500,000	$0	$0	$0	$0	$0	$500,000	$0
3	Program Mgmt / Reporting	$1,346,033	$621,063	$196,872	$12,314	$112,118	$21,646	$664,002	$33,702
	Fed	$311,900	$407,250	$122,850	$6,012	$2,505	$1,503	$70,400	$17,063
	In-Kind	$1,034,133	$213,813	$74,022	$6,303	$109,613	$20,143	$593,602	$16,639
4	Planning	$308,400	$185,040	$86,352	$30,840	$6,168	$0	$0	$0
	Fed	$308,400	$185,040	$86,352	$30,840	$6,168	$0	$0	$0
	In-Kind	$0	$0	$0	$0	$0	$0	$0	$0
	Total	$3,032,638	$911,439	$328,368	$43,154	$141,806	$21,646	$1,868,207	$33,702
	Fed	**$1,498,505**	**$697,626**	**$254,346**	**$36,852**	**$32,193**	**$1,503**	**$774,605**	**$17,063**
	In-Kind	$1,534,133	$213,813	$74,022	$6,303	$109,613	$20,143	$1,093,602	$16,639
	Mapping	$1,190,105							
	Planning	308,400							

TETRA TECH

September 30, 2009

North Dakota Information Technology Department
Telecommunications Division
1615 Capitol Way
Bismarck, ND 58501

Attn: Brandy Peterson

Subject: Clarification on Broadband Mapping Update, Maintenance, and Technology Transfer

RFP Number 112-0913, Broadband Mapping Services

Brandy,

Thank you for the opportunity to allow Tetra Tech to further clarify our Cost Proposal for the North Dakota Broadband Mapping Services RFP #112-0913. This letter includes clarification on 1) the update and maintenance of the broadband map, 2) maintenance assumptions, 3) maintenance costs, and 4) the hosting of the broadband map application and its transfer to the State.

1. Broadband Mapping Update and Maintenance Clarification

Tetra Tech will provide updates to the North Dakota Broadband Map at an interval requested by the State (e.g. Every 6 months or 1 year). The map updates will be based on newly available broadband provider data. Updates will include the GIS and tabular databases that comprise the broadband map and the associated data exports required by the National Telecommunications and Information Administration (NTIA). Our update methodology will be based on the same process used for broadband service provider data as described in our technical proposal. However, these methods will be modified, as appropriate, to focus maintenance efforts on areas where changes in broadband infrastructure are known to have occurred.

2. Maintenance Assumptions

There are many uncertainties related to future changes in NTIA requirements, broadband technologies, and the needs of North Dakota for broadband mapping information. To account for these uncertainties, Tetra Tech has made the following assumptions to arrive at our cost estimate for ongoing maintenance. If these assumptions do not prove valid, the estimated maintenance costs may need to be increased or decreased accordingly.

a) No more than 10% of the broadband mapping data will require updating during any single update cycle.
b) NTIA and the State will not require new or materially different data products than those currently specified in our proposal.
c) No more than one two-day trip to North Dakota by one Tetra Tech staff or subcontractor will required per update cycle.
d) Tetra Tech staff or subcontractors will spend between 175 and 225 hours total per update.

SGS

19803 North Creek Parkway, Bothell, WA 98011
Tel 425.482.7600 Fax 425.482.7652
www.tteci.com

3. Maintenance Costs (per update)
Our original proposal costs are based on developing the broadband map for North Dakota. Costs for on-going updates to the map for broadband service provider data are as follows, and are based on the assumptions listed in #2, above. The total update cost/year will depend on how many updates/year the State requires.

Year 2 - $33,250
Year 3 - $34,460
Year 4 - $35,718
Year 5 - $37,027

4. Clarification of Broadband Map Application Hosting and Technology Transfer

In order to be responsive to project needs, implement frequent data updates, and meet NTIA schedule requirements, Tetra Tech plans to host the web applications required by this project during the first seven to twelve months. The associated costs for hosting these applications were included in our original cost proposal. Because the State will host these web applications, no additional hosting fees will be required. If, for some unforeseen reason, the State requires Tetra Tech to continue hosting the applications after the first two years, the hosting fee will be $500/month, as stated in my letter dated September 28, 2009.

We have allocated time to facilitate technology transfer to the State in our project approach, and will be prepared to transfer the applications anytime after May 2010. Technologies required by the State to host the applications developed by Tetra Tech will include Microsoft's Server 2003, IIS, and SQL Server 2003, and Environmental Systems Research Institute's (ESRI) ArcGIS Server 9.3. In most cases, newer releases of the specified software can be substituted.

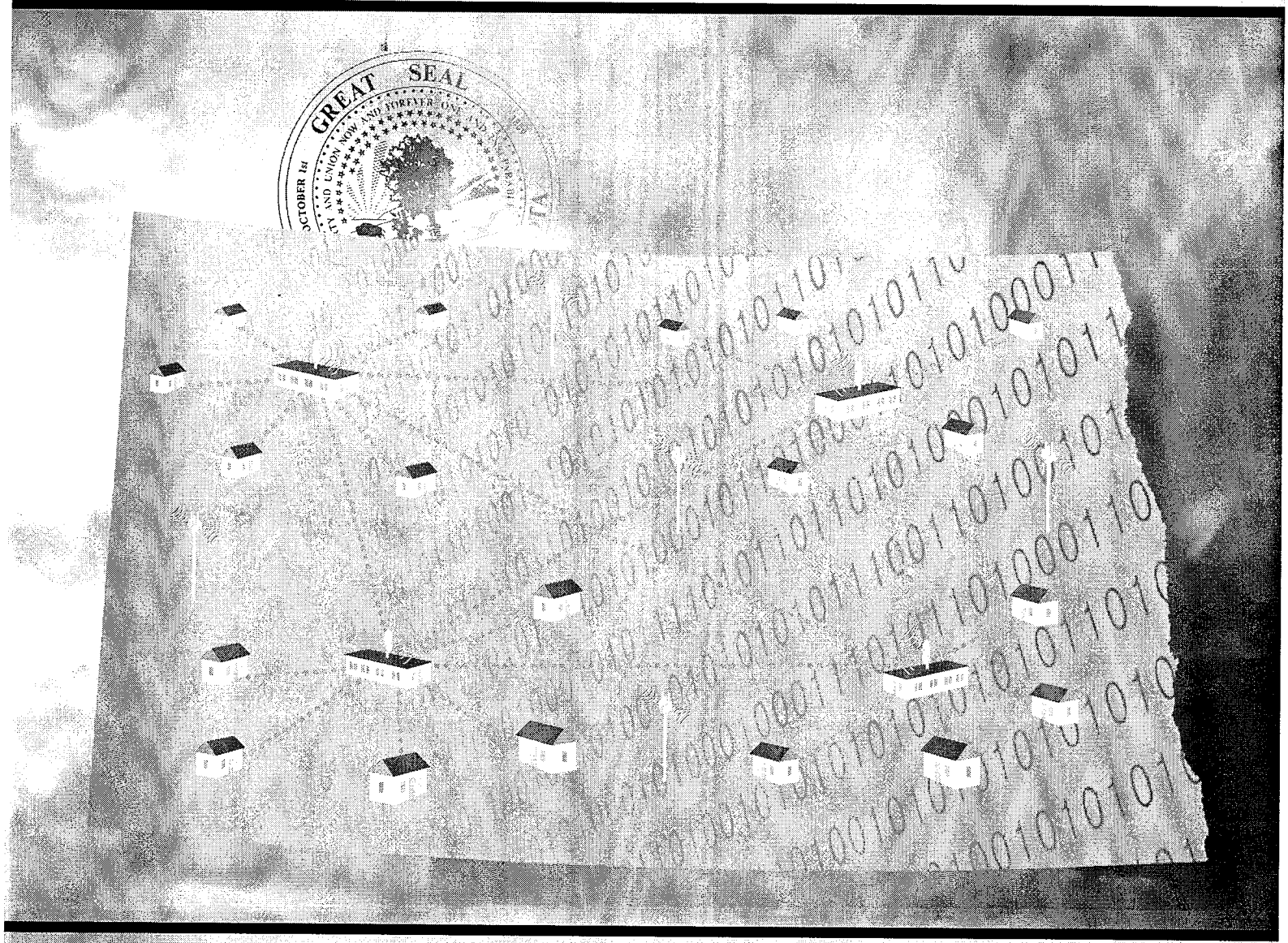
Thank you, and please feel free to contact me if any further clarification is required.

Sincerely,

Andy Bury
Seattle Lead Scientist
National GIS Discipline Lead

19803 North Creek Parkway Bothell, WA 98011
Tel 425.482.7600 Fax 425.482.7652
www.ttaci.com

Technical Proposal



State of North Dakota • Information Technology Department

RFP Number: 112-0913

September 25, 2009

TETRA TECH EC, INC.

TECHNICAL PROPOSAL
for
Broadband Mapping Services

STATE OF NORTH DAKOTA

Information Technology Department

RFP Number: 112-0913

Prepared by:

TETRA TECH

Tetra Tech EC, Inc,
19802 North Creek Parkway
Bothell, WA 98011

September 25, 2009

CONTENTS

FIGURES

TABLES

1. Introduction

Tetra Tech EC, Inc. (Tetra Tech) is pleased to present our response to the State of North Dakota (also referred to herein as "State" or "the State") for the Request for Proposal (RFP) 112-0913, Broadband Mapping Services.

We understand the State's need to establish and maintain a statewide mapping system for broadband service availability in North Dakota, and why it is so important for economic development. We feel that our technical solutions and superior value will not only maximize State resources, but will also maximize local and federal resources needed to map broadband service in North Dakota and to promote broadband adoption programs throughout the State.

The Tetra Tech Team is uniquely qualified to perform all of the work activities requested by the State. In an effort to provide the absolute best service to the State, Tetra Tech has invited Geodata Services, HierComm, Inc., Applied Communications, and Access Consulting to participate with us as a Team on this project.

Our Team is composed of companies with an intimate understanding of North Dakota's unique needs and a proven track record of fulfilling them. Our local expertise is strengthened by Tetra Tech's nationwide horsepower, providing the breadth and depth of resources to respond to demanding project workloads and compressed timelines.

Why Choose the Tetra Tech Team?

- Local telecom and GIS knowledge and experience
- National company with abundant resources of equal expertise
- Experience developing collaborative broadband planning frameworks
- Close working relationship with North Dakota Anchor Institutions
- Unique technical approach
- Proven methodologies to attain the State's goals and objectives.
- Capacity to rapidly respond to escalated workload and schedule requests.
- Effective project management and delivery experience with projects of similar or greater size.
- Proven and effective GeoManager web-based information management system for mapping, querying, updating and reporting on broadband data.

Our Team was carefully built to address all aspects of this project: from our experience with similar projects in size, population, and technical requirements; our understanding of the telecommunications industry in North Dakota; our experience developing strategic plans to stimulate broadband demand and adoption; our understanding of telecommunications infrastructure for broadband; our process of acquiring broadband data through a balanced combination of proven, cutting edge technology combined with more common techniques; and our experience in the characterization of community anchor institution broadband availability, usage, and transmission; to our experience collecting data from reluctant broadband carriers; our familiarity with and understanding of data collection in rural and agricultural areas and the challenges that entails; our skill in developing, implementing and hosting web-based mapping and information management sites for complex, multi-state projects; and our proven

project, subcontractor, and communication management practices that will keep this project on time and under budget while producing the high-quality products that the State expects.

For nearly a quarter century, we have been accumulating project experience that has prepared us well for this broadband project in North Dakota. For instance, we have successfully completed strategic plans for broadband telecommunication, particularly in rural states, and have mapped broadband usage across populations of equal or greater size. We have conducted community outreach across multiple states; and have simultaneously interfaced with multiple federal, state, and local governmental agencies, tribal councils, and both private and public stakeholders. Our Team has worked closely with local anchor institutions cataloging their broadband use, availability, and transmission; and we have completed projects wherein we successfully acquired broadband service area information from sometimes reluctant broadband carriers and subsequently mapped their service areas. Furthermore, we have project experience developing and maintaining web-based mapping and information management systems for large projects spanning multiple states.

Our high level of local knowledge, national strength, and project experience combine to give the Tetra Tech Team a composition that will provide the most value to the State over the course of this project. Please refer to Section 3.3, Experience and Qualifications, for more detail on each company forming this exceptional team.

2. Information Technology Solution

2.1 Planning

Developing a Broadband Planning Framework

A. Overview

The Tetra Tech Team has extensive experience with telecommunications planning and stakeholder outreach. Both Paul DeWolfe and Kathleen McMahon have completed telecommunication assessments that rely on a collaborative model between local officials, information technology (IT) professionals, and telecommunications providers. This collaborative approach includes community meetings, key informant interviews, and planning charettes to engage a variety of stakeholders in the planning process.

We also bring a systems engineering approach to our planning efforts. The systems-engineering-based methodology is used to find an optimal communications network to best service the residents, businesses, governments, schools, hospitals, and other organizations in a geographic area. Using this methodology, a number of alternative broadband plans are prepared, and after extensive evaluation, one or more is recommended for implementation in the county or region.

The combination of the collaborative model and system engineering approach has the following advantages:

- Community stakeholders have an opportunity to express concerns regarding service gaps, quality of service, and costs.

- Technology professionals can provide local insight on the effectiveness of alternative network design solutions.
- Telecommunication providers can be more responsive to community needs by engaging local stakeholders.
- Community outreach generates interest in technology solutions and increases Internet usage by residents and businesses. This creates a market for broadband services and improves the business models of telecommunication providers.
- Users and providers will benefit from enhanced communication.
- Strong public support for action will be developed based on thoughtful planning and analysis.
- Teams are created that become self-sustaining to follow through on multi-year deployment and adoption strategies.

The systems engineering planning methodology provides a disciplined and very cost-effective approach to broadband communications systems design in a variety of network environments.

B. Methodology

The broadband mapping data developed under this contract will be a powerful foundation for the future deployment of services into underserved and un-served communities. To build on that foundation, the Team will leverage a methodology that was successfully used in Grand Forks County, north central Idaho, Colorado, southeast Wisconsin, and other areas. The planning approach relies on the creation of eight regional "Broadband Planning Teams." These working groups will be comprised of volunteers representing stakeholder groups such as residential users, business users, telecommunication providers, public safety, local government, and other anchor institutions. The teams will work with our consultants to develop a deeper understanding of the barriers to wider broadband adoption and to develop detailed plans for improving deployment and adoption in each region.

We recommend organizing the planning effort into the same eight regions used by the North Dakota Department of Commerce Regional Councils. Aligning this planning effort with that of the Commerce Council will allow us to take advantage of existing relationships with the business community and local government. It also provides the Team with an existing support network for communicating between regions and coordinating efforts at the state level. Each regional Broadband Planning Team will work with our consultants to address the issues of broadband adoption and deployment within its region.

There are four tasks involved in this planning process: 1) team organization, 2) needs analysis, 3) alternative identification and evaluation, and 4) implementation. The following sections describe these tasks in more detail.

Task 1: Team Organization

We begin our process by organizing the eight regional Broadband Planning Teams. We recommend a State-level kick-off meeting to include representatives of the State Information Technology Department and the Department of Commerce as a minimum. At this session, we will discuss our vision of the roles

of State agencies, detail our plan and schedule for this process, and request client suggestions and comments.

Once consensus is reached on our planning approach, we will begin recruiting Broadband Planning Team members in each region. Community anchor institution (local government, public safety, education, healthcare, and business) and provider representatives who provided input to the map development will be encouraged to participate. Team members will also be recruited from the population at large through published meeting notices. The volunteers will be invited to a regional kick-off meeting in the first quarter of 2010. At this kick-off meeting, they will receive a briefing describing the planning process and the results to date of the mapping effort. They will also participate in a detailed discussion of local infrastructure issues and assist in building a database of current and anticipated/desired broadband applications.

Task 2: Needs Analysis

This task identifies the needs and priorities of the communities. It results in a set of objectives, priorities, and policy directives that will be the basis of decisions regarding the ultimate network design. It includes the following tasks:

1. Assess barriers to wider broadband deployment such as geographic analysis, gaps or lack of capacity in the backbone network, and/or terrain features that inhibit deployment. This is the first critical input required for a successful broadband development plan. This assessment will be based on the following:
    - Analysis of the data collected for the broadband map
    - Local knowledge and experience from IT professionals
    - Socio-demographic analysis
    - Online survey results (conducted as part of the TeleTraceRouting exercise)
2. Analysis of the broadband applications that are, or could be, used in the region if service were available. The community meetings and the online survey will indicate the types of broadband applications that are being used or are proposed in each region. These applications may include telemedicine, distance learning, e-commerce, e-agriculture, e-government, public safety, or others. A thorough understanding of the applications will enable the Team to develop a broadband demand estimate, a second critical input to a successful broadband development plan. The Team will develop detail issue papers addressing specific applications.
3. Assess existing infrastructure for broadband delivery to satisfy the predicted demand. This assessment will enable the Team to identify the critical gaps or capacity shortfalls in the existing infrastructure. Depending on applications that a community may want to develop, any one or a combination of the following service/infrastructure issues must be addressed:
    - Limited broadband alternatives
    - Slow download and/or upload speeds
    - Incomplete cellular telephone coverage
    - Insufficient bandwidth for network with multi-user or bandwidth-intensive applications
    - Lack of affordable wide-area network options
    - Cost-prohibitive for low/moderate households or small business

- Low performance (throughput) for general application
- Unreliable service – frequent outages, local loop issues
- Back-haul bottlenecks
- Lack of redundancy in backhaul network
- No infrastructure for mobile applications (i.e., public safety)
- Pockets without any coverage due to topography, geographical barriers, vegetation, etc.
- Lack of triple play alternatives

Task 3: Identify and Evaluate Alternatives

Local officials must balance the cost of investing in broadband networks with fiscal responsibility. Officials must justify the investment in technology through sound analysis and planning. This task will identify alternative network designs and business models.

The three "business model" options most commonly discussed include encouraging private investment, establishing a public utility, or fostering a public-private partnership approach. We will evaluate the most appropriate "business model" for a broadband development plan based on the following criteria:

- What are the range of goals and applications for the network?
- What technology or network design is best suited to meet the goals that have been established for the network?
- What is the appropriate business model for deploying and operating the network?
- Who are potential partners for deploying, operating, and using the network?
- What are the costs at all stages (including feasibility analysis, build-out, and operation) of investing in a broadband network?
- What is the potential market/revenue for the network?
- What are potential liabilities and risks in building the network?

Team member Applied Communications has published a guidebook, "Public Broadband Networks: A Decision Makers Guide" that reviews various factors communities should consider in evaluating the business models. This guidebook is based on case studies of over 50 projects from around the country. (See project description provided in Appendix A.)

In the development of public (or private) infrastructure, planned outcomes are almost always better than unplanned outcomes. Communications networks, because of their complexity and the multiplicity of technical alternatives, are particularly in need of systematic planning to achieve their promised benefits. In the development of broadband networks in economically marginal un-served/underserved areas, the need for such planning is a necessity. In low-density rural areas in particular, there is little margin for error. In many instances, only a well-engineered communications network has any chance of economic survival. Our time-tested infrastructure planning methodology is vital to the planning of communication networks given their complexity and rapidly changing technology. This methodology will identify and evaluate typical technology options such DSL, cable modem, fixed wireless, or cellular

data (3G/4G). The choice of technologies will be a function of available existing infrastructure, cost, applications, and knowledge of local barriers to deployment and adoption.

The Team will also identify other telecommunications initiatives that, through cooperative planning and development, could reduce the overall cost of deployment, advance the schedule for deployment, leverage multiple sources of funding, or otherwise improve the level and quality of service to un-served and underserved users in North Dakota. One example of a potential partner for this effort is the state-wide initiative to develop a Public Safety Wireless Broadband Service using the dedicated 4.9GHz band. We understand that at least one application for ARRA BTOP/BIP funding for this activity has been submitted and that the State has retained a consultant to assist them in evaluating and understanding such an initiative. Team member HierComm has demonstrated the benefits of using the infrastructure common to 5.8GHz commercial wireless broadband and dedicated 4.9GHz public safety broadband in a project in Kenosha County, Wisconsin. Team member Access Consulting used a similar approach in the design of common infrastructure for cellular voice, public safety radio/mobile data, and wireless broadband for Grand Forks County, North Dakota.

Task 4: Implementation

Implementation involves identifying and pursuing funding opportunities and compiling a Regional Broadband Development Plan. Funding opportunities may include federal NTIA or USDA Rural Development grants and loans, state and local government funding, or private funding. Federal funding opportunities will include the second and third rounds of ARRA BTOP/BIP funding. State and local government funding may include economic development, public utility, or public safety sources. Private funding may include pooling of existing expenditures for telecommunications services to procure more cost-effective services. Provider investment may also be obtained through the clear communication of community or business demands identified through this process.

The Regional Broadband Development Plan integrates all phases of the planning process and presents a prioritized schedule of actions required to meet the Region's broadband needs. The Plan will be coordinated with adjacent Regions, local providers, and at the State level to exploit any common investments and coordinate infrastructure placement at Region boundaries. The Plan will include a list of prioritized actions, including a detailed design of infrastructure investments, funding requirements, pursuit of funding opportunities, and milestone schedules for measuring progress towards the Plan's objectives. The Plan will also establish a recurring review/update schedule to measure progress and incorporate the impacts of changing technology and/or regional needs.

C. BENEFITS

We recommend the method described above because it has worked successfully in other states. Examples of successful projects (detailed descriptions included in Appendix A) include the following:

- Grand Forks County, ND—In 2007, Access Consulting worked with Grand Forks County to develop a "Broadband Business Development Roadmap." The objective of the Roadmap was to provide a plan for improving telecommunications services in the rural communities that surround Grand Forks Air Force Base. The Base is undergoing "realignment" and the County was engaged in a

multifaceted effort to mitigate the economic impacts of the predicted reduction in staff at the Base. Improved broadband services are viewed as a crucial component of diversifying the economies of those communities and attracting new residents. Using the team approach recommended in this proposal, the County and Access Consulting developed a plan for a public-private partnership whereby the County would develop four antenna sites and make them available to broadband, cellular voice, public safety radio, and other wireless services. The County is currently seeking funding to begin construction of the sites.

- North Central Idaho Telecommunications Working Group (NCITWG)—NCITWG has successfully engaged individual users, business users, public safety, local government, education, wireline providers, and wireless providers in a 2+ year dialogue and planning effort that has led to three on-going service improvement efforts.

- Southeast Wisconsin—HierComm Develop a regional telecommunication plan for a seven-county region of southeastern Wisconsin. The methodology used to develop the plan included:
  - Developing plan objectives and standards
  - Collecting, analyzing, and mapping service inventory data
  - Collecting, analyzing, and mapping broadband communications infrastructure data
  - Design of alternative regional broadband telecommunications plans
  - Evaluating alternative plans and selecting the recommended plan
  - Implementing both the public safety and commercial broadband network plans

  The planning effort resulted in the region applying for a BTOP infrastructure grant to implement a wireless network.

- Colorado Multi-Use Network—In 2000, the State of Colorado provided funding for localities to prepare a Network Implementation Plan that would indicate how local public offices could connect to the State multi-use network. The State of Colorado used the methodology for the plans that were developed by Applied Communications as a model for all counties. Applied Communications prepared the Network Implementation Plans for eight individual counties as well as the five-county TRECC region. Four of the plans were subsequently funded for second phase implementation projects.

D. PLANNING SCHEDULE

We will begin organizing the regional Broadband Planning Teams during the first quarter of 2010. The first regional team meetings will be held in March 2010, and subsequent team meetings will be held quarterly for the duration of the year. An in-depth analysis of regional infrastructure and applications will be completed during the second quarter. Coordination with other regions and other State initiatives as well as the creation of a draft Broadband Development Plan will be completed in the third quarter. During the fourth quarter of 2010, the teams will review a final draft of their Broadband Development Plan and publish the final Plan in December. Please refer to Work Plan and Timelines, Section 2.3.

Overview of Development and Data Collection Methodology

The Tetra Tech team's methodology includes eight major tasks as listed below. Our methods are unique in two primary ways. First we leverage broadband coverage and infrastructure data from providers, public sources, surveys, and anchor institutions, with scientific measurements from our TeleTraceRouting techniques—an extremely effective independent method to reverse engineer middle-mile and back-haul broadband networks, and to cross-check and confirm data from providers and other sources. The TeleTraceRouting method has proven an accurate and cost-effective method, applied to millions of broadband subscriber lines in previous broadband mapping efforts. Second, all the data we provide to the State of North Dakota as deliverables for this project will be open public information, free of proprietary restrictions, with their development techniques and applications provided in a comprehensive maintenance plan so that the State can continue to apply the methods in the future. The broadband map for North Dakota should not be a single snapshot—it should be a living map with capability for future updates on a regular basis.

Our team's methodology also takes advantage of resources within North Dakota State Government where practicable and favorable to a good public outcome, and employs State oversight when necessary for the successful completion of the goals and outcomes required by the State. The web tools and project methodologies described in our approach are designed specifically to support input from project participants on key data elements—addresses or location, broadband provider, and measured bandwidth. These tools will be used to collect fine-grained data from project participants and will be provided to the State for use in subsequent phases of the Broadband Mapping effort.

Summary of Project Tasks

Development Tasks

1. **Interactive Broadband Web Map Application** – A state-of-the-art ESRI ArcGIS Server-based interactive broadband mapping web application will be developed and installed on Tetra Tech servers and then transferred to State servers. This task will result in several broadband map web applications to support project activities and the final technology transfer to the State of web mapping applications and supporting data.

2. **Preliminary Modeling of Broadband Infrastructure and Coverage** – Map and model high-speed broadband infrastructure, DSL, cable, and wireless coverage areas based on publically available data for logistical planning and field data collection in subsequent sections. Outputs of tasks 1, 2, and 3 will be used to develop Substantially Complete Broadband Status (Deliverable 1, Based on Publicly Available Data) by October 30, 2009.

3. **Anchor Institution Rural Broadband Infrastructure Assessment** – Interview key IT professionals in 150 North Dakota communities with a population of more than 250 residents, and at statewide IT conferences; assess their broadband coverage and infrastructure, and the middle-

mile broadband infrastructure in their region; and then map their networks through TeleTraceRouting.

4. **Map Broadband Infrastructure Coverage and Develop Database for Substantially Complete Map (NTIA formatted deliverable) –** A substantially complete map (Deliverable 2, Enhanced with TraceRoute and provider data) by February 5, 2010, will be compiled and submitted to the State in NTIA compliant format and standards to fulfill North Dakota's responsibilities to the federal government and Congress as they begin developing the national broadband map.

Data Collection Tasks

5. **Broadband Provider Data Collection –** Contact the estimated 40 to 50 broadband providers in the state, arranging non-disclosure statements as needed, and collecting coverage, middle-mile infrastructure locations, subscriber numbers, and related database information.

6. **Broadband Infrastructure Inventory of Available Public Data –** Research FCC, FAA, state, tribal, and local government records, public data available from providers, and other ancillary sources for provider information, middle-mile infrastructure locations, and data. Establish a web portal survey for North Dakota broadband consumers to report their location, provider, type of service, and results of standard broadband speed tests.

7. **Independent Infrastructure Measurements Using Web-based TeleTraceRouting –** Organize and publicize a series of structured web surveys and measurements to collect, analyze, and independently map broadband coverage areas and node elements of the network infrastructure throughout rural parts of the state from thousands of trace routes, user information, signal data, and line speeds, providing required data elements and supplemental information not available from any other source.

8. **Survey of Residential and Commercial Addresses and Accuracy Assessment –** A random sample survey, serving as an independent assessment of the completeness and accuracy of the five methods used for the broadband mapping process. The primary objective of the survey is to determine the need and demand for broadband service across four rural strata of residential and commercial addresses to supplement the broadband mapping, needs assessment and strategic planning processes. The survey research will be conducted using a proven, standard methodology designed to provide valid and reliable statistical estimates of coverage, by type and by demand for coverage, with at least 95 percent confidence that the actual population parameters are within +/- 5 percent of the statistical estimates.

2.2 Development

Task 1 – Interactive Broadband Web Map Application

Tetra Tech will integrate data-driven and web-based GIS technologies into all aspects of our project approach to support data acquisition, data maintenance, and collaboration between project stakeholders. Web technologies will be used for collecting site-specific broadband information from anchor institutions, private businesses, and the public. They will also be used for the collection of

enhanced infrastructure information and for interactive display and query of broadband resources at the census block and anchor institution level.

Tetra Tech's deployment of web technologies will consist of the data and application tiers described below.

Data Tier

The foundation that our web applications will be built upon is the data tier. Tetra Tech's approach will be to leverage existing data resources and services in North Dakota wherever possible. We will extend these resources and services with compatible resources and services to build an application infrastructure that integrates with State systems at the data and technology level.

The broadband resources data developed by Tetra Tech will be integrated at the census block, anchor institution, and street address level as appropriate. The integration will include database linkages by key fields and spatial integration by geography.

To integrate our data tier at the technology level with the State, Tetra Tech will deliver all data products used by our applications in the Environmental Systems Research Institute (ESRI) Geodatabase and Microsoft SQL Server format and version specified by the State.

Application Tier

Tetra Tech will develop and deploy a suite of web services and applications to meet project objectives. The services and applications will be built using ESRI ArcServer and Microsoft .Net technology. To meet schedule requirements, Tetra Tech will initially deploy all project applications on our servers. However, we will coordinate with State staff to ensure version compatibility of all web applications and to allocate the necessary time and resources to install fully functioning versions of all project web applications on State servers.

Tetra Tech's applications will be built using ArcServer map services and Microsoft .Net XML data services. These services will provide the link between our data and application tiers. They will support the access, query, viewing, and updating of all data elements required by the broadband mapping project. All services will be designed to support fast, seamless access to statewide project data. The services will be designed to either consume data services or data layers where appropriate. To meet performance objectives for our web applications, Tetra Tech may be required to condition data layers for use in our web services. Where this occurs, Tetra Tech will provide detailed instructions on how data resources were manipulated, and where possible, provide geoprocessing models or scripts that allow for easy replication of the data processing steps to support application maintenance.

Tetra Tech will be basing the Broadband Mapping web application on our already existing and operational GeoManager product. The GeoManager is an internet-based, interactive information management system with core capabilities that facilitate mapping, queries, reporting, and database edits through a Web browser. Built using ESRI ArcServer technology, Tetra Tech designed the system to integrate project GIS databases with the data, querying, and viewing capabilities of Google Maps. With

the GeoManager, any project data can be viewed over Google Maps reference datasets, such as street maps and aerial photography.

In addition to the standard Internet GIS capabilities of pan and zoom, data query, line and area measurement, and layer display control, notable features of the application include:

- Ability to update attribute data through the browser
- Custom user "geo notes" that allow project staff to add comments at any location (free floating) or attach them to a feature
- Ability to attach images, such as scanned documents or photographs, to geo notes

Tetra Tech has enhanced the GeoManager for clients to include custom reports, data entry forms, special access restrictions and custom queries for field staff, an Excel export tool, and more. The result is a powerful and flexible tool our clients can use to view, query, update, and report on project information through an easy-to-use interface.

Using the code base of GeoManager, Tetra Tech will develop two Web applications to support broadband mapping project objectives: a public query application (public application) and a project participant query and update application (update application). The public application will support querying broadband status information at the census block level. Users will be able to locate census blocks through geographic or attribute queries, through locating the nearest geographic feature such as towns or water bodies, and through map-based zooming and panning. The interface will be designed to be minimalistic and easy to use by the general public on slow data connections. Once a census block is located, the user will be able to view broadband status information and basic census attributes.

The update application will use the same basic query functionality as the public application, but will also allow update of broadband status information. It will be possible to update broadband status on multiple census blocks at once. The updates will go to a staging database that will require review and posting to the project database by the database administrator. The update functionality will require access through authenticated accounts (using login and password). Tetra Tech will provide the State with the tools, instructions, and workflows for reviewing edits and updating the project database.

Task 2 – Preliminary Modeling of Broadband Infrastructure and Coverage

With public data on broadband coverage and the middle-mile and back-haul network data, we will complete preliminary mapping and modeling. We anticipate a longer lead time before providers respond to our initial data requests, and it is unlikely that any of their data will be available before the first data submittal on November 1, 2009. We will make use of publicly available data and engineering knowledge of the three communications technologies involved in this phase. Examples include using the knowledge that telephone-based xDSL networks are organized around central offices and wireless networks around antenna base stations. Each major communications technology presents somewhat different challenges and data requirements.

The NTIA requires the State "to: 1) provide a substantially complete set of availability data by November 1, 2009 or propose to provide an alternative data set by that date". Since this first deliverable date occurs less than 30 days after the earliest possible date to have a contract in place, we anticipate working with the State to provide an answer to this deliverable. It may be a copy of the publicly available data and the portion of the initial GIS modeling that would be complete as of the end of October. There is not enough time to produce a substantially complete set of availability data by that early date.

DSL Networks

DSL networks, both the basic aDSL and the newer high-speed sDSL, represent 19 percent, or 62,183 out of the total of 321,663 broadband subscriber lines in North Dakota (FCC report, June 2008). DSL networks are organized around central offices (COs) and remote terminals. When the locations of these central offices and remote terminals are known, DSL coverage areas may be estimated based on the specified coverage areas of aDSL and sDSL technologies. aDSL networks range 18,000 feet from a CO or a remote terminal. sDSL networks usually operate exclusively from remote terminals called ISAMs with an effective radius of 3,000 feet. ISAM terminals are a collection of two enclosures usually located along a roadway. Geospatial modeling will be used to provide a preliminary coverage map based on a radius around established central offices and remote terminals.

The locations of most COs are available in state utility records because they were mainly established prior to the Federal Telecommunications Act of 1996. Following the passage of this act, telephone companies were no longer required to report the locations of their network facilities to the FCC, particularly the more recent packet-switched network facilities. For preliminary DSL broadband mapping, the accuracy of the network will depend on the ability to obtain remote terminal location data. aDSL remote terminal information is typically unavailable from service providers. In contrast, the newer sDSL ISAM terminals require registration in some jurisdictions, at least at the community (city, village) level. Obtaining information on ISAM locations will highlight the more advanced form of broadband communications in telephone networks.

Wireless Networks

Wireless networks center around antenna base stations. Knowing the geographic coordinates, heights, and operating frequencies of service providers on these base stations, it is possible using radio propagation modeling to generate preliminary coverage areas of wireless networks. Transmit power is another important modeling variable that could be difficult to obtain. Most fixed wireless networks, however, operate in unlicensed frequency bands that have stringent FCC transmit power restrictions. The assumption of maximum FCC transmit power on most base stations should be extremely close to actual operating conditions. Sources for antenna base station data are plentiful, including the FCC and FAA databases along with maps posted on the websites by the individual providers themselves. Since many rural fixed wireless providers are alone in their service territories, they are often anxious to share the extent of their coverage as a form of free advertising for their business. Preliminary mapping of fixed wireless networks should be one of the more accurate areas of preliminary broadband mapping.

Broadband Cable Networks

Hybrid fiber-coaxial (HFC) cable networks, first in the number of broadband users in North Dakota based on the 2008 FCC F477 report, are perhaps the most difficult to map on a preliminary basis. We anticipate most of these subscribers to be in the four largest cities in North Dakota. These cable networks are linear in nature, fanning out from optical nodes in a tree-like fashion. Cable networks have also never been regulated by state agencies in the same way as telephone networks. There is, therefore, no original database as there is in the telephone industry. There are, however, three data sources that were found useful in tracing broadband cable networks in previous mapping efforts:

1. Franchise agreements
2. Cable deployment economics
3. Sanitary sewer deployments

Using all three of the above sources, preliminary broadband mapping of cable networks becomes feasible. Most cable network deployments were based on an exclusive multi-year franchise agreement with a local unit of government. The first step in preliminary mapping of cable networks will be the retrieval of these franchise agreements, and we have budgeted to conduct interviews with local government record-keepers in the estimated four to six North Dakota communities with cable services. These documents will identify the franchised cable provider in each governmental jurisdiction. Unfortunately, most of these agreements do not require the cable service provider to service the entire franchise area. For this reason, cable coverage of the whole franchise area cannot be assumed. Additional information is required to accurately determine the extent of cable deployment in a given cable franchise. For the purposes of this preliminary mapping, we will err on the side of over-estimating the cable subscription service area, since we are using this data for planning and logistical purposes.

This additional information is best found in the decision rules used by the cable service providers in their deployment decisions. The most important of these decision rules relates to the number of household units in a mile stretch of roadway. Most providers specify the need for at least 20 units per mile of roadway to achieve an adequate return on the cable deployment investment. Cable deployment costs range from a minimum of $25,000 to a maximum of $40,000 per mile in most lower density rural areas. We will utilize ESRI Business Analyst to conduct a market feasibility for this item.

The finest level geographic location of all data collected in the initial public source research will provide the basis for a coarse filter mapping step at this stage of the project. Demographic and economic information available at the census block group, census tract, and county level will be apportioned to the census block level, using ESRI block centroid apportionment methods in Business Analyst. We will use the North Dakota city and corporate boundaries developed by the North Dakota Department of Transportation (NDOT) and available from the North Dakota GIS Hub.

We will also utilize other North Dakota GIS databases that will be useful in the geospatial modeling and assessments. There are several categories of these databases. For DSL and wired telecom providers, we do not anticipate receiving detailed infrastructure maps or inventories of copper or fiber lines used for

DSL connections. Experienced engineers on our team will provide expertise that will be leveraged with GIS data sets to provide a coarse filter mapping of the initial broadband infrastructure. In a few of the larger communities in North Dakota with sewer and transmission lines, we will be able to utilize those data sets to assist in identifying potential areas for DSL coverage. For the remainder of the State and virtually all of the rural areas, we anticipate using the publicly available transportation data, supplemented as necessary by commercial data sources from Tele Atlas, as a surrogate for the potential capability and capacity for DSL.

We will utilize proximity measurements adjusted by the transportation and other infrastructure networks to provide a more realistic initial assessment of DSL coverage. We will use the USGS national elevation data set (DEM) in their current combination of 10- and 30-m resolution for the digital elevation modeling required at this step for portions of the state with some terrain relief. In most cases, this level of accuracy is sufficient for the radio propagation modeling required. Vegetation, particularly forest vegetation, also influences the wireless radio propagation modeling; therefore, we will utilize the best available vegetation data for the forest/non-forest coverage availability. This will be incorporated into the radio propagation models supplementing the other features.

We anticipate the FCC data initially examined in preparing our response will be relatively more incomplete than wired middle-mile infrastructure regarding the location of wireless cell phone towers. Supplemental sources will be examined in attempt to identify the latitude and longitude locations of the unknown cell towers, and whenever possible, the tower height. Although the revised NTIA requirements in the Federal Register appear to eliminate the requirements to identify rural, underserved, and un-served areas as part of the database reporting requirements, this data is still required in reporting and final verification as required by NTIA. Regardless, these end-user categories are important for policy decisions in North Dakota, and we intend to conduct this portion of the analysis. Census block data is readily available and analysis methods are not time-consuming. We will develop a database of census blocks that are greater than and less than 2 square miles using the Census Bureau rule of thumb of 1,000 residences per square mile to identify the rural density requirements for an urbanized area contiguous and adjacent to Fargo and Bismarck (population of greater than 50,000 inhabitants) and Grand Forks and Minot for the criteria for towns with population more than 20,000 (see Figure 1 for an example of this procedure drawn from neighboring Montana). Combining this with the North Dakota city and corporate boundaries developed by NDOT and available from the North Dakota GIS Hub, we will determine the census blocks that adjoin these areas to identify the required areas for rural designation.

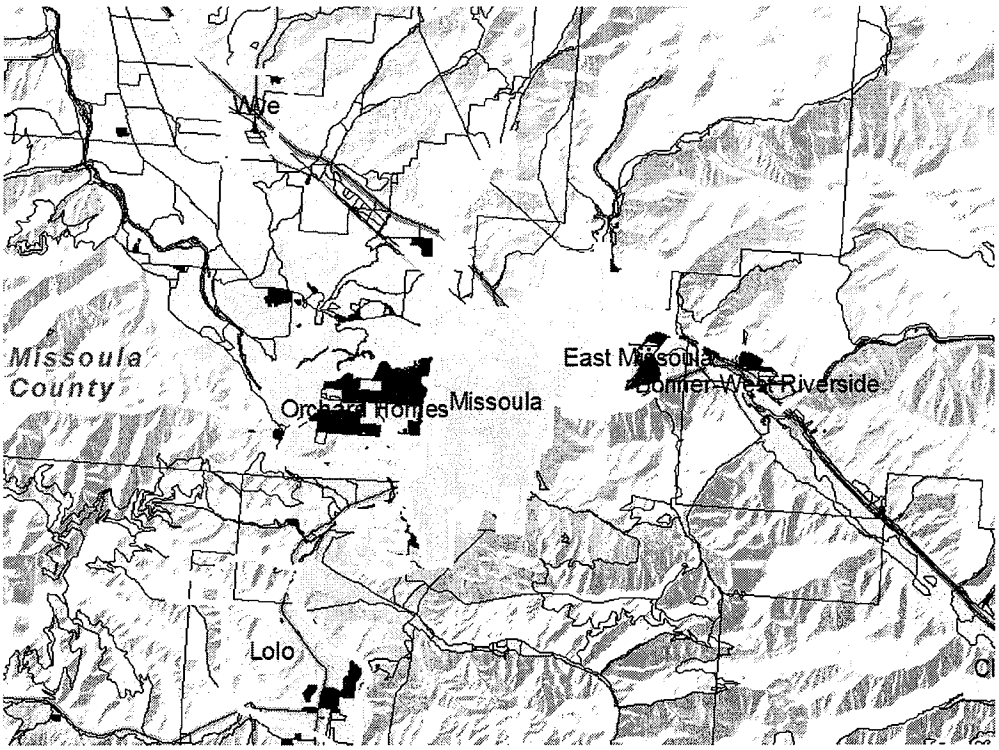


Figure 1. Rural Census Block Adjacent to City Greater than 50,000 Inhabitants, Drawn from an Example in Neighboring State of Montana

As stated in the previous sections, our mapping will also utilize several commercial indicators as well as demographic indicators and assessments of market areas. This will allow correlation and cross-tabulation of factors to compare to the infrastructure mapping. As an example, consumer expenditure data on streaming broadband, cable TV services, and other economic expenditures at the block group level will be apportioned to the block level using ESRI Business Analyst.

For the coarse filter mapping, we initially anticipate a conservative approach overestimating the available capacity. Since we will know some, but not all, of the infrastructure from available sources (such as central offices and remote terminals), our coarse filter initial approach will use cumulative proximity measure from the central offices, along with an additional buffer, so that we are confident we are overestimating the availability. Initial overestimating will limit errors of omission later in the independent measurements and assessments. In portions of North Dakota with extensive public lands, we will also utilize the latest public land ownership data layer to screen out areas where there are no residential developments. Cable broadband providers are likely to be limited to the large cities in North Dakota. For this initial phase, we will use a combination of publicly available sources and limited assessment with local government regulatory records to determine the extent of cable broadband providers and consumers. The coarse filter level may be limited in some instances to the incorporated city boundary for identified cable broadband providers.

The map products from this phase of the project will include statewide coarse filter maps of potential availability for broadband services, with separate feature classes for DSL coverage, cable coverage, and

wireless coverage. Separate feature classes, primarily composed of infrastructure point data, will be developed with the best available information we have on provider infrastructure.

Task 3 – Anchor Institution Rural Broadband Infrastructure Assessment

We estimate that there are more than 5,100 community anchor institutions in North Dakota, including approximately 700 public schools, 3,600 public administration buildings including police and fire, more than 300 hospitals and clinics, 34 registered quick response units, 309 airports, 139 ambulance providers, 46 trauma centers, 56 counties, and 129 municipalities. Our approach to cataloging their broadband use, availability, and transmission method begins with developing a complete list of these institutions. We will begin with the any data that can be made available by the State. We will then verify and enhance that data by cross-referencing with lists available from other statewide institutions. For example, we will compare the list of medical/healthcare institutions with data available from the NDHA (North Dakota Health Care Association). This and other reviews will enable us to quickly develop a complete list of community anchor institutions.

The second step will be to identify the availability of broadband internet service at the institution, the transmission technology being used, and the advertised downstream and upstream data rates. We will develop this data through existing working relationships with providers, telephone surveys of the institutions, and review of available statewide data. For example, we will query the North Dakota Department of Public Instruction for any data available on public school internet services. Similarly, we will contact North Dakota University System schools to develop relevant data for all campuses in the university system. We will cross-correlate data developed from independent sources, including existing clients in healthcare, local government, and K-12 and higher education, to ensure the accuracy of the data developed.

Lastly, in regions where broadband availability is limited or where data regarding availability are sparse, we will conduct one-on-one interviews with the key anchor institutions to develop additional insight into the issues preventing broader deployment of broadband services. During our work in north central Idaho, these one-on-one interviews provided significant insight and contributed a great deal toward developing a thorough understanding of the realities of rural broadband service.

During the initial phases of the project, we will make preliminary calls to approximately 150 key IT professionals in North Dakota representing approximately 100 towns with populations greater than 1,000. We will focus on police and emergency operations centers, hospital and clinic staff and other IT professionals in anchor institutions, and professional organization leadership positions who have more familiarity with the middle-mile. In these initial interviews, our goal will be to introduce them to the program and use their expert local knowledge to assess the completeness of our initial identification of broadband infrastructure from public sources. We anticipate this knowledge will be primarily helpful in confirming provider areas of coverage, central offices and remote terminals, and to a lesser extent, wireless tower locations that did not show up in the FCC research. We will also assess their local infrastructure and discuss the broader issues, plans, and interoperability.

Task4 – Broadband Infrastructure and Coverage Mapping and Database for Substantially Complete Map (NTIA formatted deliverable)

Using the TeleTraceRouting data, we will develop a substantially complete map and data to meet the February 5, 2010 delivery, which will be compiled and submitted to the State in NTIA-compliant format and standards to fulfill North Dakota's responsibilities to the federal government and Congress as they begin developing the national broadband map. Following is a description of our methods and the products developed.

Broadband Service Availability

The output from the TeleTraceRouting method allows development of area coverage of broadband availability. These areas will be compiled into a project geodatabase with the database items for each provider as specified by the NTIA and as published in the Federal Register on July 9, 2009, and amended in the Federal register on August 12, 2009. The method will also allow supplemental data over and above the RFP and NTIA requirements of actual measured signal speed and quality measurements. Where maximum advertised downstream or upstream speeds vary within a coverage area for a provider, the technology of transmission and the spectrum use classes identified in the NTIA database listings below to be identified at the census block level. This broadband service availability data will then be integrated with census, address, and anchor institution data to produce a project geodatabase with the database items for each provider by subscriber at the census block and address level as specified by the NTIA and as originally published in the Federal Register on July 9, 2009, and amended in the federal register on August 12, 2009.

Residential Broadband Service Average Weighted Speed in Provider's Service Area

The TeleTraceRouting method will allow technology of transmission and the spectrum use classes identified in the category listings below to be identified at the county level by provider.

The number of subscribers required for the weighted nominal speed measurements will ideally be provided by the broadband providers. In instances where the providers are not willing to provide this data, even with a signed non-disclosure statement, we will utilize the latest available statewide number of customer lines, as reported in the FCC F477 June, 2008 report. These will be apportioned to provider coverage areas using the ESRI Business Analyst census block centroid method with the 2009 census household estimates. The formula we will follow in computing the average weighted speed will be calculated as the sum of the products of the provider's advertised maximum download data transmission rate (in kbps) for each residential rate tier advertised by the provider in the county, times the average monthly number of residential subscribers receiving the advertised download transmission rate tier for the relevant reporting month (i.e., June or December, as applicable), divided by the average total number of residential subscribers for all the included data transmission rate tiers in the county for that month. This will be expressed in the following formula:

> [(speed tier-1in kbps x no. of tier-1 subscribers)+ (speed tier-2 in kbps x no. of tier-2 subscribers)+...] / [total average monthly subscribers]

The county level data will be compiled into a project geodatabase with the database items for each provider as specified by NTIA requirements.

Middle-Mile and Backbone Interconnection Points

The TeleTraceRouting method will also provide a list of interconnection points of facilities that provide connectivity between (a) a service provider's network elements (or segments) or (b) between a service provider's network and another provider's network, including the Internet backbone. (Collectively, (a) and (b) are "middle-mile and backbone interconnection points").

The middle-mile and backbone interconnection points data will be compiled into a project geodatabase with the database items for each provider as specified by the NTIA and as originally published in the Federal Register on July 9, 2009, and amended in the Federal register on August 12, 2009.

Task 5 – Broadband Infrastructure and Coverage Assessment for Accuracy Verification (NTIA and State address-level deliverable)

Using all public, provider, and TeleTraceRouting data collected to date, the Tetra Tech team will build final project geodatabases and data deliverables to meet all State and NTIA standards and requirements by February 5, 2010.

Broadband availability from all sources will be cross verified. Where anomalies are noted, further research and/or trace-routing will be performed to rectify data. Mapping and database results will be verified and compared to NTIA and North Dakota State broadband mapping standards; and demographic and geographic characteristics and final verified coverage, middle-mile infrastructure, and NTIA map products prepared and delivered. This final step will incorporate the final coverage polygons and infrastructure points into the project geodatabase format. The final independent measurements will be updated with final provider submissions and corrections. All data will be loaded into the final geodatabase structure, with three feature classes for each provider and the appropriate point infrastructure layers as point feature classes by provider.

The data collected in the first three phases of this project will be aggregated into the final data structure and geodatabase format. Based on our independent measurements of broadband provider infrastructure, and further enhanced by the trace routing, consumer surveys, anchor institution interviews, and subsequent geospatial modeling of the coverage resulting from this enhanced data, we anticipate communicating again with all providers requesting review and confirmation of the independently assessed data combined with the data they have provided. Our primary realistic goal from the providers at this point will be a confirmation at the census block level of presence or absence of availability for their services. We also expect to obtain confirmation on the number of customers they serve in their coverage areas. We will make extensive use of WebEx-enabled conference calls, in-person meetings when practical, and any other reasonable method, to review and incorporate provider responses into our initial enhanced inventory. We will use all due diligence, incorporating their comments and corrections, and adjusting our data as appropriate.

We identified limited time in the budget for additional edited independent assessments, comparison of provider comments, and review of modifications against our independently enhanced database. Data anomalies will be identified and examined. This will be conducted by comparing independent areas where the information is conflicting or confusing when comparing multiple independent sources.

During this project phase we will also overlay broadband availability data with demographic data at the census block level to determine percent of households completed for each component, per the NTIA criteria. We will ensure compliance with the following criteria, and will provide a table reporting our results compared to the minimum requirements:

- Underserved: at least one of the following factors is met (one or more contiguous census blocks)
    - No more than 50 percent of households in the service area have access to facilities-based terrestrial broadband service
    - No fixed or mobile broadband service provider advertises broadband transmission speeds of at least three megabits per second (``mbps'') downstream in the area;
    - Rate of broadband subscribership for the area is 40 percent of households or less
- Un-served: one or more contiguous census blocks
    - At least 90 percent of the households in the service area lack access to facilities-based terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed (set forth in the definition of broadband above)
- Rural area
    - A city, town, or incorporated area that has a population of greater than 20,000 inhabitants
    - An urbanized area contiguous and adjacent to a city or town that has a population of greater than 50,000 inhabitants

Rural Addressing

In the description of Task 5 above, we describe our understanding of the NTIA technical requirements and how we have incorporated them into our methodology. Although the NTIA requirements focus on coverage reporting at the census block or road segment level, depending on the 2-square-mile size rules, our source level coverage maps by provider will be polygons irrespective of census boundaries. These will be derived through geospatial models as described in our different methods sections, such as radio propagation maps for wireless towers, or DSL coverage modeled with distance buffers from central offices or remote terminals, using transportation framework layers, digital elevation models, vegetation cover, TeleTraceRouting weighted mean centroids, and other methods.

These core-level coverage polygons for each provider will be generalized for NTIA requirements, requiring rule-based decisions to generalize the information. An example may help to illustrate the process: For NTIA requirements, Figure 2 shows a simplified coverage area for simulated DSL coverage for CenturyTel in Flathead and Lake Counties in Montana (derived from FCC records).

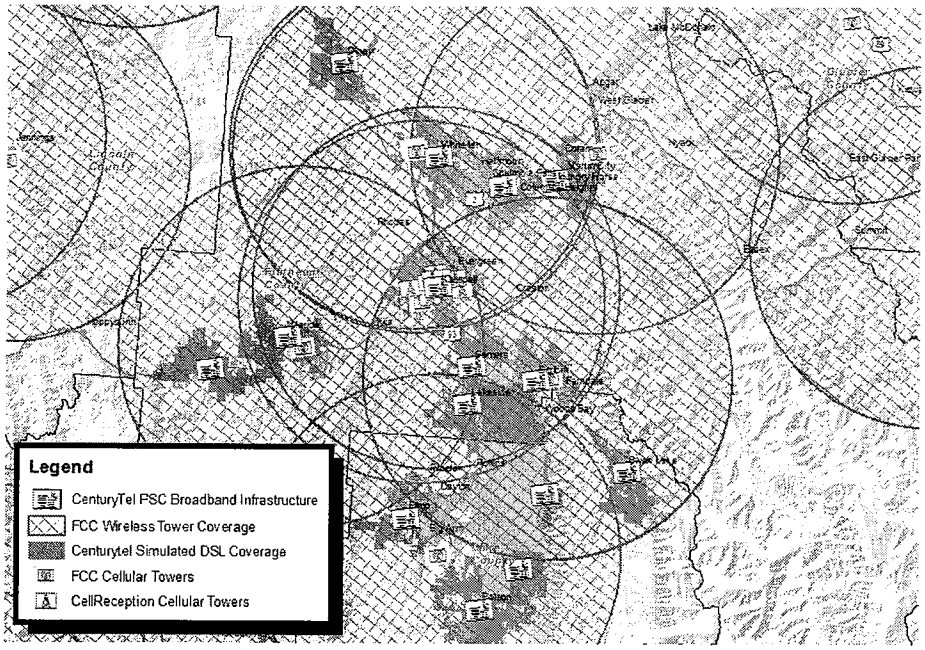


Figure 2. Coverage Area for Simulated DSL Coverage

The actual modeling we conduct would be more complex with engineering input from HierComm and Access Consulting. We will implement decision rules to classify the census block as having broadband coverage if any part of the coverage intersected with the census block (as shown in Figure 3), or if a certain percentage, e.g., 10 percent intersected; or if the majority of the census block intersected. Whichever option was the decision rule, the resulting map submitted to NTIA would not include the higher resolution core coverage polygons.

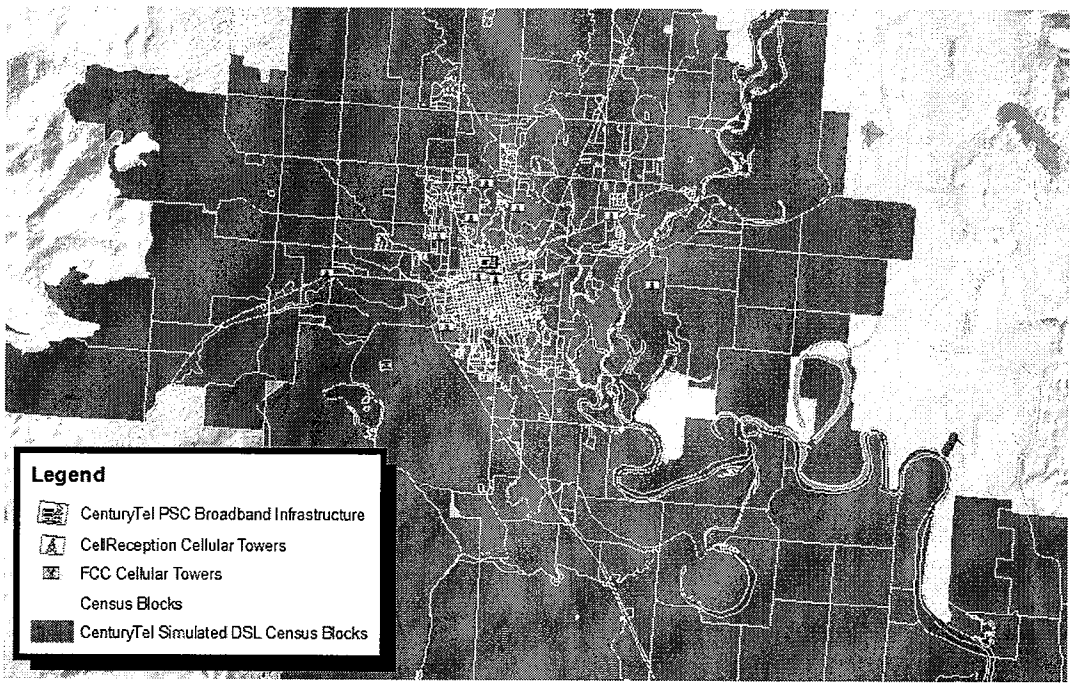


Figure 3. Broadband Coverage Intersected with Census Blocks in Kalispell, Montana

In the situation where transportation road segments are reported for larger census blocks (using the 2-square-mile rule, the road segments would be intersected with the core coverage polygons using similar rules. We would apply this intersect using all roads in available digital transportation layers for North Dakota. We would not limit this to the census blocks larger than 2 square miles, but run them for all road segments. We would also run a spatial intersect of all road segments with census block polygons and attribute the transportation road segments with the majority value census polygon SIC code for each road segment as shown in Figure 4. This will allow the NTIA reporting requirements to be fulfilled through a database query and provide results to comply with the NTIA reporting requirements. . This is one method that could be used in the interactive broadband map for identifying broadband coverage by address. It may not be the preferred method, because the address ranges in North Dakota are not actual address ranges in almost all cases, but typically are hypothetical or predetermined address ranges between intersections. In rural route areas, the error margin can be very large. Results vary across North Dakota, depending on the county, the vendor who developed the enhanced 911 rural addressing, and other factors.

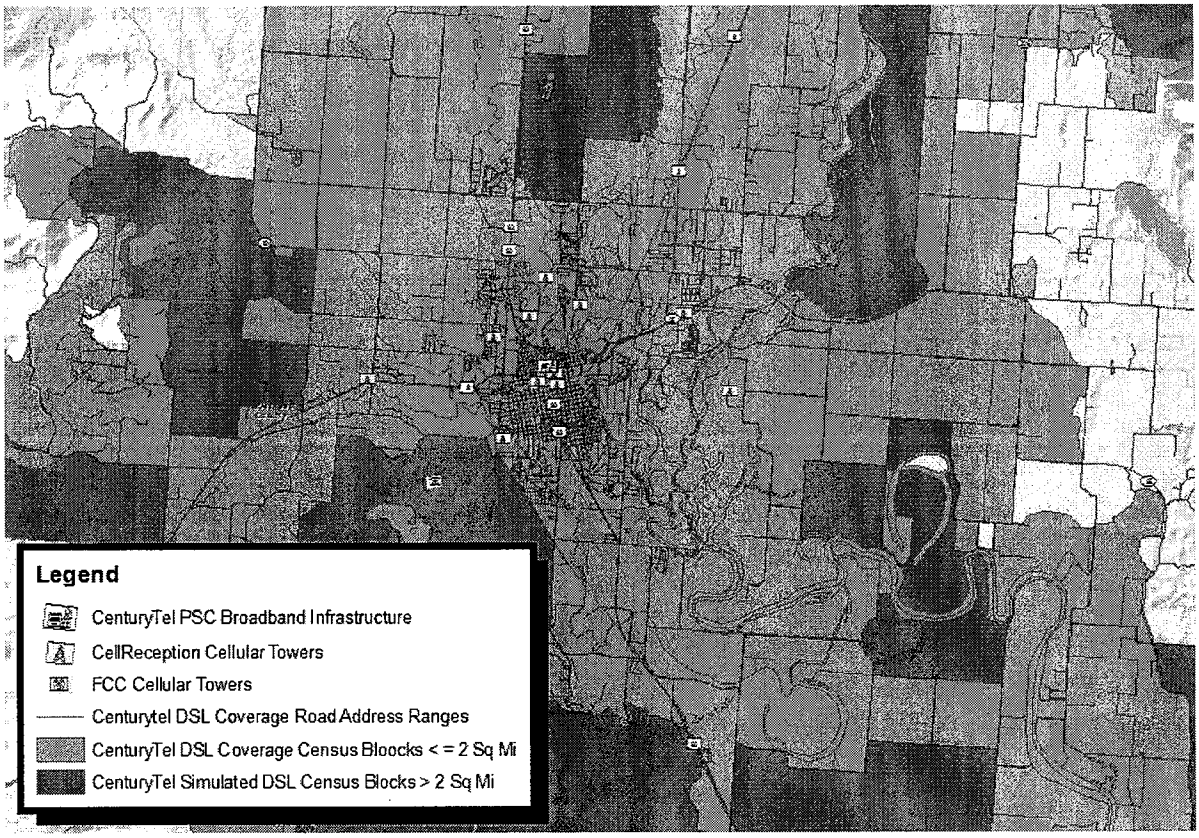


Figure 4. Road Segments Attributed with Census Polygon SIC Codes

All polygon coverage maps for each provider, used as core base layers in the intersects and unions discussed in this section, will be delivered to the State as an addition to the census block and transportation coverage layers produced for NTIA requirements. This will allow the State to use the layers in other ways, or as standalone layers for additional modeling, display, or feature-on-polygon

operations in the future. They will also provide a reference point for change detection and modifications over time within future iterations of the broadband map.

Our team will collaborate with the State in evaluating the ESRI Broadband Mapping Solution (BBMS) and its value to the State. ESRI has assured our team that any winning contractor for this RFP will be supported in efforts to evaluate ESRI's unique solution for broadband mapping development and maintenance.

NTIA Technical Requirements and Technical Requirements Clarification

The Tetra Tech team has a thorough and complete understanding of the NTIA technical requirements and the two technical requirements clarifications as reported in the Federal Register and in the State of North Dakota RFP documents and amendment. Our team has significant experience with NOFA and NTIA requirements. HierComm, Applied Communications, and Access Consulting all have extensive experience with telecommunications programs and have spent many years working with the requirements in the industry. They have been working in other states, including Wisconsin, Colorado, Idaho, North Dakota, and Montana with the NOFA and NTIA stimulus funding programs and understand the technical requirements. Tetra Tech and Geodata Services have had years collective experience working with the data sets and geospatial modeling and analysis techniques specific to meeting and exceeding the NTIA requirements.

In this section, we provide our assessment of the NTIA Technical requirements as originally published in the Federal Register on July 9, 2009, and amended in the Federal register on August 12, 2009. We also referenced our methods and deliverables in relation to these technical requirements.

The NTIA Requirements in the Federal Register on July 9, 2009, is essentially a definition of databases defining broadband service availability in a provider's service area, residential broadband service pricing and weighted average speed in a provider's service area, broadband service infrastructure in a provider's service area, and community anchor institutions. Several components of these databases were clarified and modified by the NTIA requirements in the Federal register on August 12, including technical requirement clarifications with changes affecting all sections except the community anchor institutions.

Originally in the Federal Register on July 9, 2009, the broadband service availability in a provider's service area included data collected at the End User level (address of every subscriber) in two categories 1) Availability by Service Address-Service Associated with Specific Addresses and 2) Availability by Shapefile--Wireless Services not Provided to a Specific Address. The former focused on broadband availability by provider for two size class categories of census blocks, those no greater than 2 square miles in size, and those greater than 2 square miles in size. Since census blocks are intended to be similar in number of households, the variance in size typically means that larger census blocks tend to be more rural, and smaller census blocks tend to be more populated.

The NTIA requirements in the Federal register on August 12 clarified these categories and dropped the requirement to provide end user metrics for provider areas and dropped 11 database fields from the provider service data dealing with end users. They dropped the end user category specifying the

designation as rural, underserved, or un-served from this section. This was the only mention of the category of end user in the NTIA technical requirements, but they are still required as part of the compliance verification procedures required by the NTIA. Instead of end user, an amendment from the August 12 Federal Register requires the census blocks no greater than 2 square miles to be reported as simply available or not available per provider, along with the associated service characteristics in the database. This presumably represents the situation that most populated census blocks have fairly complete broadband coverage.

Those census blocks larger than 2 square miles require either the address-specific data as described in the original Notice or a list of all street segments with address ranges in such census blocks, as contained within the U.S. Census Bureau's TIGER 4/Line Files or such other database of at least equivalent granularity, in which broadband service is available to end users, along with the associated service characteristics. Figure 5 shows the census blocks in each category in the Helena, Montana area. The yellow census blocks, no greater than 2 square miles, representing the more populated areas will have broadband availability recorded as available or not at the census block level. The brown census blocks, larger than 2 square miles, representing the more rural areas will have database attributes reported to the street segment.

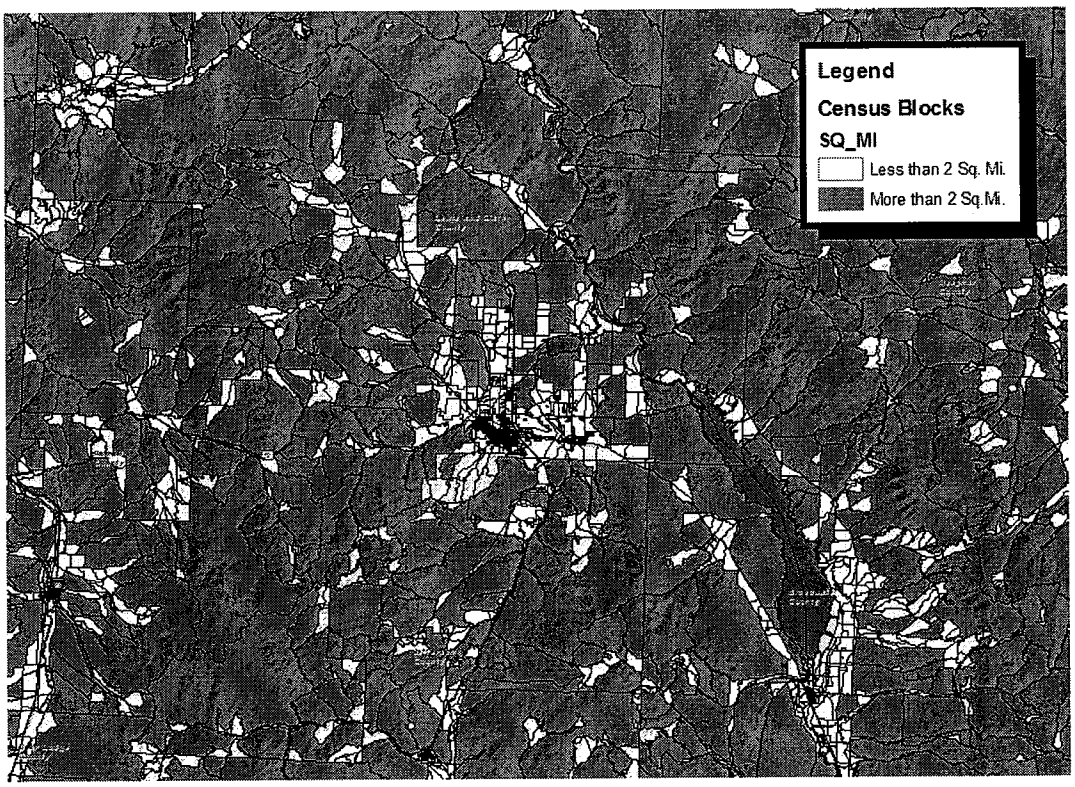


Figure 5. Census Blocks Greater Than and Less Than 2 Square Miles

The other change in this section modified the broadband speed recordation in the database. Originally in the Federal Register on July 9, 2009, the maximum advertised upstream and downstream speeds and the typical upstream and downstream speeds were required. The amendments on August 12 dropped

the requirement for advertised upstream and downstream speeds at the census block or street segment to a broader level of geography, the Metropolitan or Rural Statistical Area. There are no Metropolitan statistical areas in North Dakota, and the rural statistical areas of the census bureau would typically be counties in North Dakota.

For purposes of meeting the NTIA requirements and the February 5, 2010 deliverables, we will generalize to the census block or street segment level of geography (depending on the appropriate category for the 2-square-mile rule). From our independent measurements and provider data, we anticipate being able to substantially complete the database items as specified in the NTIA address record format details for this section.

The second major category of the provider database in this section of NTIA focused on the availability by Shapefile—Wireless Services not Provided to a Specific Address. This deliverable will be a point GIS file with provider infrastructure database items including technology of transmission and spectrum user classes. From our independent measurements and provider data, we anticipate being able to substantially complete the database items as specified in the NTIA address record format details for this section. The only modification in the August 12 amendments was in the availability of shapefile details. The item numbered 4, as shown below, was deleted.

> *"4. In the area covered by each polygon, subscribers must have broadband service with the speed characteristics shown in the data record 95% of the time to within 50 feet of the polygon's boundary."*

In its place, the August 12 amendments specified Item 4 will be satisfied if each polygon indicates the subscriber broadband service authorized maximum downstream and upstream speed available. Unlike the provider coverage area, this deliverable will be a point GIS file, and we will use the advertized upstream and download speeds provided by providers at the attribute for this database item with all the provider's infrastructure points.

The Federal Register on July 9 required the residential broadband service pricing and weighted average speed in provider's service areas. Originally, the Federal Register on July 9 required revenue for end users, but that was modified in the August 12 amendments, and all service pricing was dropped from the requirements, leaving only weighted average speed per provider service area. The August 12 amendments also modified the geographic granularity required for weighted average speed per provider service area, moving from an end user level to the broader level of geography, the Metropolitan or Rural Statistical Area, which as stated before, translates to the county level of geography for North Dakota. From our independent measurements and provider data, we anticipate being able to substantially complete the database items as specified in the NTIA address record format details for this section.

Originally in the Federal Register on July 9, the broadband service infrastructure in provider's service had geographic and database requirements for both last-mile connection points and middle-mile and backbone interconnections points. The August 12 amendments dropped the requirements for all of the

last-mile connection points and there were no other modifications of the remaining middle-mile and backbone interconnections points. From our independent measurements and provider data, we anticipate being able to complete the database items as specified in the NTIA address record format details for this section. Although it was not changed or modified by August 12 amendments, the community anchor institutions record format and database items will be populated from North Dakota anchor institution critical infrastructure data and ancillary data we will gather during the project. From our independent measurements and provider data, we anticipate being able to complete the database items as specified in the NTIA address record format details for this section.

As described in this narrative of our proposal, we have demonstrated understanding of the NTIA technical requirements and integration of all requirements into our methods and deliverables.

2.3 Data Collection

Task 6 – Broadband Provider Data Collection

The Tetra Tech Team will first identify a list of broadband providers based on publicly available sources, including the FCC database and the FCC F477 reporting information. The most recently available FCC F477 report indicates there are 40 broadband providers in North Dakota. Our budget estimates, using the FCC and ancillary data, are based on 40 to 50 providers with potentially as many as 30 wired providers of DSL service, 16 wireless service providers, and 4 or more cable providers. In North Dakota, the PSC records and reports on companies that request rate changes providing more detailed information in annual reports on central stations, remote terminals, and other infrastructure as well as on the number of subscribers. Twelve of the provider's annual reports are available, primarily DSL providers, and we anticipate researching the remaining PSC database of all registered telecom providers in order to develop a file master list of all providers. This will be compared against ancillary data from other sources.

Concurrent with the research of available providers, we will develop a standard letter and questionnaire to be mailed to each provider requesting the data required by the NTIA criteria. Our focus will primarily be on the presence or absence of coverage by census block, the providers key infrastructure locations for central offices, remote terminals and wireless towers, and numbers of subscribers by county. We will also request information on the categories of use spectrum that they service.

We will also develop a standard letter and set of materials to initiate and complete nondisclosure agreements with broadband providers with the anticipation that some of the providers will require this as a prerequisite to sharing data.

Our basic strategy for the initial collection will assume fairly complete coverage in urban areas of North Dakota. However, the fact that a provider has a central office in a community does not necessarily indicate that the provider provides DSL service. This underscores the importance of both the multiple independent source strategy of our proposed methodology and the TeleTraceRouting measurements. Nevertheless, we anticipate our primary challenges to be in rural broadband coverage.

We will set up a database tracking process and procedures to track the results and to allow follow-ups with providers on regular intervals. We have budgeted for three follow-ups with each provider via registered certified mail and two follow-ups via telephone. For those providers that respond in the initial data collection phase, or at any point during the project, we have budgeted response time to follow-up with those providers through Web-enabled conference calls or in-person meetings and WebEx- and GIS-enabled conference calls in order to capture as much geographic-specific information as possible. Our initial estimates are based on a 20 percent response rate requiring significant time spent with the providers. Our intent is to collect provider data at the census block, or in lieu of that, at the finest geographic level possible in order to incorporate the provider information into the project database.

We will provide a standard format in our requests to comply with the NTIA database criteria and we will supplement provider data with independent measurements. We anticipate being able to collect advertised speeds, advertised rates, and other key variables in public sources such as the websites of the providers. In our question format on sensitive or potentially proprietary data, such as number of customers at a fine granular level of geography, we will request ordinal or categorical level of data rather than exact numbers. We anticipate then requesting data at a broader level of geography (census block group, census tract, or county) if they are not willing to provide it at the census block level. Whatever level they provide can be compared to our independent measurements and would be useful. For infrastructure data, we will request latitude, longitude, or address-level data that we will subsequently geocode.

Task 7 – Broadband Infrastructure Inventory of Publicly Available Data

With the initial list of providers and contacts identified in Task 6, all publicly available broadband infrastructure will be researched in this project task. Research will be primarily based on the FCC databases. We will supplement these data from commercial sources, in the InfoUSA business listings, for telecommunications industry NAICS codes in the ESRI Business Analyst software product. We will also supplement this with independent research from open public sources such as websites, broadband provider retail outlets, trade journals, professional organization contacts we have in North Dakota, and other sources.

The June 2008 SEC 477 report lists statewide numbers for many of the database elements required as NTIA deliverable items. During the initial phases of the project, we anticipate apportioning these using existing demographic and economic data to obtain estimates on number of customers by provider. These rough estimates will be enhanced through TeleTraceRouting and our other independent measures throughout the project to obtain a more refined database entry for the final deliverables. Although the FCC in 2009 has requiring census tract-level reporting by the providers, our discussions with FCC staff indicate that reported measures at the census tract level will not be available during the critical timeframe of this broadband project, and will not be available until February 2010 at the earliest. Once this data becomes available, we will immediately incorporate the census tract level information into our methodology and process. We do not anticipate any additional information beyond the June

2008 reporting of aggregated information at the statewide level. The FCC reports on the presence or absence of a least one customer per ZIP code may be meaningful in some of the more rural census blocks in North Dakota, and we will use that data as provided by the FCC.

The final work products from this phase of the project will include a tracking database of provider communications and a spatial database managed using a web application of provider infrastructure for broadband such as central offices, remote terminals, and wireless cell phone towers, identified to the finest level of geography possible. If address-level information is available, it will be geocoded using the best available public transportation database and/or Tele Atlas data using standard geocoding techniques. Our web application will be used by project team members and North Dakota state and local government partners to collect and track the infrastructure points on a centralized web service, providing up-to-date access to the master inventory at any time, and act as a structured and efficient data entry system by all project team members and partners. Providers will also be encouraged to use this internal system during the course of the project. The web application will allow users to identify locations of facilities by address or map location and then enter appropriate information about the provider and associated infrastructure at that location. The data will be collected in a SQL Server database and used in the development of several subsequent data products. This web application will not be publically available and will require access by authenticated login and password. Updates to the database will be initially stored in a holding database until they are reviewed, approved by the database administrator, and published to the master database.

We will also use ESRI Business Analyst demographic and economic data and software modeling techniques to provide an independent assessment of market characteristics and demographic and economic characteristics as a cross-check against the FCC data and other ancillary sources. This software and tool will be advantageous throughout the project with its suite of data sets, prepared by some of the best data providers in the nation, and internally by ESRI's team of 30 demographers. It also has more than 60 additional geospatial functions not available to other ArcMap products specifically targeted at commercial market analysis, and apportionment of data such as broadband coverage maps, wireless radio propagation model polygons, and other map layers such as census blocks and incorporated cities and towns.

Task 8 – Independent Infrastructure Measurements (web-based TeleTraceRouting)

To acquire data on broadband availability that is not available from the providers and public sources, and to verify and enhance data that is available, our team will use a method developed by project team member HierComm called TELSIS (TELecommunications Services Inventory System) TeleTraceRouting. The TELSIS TeleTraceRouting methodology collects data for broadband coverage and infrastructure mapping utilizing user provided data and network trace-routing from a project website.

Data for all three classes of network—DSL, cable, and wireless—come from the same website source. Internet users from around the state will be recruited to access the trace-routing website and provide data on their geographic location and service provider. The website will also capture the measured upstream and downstream line speeds, and acquires the upstream trace-route. All data collected from

those logging on to the website is compiled into a database. After editing, the database is used to define network type and infrastructure, coverage, and actual network speed.

Using these direct network managements provides the following advantages:

- Accuracy: Recent experience with this approach has revealed significant differences between field measurement and service providers advertised claims of network coverage and performance.
- Consistency: A direct measurement methodology provides a standard technique for the evaluation of all service providers independent of the technology employed. Service provider data collection methods frequently lack such standards.
- Transparency: Because direct measurements are independent of service provider confidential data, they provide an open database accessible by all interested parties.
- Ease of Updating: Direct measurements support the State's goal of having a repeatable methodology for maintaining broadband availability.
- Infrastructure Map: The output of the TELSIS process provides data for a network infrastructure map as well as a broadband coverage/performance map. Such a "network of networks" infrastructure map of the State of North Dakota will be invaluable in future broadband planning for the State.

Following are the major work components of our direct measurement methodology.

Design and Install Web Site

The TELSIS methodology requires users to login to the project website and provide basic information about their location and provider (if known). The data collected from the web site is used to populate a database for subsequent analysis. The website will be designed to be easily navigated and to require a minimum of user information. Data collected will include user\organization name (optional), user type (private, business, anchor institution, etc.), location either by address or clicking map location, and provider information if known. The user input process will be designed to take less than 2 minutes.

The first element in this task is documenting and verifying the web site specifications. This will be accomplished by reviewing and verifying overall project requirements in conjunction with TELSIS data requirements. Once the preliminary data elements are identified they will be reviewed by project participants (state, stakeholder, and contractor). Once the specifications are finalized they will be used to guide the development of the beta version of the web site. The web site will then be reviewed by the project participants and tested to verify data integrity and accuracy.

Plan and Implement Trace-route call-in campaign

A key element of our direct measurement methodology includes getting Internet users from around the State to access the project website. We will implement two major efforts to get users to access the project web site – one focused on project stakeholders and one on the general public.

Coordinating with and leveraging project stakeholders is a key component of our methodology. To achieve participation of project stakeholders, we will work with the State to develop contact lists of key officials in city and county government, state government agencies, emergency services providers, Tribal officials, and others.

To achieve the broadest public participation possible will require a well designed and executed publicity campaign. This will be accomplished through developing informational materials including project flyer, press releases, presentations, and informational web site. The press releases will be provided to all major media outlets in North Dakota (print, radio, television) with follow-up contact via phone. Meetings and conferences with key target groups will be identified for delivery of presentations about the project.

In addition to driving participants directly to the project trace-route web site, these efforts will be used to develop lists for direct mail, email, and telephone tree campaigns. The direct mail and telephone tree campaign will be coordinated with press releases to occur over a one week period early in the project lifecycle. Once the results of the initial campaign are analyzed, a follow-up campaign will be implemented to fill in areas with data gaps. The follow-up campaign will include re-contacting non-participants from the first campaign and enhancing contact lists through focused research and commercial mailing lists.

Mapping and Analysis of Trace-Route Data

TeleTraceRouting is a methodology for generating data for broadband service and network infrastructure mapping that combines data generated from user access to a designated website with trace-routing information to determine the coverage areas and infrastructure of the designated network. Using website-acquired geographic locations, service provider designations, and line speeds, TeleTraceRouting is able to define the boundaries of broadband coverage areas and locate the node elements of the network infrastructure. The nature of the network structure varies with the communications technology as described below:

DSL-based network coverage and performance estimation

Telephone carrier–based xDSL networks are organized around central offices and various types of remote terminals. User locations will tend to be clustered about either central offices or remote terminals. Such location points will allow for the construction of the coverage boundaries and centroids of these clusters for both coverage and infrastructure network mapping. Having located the centroid of the cluster that represents a DSL node (central office or remote terminal), it is possible to reconfirm the nodal coverage based on the established operating radii of aDSL or sDSL nodes. The hierarchical nodal network generated also allows for mapping not only the local infrastructure but also the backhaul structure through the levels of central offices.

Wireless coverage and performance estimation

Wireless network coverage and infrastructure data will be generated in a similar fashion to DSL. Wireless networks are organized around access points or antenna base stations and operate

functionally like wireline DSL networks, with the antenna base station serving as the DSL central office node. Relay stations are sometimes used in wireless networks, functioning in the same manner as DSL remote terminals. The TeleTraceRouting data will also provide for links to the backhaul network.

Cable-based network coverage and performance estimation

Cable networks have a completely different structure from DSL and wireless and are structured in a tree-like formation. Designated as hybrid-fiber-coaxial (HFC) cable network structures, these networks fan out from a headend transport ring through fiber cables to optical nodes where they expand into a multiple coaxial copper wire network along the street network to individual homes and businesses. Combining the geographical locations of the homes and businesses along the cable routes with the trace-route set of nodes, TeleTraceRouting is able to define the topology of the network and determine both the coverage and structural diagram of the HFC network. Broadband coverage mapping requires only the tree-like diagram up to the local optical node, but infrastructure network construction makes use of the full sequence of tracerouting nodes to delineate the full network back to the central fiber transport ring.

Task 9 – Independent Accuracy Assessment via Random Sample Survey of North Dakota Residential and Business Addresses in Four Rural Strata

A key focus of the North Dakota broadband coverage mapping and assessment project is on identifying and mapping broadband coverage in rural environments, including potentially un-served and underserved communities and the anchor institutions and individuals that live there. The following section describes the independent survey methods that will be used to assess North Dakota household and businesses addresses to determine the availability and type of service for broadband in North Dakota across four strata of rural markets. In addition to this survey, our other inventory methods include an initial assessment of broadband infrastructure and coverage using publicly available sources, information from broadband providers, geospatial modeling of infrastructure, and TeleTraceRouting.

The primary objective of the survey is to determine the need and demand for broadband service across four rural strata of residential and commercial addresses to supplement the broader needs assessment and strategic planning processes. This random sample survey will also serve as an independent assessment of the completeness and accuracy of the five methods used for the broadband mapping process.

For the North Dakota broadband coverage mapping and assessment project, we propose stratifying the overall rural population into the following four categories:

1. Areas estimated to have broadband service available within a rural incorporated place
2. Areas estimated to have broadband service available outside a rural incorporated place
3. Areas estimated to be un-served outside a rural incorporated place
4. Areas estimated to be un-served within a rural incorporated place

The survey will determine the percentage of addresses within each of the four strata that have access to broadband service. We will compare these results against the mapped results and analyze the results in our report and accuracy assessment.

The Federal Register /Vol. 74, No. 130 /Thursday, July 9, 2009, Department of Agriculture Rural Utilities Service Broadband Technology Opportunities Program provided the following definitions that we will use in our analysis:

Underserved area means a proposed funded service area, composed of one or more contiguous census blocks.

1. No more than 50 percent of the households in the proposed funded service area have access to facilities-based, terrestrial broadband service at greater than the minimum broadband transmission speed;
2. No fixed or mobile broadband service provider advertises broadband transmission speeds of at least three megabits per second ("mbps") downstream in the proposed funded service area; or
3. The rate of broadband subscribership for the proposed funded service area is 40 percent of households or less.

Un-served area means a proposed funded service area, composed of one or more contiguous census blocks, where at least 90 percent of households in the proposed funded service area lack access to facilities-based, terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed

The second level of stratification, **rural incorporated space,** was not defined in NTIA requirements. It reflects our professional judgment on a finer level of geographic assessment tailored to the North Dakota defined objectives. Our rationale for this selection is provided below.

NTIA guidelines, originally published in the Federal Register on July 9, 2009, and amended in the Federal register on August 12, 2009, differentiate between census blocks less than and greater than 2 square miles in size and as amended differentiate service in two categories

1. Availability by Service Address-Service Associated with Specific Addresses, and
2. Availability by Shapefile—Wireless Services not Provided to a Specific Address.

The former focused on broadband availability by provider for two size class categories of census blocks, those no greater than 2 square miles in size, and those greater than 2 square miles in size. Since census blocks are intended to be similar in number of households, the variance in size typically means that larger census blocks tend to be more rural, and smaller census blocks tend to be more populated.

If we were designing this survey in a more densely populated state, we would use these definitions for our sampling stratification. In predominantly rural states like North Dakota and other western states not dominated by large metropolitan areas, the resulting classification of census blocks creates a

diffused geospatial pattern without the geographic clustering that would occur in more populated areas in the United States. We determined that stratification by these classes would not be meaningful in North Dakota. We can only statistically infer at the strata level; statistical inferences at a smaller geography would be prohibitively expensive to sample in a statistically sound manner. As a result, we determined that using a rural stratification by areas that represent a more densely clustered community, represented as small, medium, or large towns, would give a more meaningful stratification for accuracy assessment, fitting the situation and defined goals in North Dakota.

The initial inventory of publicly available sources will likely be incomplete. Initial GIS modeling and mapping will be based on these same sources, and will reflect the completeness of the source data. Telcom providers, who are not required to report detailed infrastructure locations to the FCC since the 1996 Federal Telecommunications Act—particularly the more recent packet-switched network facilities—may also provide incomplete data. Despite non-disclosure statements, some may not provide all the data required for detailed mapping. Provider data will be complete in some instances, and incomplete or at a coarser geographic scale than desired in other instances. It may take longer for some providers to provide infrastructure data. Anchor institution interviews will provide other sources, and will still be incomplete in some instances, and will take several months to complete. TeleTraceRouting, by definition, will be limited to served and underserved areas within the four rural strata for these measurements, because an online session will be required by the participants. The TeleTraceRouting method is a deterministic modeling method and we anticipate generating a large number of web logins and participation by volunteers. Recruiting as many participants from as wide of geographic and demographic distributions as possible will give us the best measurements of existing infrastructure and network performance. Despite these efforts, we expect gaps in coverage where volunteers do not log in.

With five different sources of infrastructure data and coverage and the subsequent analysis of differences between the sources, we anticipate providing as thorough and complete a map as possible. Since the sampling is based on incomplete sources and volunteer participation, however, it will not be possible to directly estimate the statistical reliability of the broadband coverage or performance estimates. The random-sample survey of addresses will provide statistically reliable estimates of coverage by strata as an assessment of the accuracy of the infrastructure mapping.

The accuracy assessment and needs assessment survey is based on survey research using random sampling methods that will provide statistically valid estimates of coverage and measurement error. The survey assessment will be designed to provide estimates of the availability of various types of broadband service across each of the four rural strata. It will also serve as an independent verification of the representativeness of the first-phase TeleTraceRouting measurement of network performance in potentially underserved areas of the four rural markets. While the TeleTraceRouting measurement of network performance is based on voluntary recruitment of participants, the second-stage coverage assessment is designed to collect information from individuals associated with a statistically valid random sample of rural addresses. The goal of the survey will be to obtain at least 400 completed responses from individuals within each of the four rural strata. This level of response will allow

estimates of coverage, by type, and demand for coverage, with at least 95 percent confidence that the actual population parameters are within +/- 5 percent of the statistical estimates.

The survey research will be conducted using proven, standard methodology designed to provide valid and reliable statistical estimates. After initial contact, potential respondents will be given the choice of completing and returning the survey by postal mail or by emailing an electronic form. The electronic form option will be based on the familiar and free Adobe Acrobat Reader software, and will allow respondents to fill out and return an electronic survey that looks identical to the postal mail version. This will ensure comparability of results between methods. Respondents will be contacted with a reminder postcard and up to two additional mailings of replacement questionnaires to ensure high response rates. If the repeated contacts fail to achieve at least a 50 percent overall response rate, an additional telephone-based non-response bias check will be performed to ensure statistical reliability of the sample results. The survey research process follows the widely-accepted general design recommendations of D. A. Dillman's *Mail and Internet Surveys: The Tailored Design Method* (Hoboken, NJ: John Wiley and Sons, Inc., 2007).

The survey sample will be derived from initially developing a census block GIS layer using the NTIA criteria for defining rural, underserved and un-served. This census block map will be translated to ZIP code areas using ESRI Business Analyst block centroid apportionment methods. Within each of the four levels of stratification we will randomly pick a geographically dispersed set of ZIP codes. From these, we will purchase and further develop representative mailing lists of household and business addresses derived from the latest phone books, directories, and public lists. From these lists, we will randomly select 1,200 individuals in each strata to participate in the survey. This represents three times the number that will be required to ultimately complete the study. From our previous experience, this should provide an adequate sample and account for expected non-response rates.

The data points that are collected will also give us additional inventory data to cross-reference and look for differences between the sources. We will not be able to infer statistically at this fine level of geography due to small sample sizes, but the data will be helpful in identifying anomalies and potential omission errors in sources of infrastructure.

Although the focus of the random survey is to conduct an accuracy assessment of the broadband coverage map, we anticipate adding a limited number of fundamental questions to the survey to assist in the needs assessment and strategic plan. We do not wish to raise the non-response rate by making the survey lengthy, but a statistically sound random survey of the four rural stratifications will add value to the needs assessment. At relatively little cost to add a few additional questions, we will gain valuable analysis to add to the interviews and planning sessions. Survey results will be documented along with estimates of statistical reliability of the broadband coverage estimates in the final report. A descriptive analysis will be of the needs assessment results will also be included. Further interpretation of survey results will be available as needed.

Work Plan and Timelines

Project Schedule

Tetra Tech has designed a project approach that entails multiple methods of developing and refining broadband availability data that build upon and enhance each other. This approach will enable us to meet the State's requirements on time. The following section provides more detail regarding the schedule and milestones.

Milestones/Delivery Schedule

Tetra Tech has developed a schedule (Figure 6) that is achievable, exceeds the State's requirements for development of the Statewide Broadband Map, and meets all project objectives. Major project milestones include the following:

- Project Kickoff Meeting – October 1, 2009
- Substantially Complete Broadband Status (Deliverable 1, Based on Publicly Available Data) – October 30, 2009
- Complete Map and Data (Deliverable 2, Meets NTIA Requirements) – February 19, 2010
- Survey Report (Deliverable 3) – May 7, 2010
- Web Map Application (Deliverable 4) – May 31, 2010
- Draft Plan (Deliverable 5) – September 24, 2010
- Final Plan (Deliverable 6) – November 22, 2010

Schedule Assumptions

Tetra Tech has made the following schedule assumptions:

- Tetra Tech has a fully executed contract from the State prior to October 1, 2009.
- The State provides all GIS and tabular data identified in Section 3.01 of the RFP to Tetra Tech by October 1, 2009.
- The State will make staff available in a timely manner to meet with Tetra Tech on technical, management, and administrative matters related to this project.

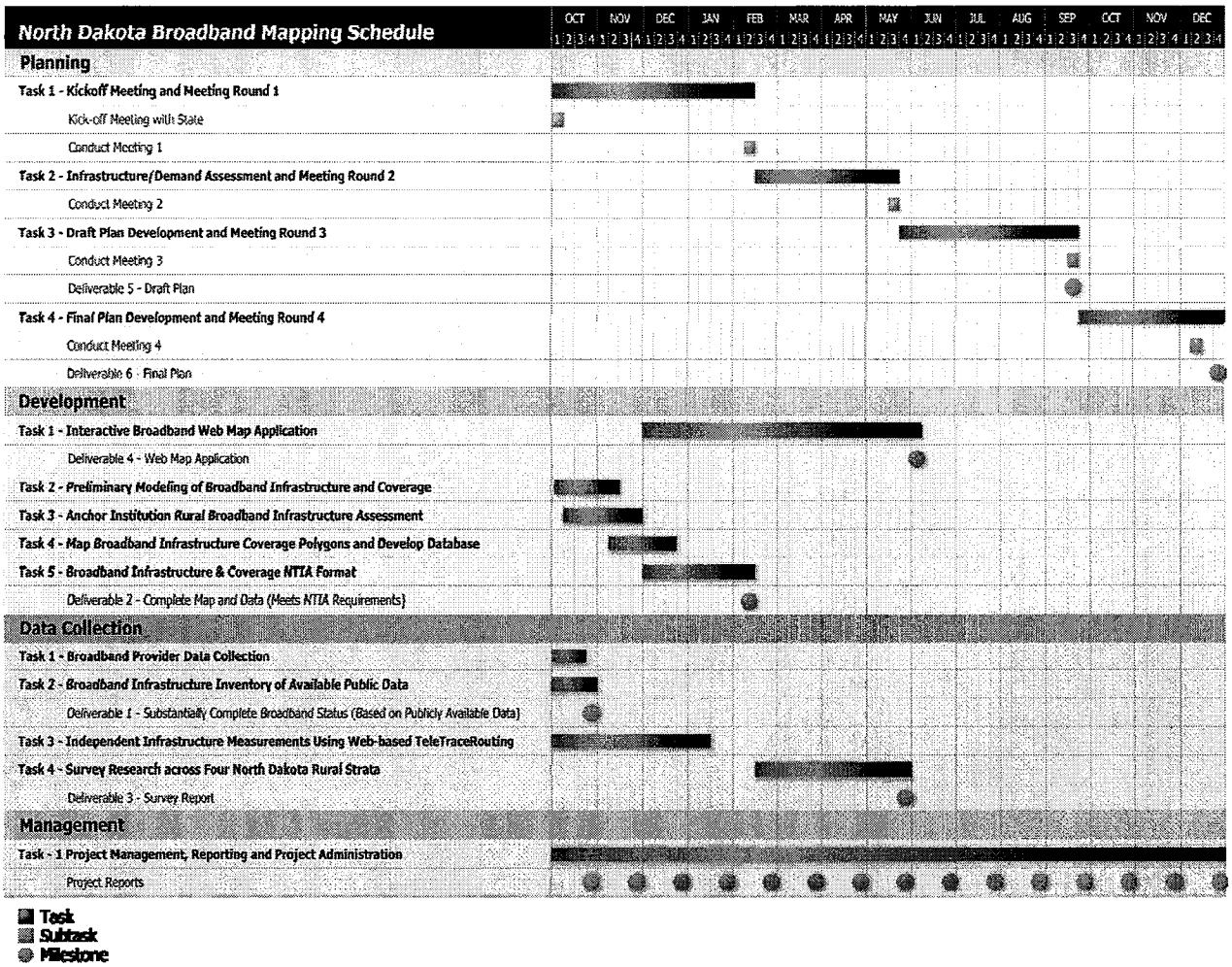


Figure 6. Project Schedule

2.4 Security

Tetra Tech's entire approach to broadband map development in North Dakota is designed around the idea that open non-proprietary data is the best source for broadband mapping. When the NTIA provided amended guidance on the broadband mapping program in the Federal register on August 12, 2009, we feel they were directly addressing the fact that telecom providers are reluctant to release data at a fine, site-specific level of geography. The revised guidance also eliminated most of the data elements that can only be gathered from broadband providers at an end user level. The NTIA and FCC are still struggling at the federal level with what data from the providers can be released at the census tract level of geography. (An average census tract represents about 4,000 inhabitants nationally.) Census blocks (the level of analysis required by NTIA) are typically bounded by streets, roads, or creeks. In cities, a census block may correspond to a city block, but in rural areas where roads are fewer, blocks may be limited by other features. Some census blocks have no inhabitants while others, containing apartment buildings for example, may have hundreds. In North Dakota, the average number of households in a census block is 3, and the largest is 1,045.

The largest number of households in a census tract in North Dakota is 6,835, and the average is 1,219. We have designed our data requests to providers to be sufficiently generalized that they will be comfortable with releasing presence or absence of coverage information, and major infrastructure locations without non-disclosure requirements, or concerns for privacy. We anticipate that they will provide subscriber numbers without security concerns to the census tract level. In situations where we have a non-disclosure agreement in place and the providers require privacy protection for even these generalized requirements, we will use our normal procedures to protect those data as discussed below under Confidential Provider Data.

There are other non-proprietary methods in which to obtain coverage data, and we have based our project methodology on these supplemental methods. Since 1997, the Tetra Tech team has completed telecommunication assessments for over 20 counties in Colorado, Wyoming, Idaho, Wisconsin, and Montana. Each of these assessments included an inventory that documented the telecommunications infrastructure, service areas, broadband speeds, and rate structures for telephone, cable, and wireless providers. Often, community officials had previously attempted to obtain this information from the service providers, but were told that the information was "proprietary" and unavailable. Because this is a common response from providers, our team developed and successfully implemented an alternative methodology that relied on a collaborative approach for obtaining the data. The methodology is described below.

1. Conducted a community meeting including all stakeholders such as local officials, IT professionals, businesses, and service providers. This meeting explained the purpose of the study, allowed early identification of issues, and provided a foundation for a collaborative relationship with the telecommunication providers.

2. Compiled information on telecommunications networks from published sources. These sources include Public Service Commission records, FCC filings, company publications such as annual reports and marketing information, municipal franchise agreements, and any other available planning documents.

3. Interviewed IT staff from key anchor institutions such as schools, hospitals, municipal and county governments, state offices, and libraries regarding the services they were using. Since the IT officials were ordering services directly from the providers, they were very knowledgeable about the networks and could provide information to reconstruct the network. IT officials were also able to identify issues with the networks such as service gaps, lack of redundancy, and reliability issues.

4. Conducted consumer surveys in each town, which provided information on take-rates, costs, reliability, applications, and consumer satisfaction. The surveys provided another means to verify some of the information collected in the previous steps.

5. Verified location of facilities through field work, aerial photographs, and other available mapping.

6. Using the data compiled from the previous steps, constructed network diagrams indicating location of central offices, cable head-end equipment, tower sites, interoffice backbone, and general service areas.

7. Contacted service providers to confirm the information that had been collected to date and fill in any gaps in information. By requesting the telecommunications providers to confirm data that was already collected, there was no need to negotiate nondisclosure agreements. Additionally, it was an efficient use of the provider's time because they only had to review data and did not have to dedicate valuable staff time to compiling data. Another benefit in this methodology was that we were able to share the community survey and stakeholder input with the providers, which helped them be more responsive in providing future services. This collaborative approach was valued by all parties.

Confidential Provider Information

While Tetra Tech believes we can build a very accurate broadband availability map without data from the providers, we intend to ask them for data as described in Section 2.3, Task 1. We understand that we may need to enter into non-disclosure agreements with the providers to obtain certain types of data, and we are prepared to do so.

Tetra Tech regularly takes receipt of, develops, and manages sensitive and confidential information for our government, military, and private sector clients. The primary method we use to protect our clients data is simple: we do not own our clients' data; therefore, we do not release it without their direct authorization. This is standard operating procedure at Tetra Tech, and we will ensure that our sub-contractors follow the same protocols.

2.5 Maintenance

Tetra Tech's overall approach to broadband mapping is designed to facilitate updating and maintenance of all core data elements. Our mapping approach presented in Section 2.2 details our methodology which integrates five different sources of infrastructure data into the broadband map. Our expectation is that over time, all five of these original data sources may be used to update the broadband map, and therefore, our maintenance methodology is built upon our development methodology.

Tetra Tech's unique approach to developing the North Dakota Broadband Map also lends itself to data maintenance. Key elements to our approach and how they relate to data maintenance include web-based data updates, easily collected direct measurement data, and a robust GIS platform for data management and update.

Interactive Web Application

The web mapping application Tetra Tech develops for the State in Section 2.2, Task 1, allows for data updates as well as data viewing and querying. Using our web map application, the broadband availability status of census blocks and anchor institutions can easily be updated. No training in GIS or GIS client software is needed to make updates using the web interface. Updates can be performed on

one or many features at a time. The updates are posted to a staging database that will allow for review by the database administrator prior to posting to the production database.

Direct Measurement Data

One of the major advantages of our innovative direct measurement TeleTraceRouting methodology described in Section 2.3, Task 3, is that it supports the efficient development and update of broadband availability. The website and other infrastructure that we set up to do the initial data development will be left in place to support data maintenance. Using this technology, the State can elect to focus updates on areas where new technology and infrastructure has been put in place, do a statistical sample as presented in Section 2.3, Task 4, to validate the status of the database and discover where changes have occurred, or simply gather connection data over time from interested parties and use that information to enhance and update the map.

GIS Infrastructure

Tetra Tech's project approach includes putting in place a robust GIS data infrastructure built using Environmental Systems Research Institute (ESRI) technology. Data will be loaded and managed as ESRI ArcSDE geodatabases, and web applications will be built upon ESRI ArcServer. This application infrastructure will include all data inputs as well as the resultant broadband map data. We will document our data development and integration methods and provide the State with documentation and geoprocessing models that support the ongoing maintenance of all data elements. We have not integrated ongoing data maintenance into our project proposal but would be glad to take on these responsibilities if directed to do so by the State.

2.6 Value-Added Features

Our team is providing many value-added features to the broadband mapping effort. Enhanced open and public broadband coverage and infrastructure maps will be available to the public and North Dakota business community and the various levels of government. This data will be mapped at a finer geographic scale than would be possible if obtained through Telecom providers' public information alone, and will be leveraged with survey data, direct measurements on availability, and network performance. We will use world-leading demographic and economic GIS data from ESRI, enhanced with over 14,000 additional data sources such as post office change-of-address forms, birth and death records, consumer expenditures, infrastructure data, and other sources, tailored to provide insight into the broadband situation in North Dakota. Our experience in working in the industry in environments similar to North Dakota, combined with our interviews and planning sessions with North Dakotans in more than 1½ years of regular contact, will provide a value-added needs assessment and strategic plan that will be customized to the North Dakota broadband environment.

3. Product Support, Customer Service, Experience and Qualifications

3.1 Dedicated Contract Representative

The Tetra Tech team is committed to serving the State for the duration of this contract. This section lists the contact information for the key personnel on this project. Information includes name, phone number, fax number, e-mail address, mailing address, and years of appropriate experience. This list includes contact information for the Project Manager, who is the primary contract representative, his project staff, and his chain of command.

It is understood that the assigned contract representatives and support staff may be required to meet with the State on a regular basis, or when deemed necessary. Tetra Tech can and will make these staff members available to meet with the State, given adequate notice. Please see Section 3.3 for an organizational chart (p. 47) and bios for project staff (p. 49). Complete resumes are provided in Appendix B.

Name	Position	Phone	Fax	E-Mail	Address	Years of Exp.
Fred Gifford	Project Manager	406-458-1140	406 458-1140	Fred.gifford@tetratech.com	Tetra Tech EC 5655 Falcon Road, Helena, MT 59602	20
Andy Bury	Corporate Sponsor	425-482-7877	425-482-7641	Andy.bury@tetratech.com	Tetra Tech EC 19803 North Creek Pkwy, Bothell, WA 98011	23
Paul DeWolfe	Telecom Infrastructure Planning Lead	406-327-0629	406-541-9881	paul@access-consulting.net	Access Consulting 265 West Front Street, Missoula, MT 59802	30
Kathleen McMahon	Strategic Planning Lead	406-863-9255	406-863-9255	Kate@appcom.net	151 Wedgewood Ln., Whitefish, MT 59937	25
Ken Schlager	TeleTraceRouting Lead	262-367-5857	262-361-4102	kschlager1@wi.rr.com Alt. kschlager@hiercomm.com	HierComm 744 Winston Way, Hartland, WI 53029	35
Ken Wall	Broadband Mapping Lead	406-532-3239	N/A	kwall@geodataservicesinc.com	Geodata Services 1121 E. Broadway #133, Missoula, MT 59802	23
Bruce McFadden	TeleTraceRouting Senior Analyst	503-709-5455	503-844-9392	bahmcf@comcast.net Alt. bmcfadden@ hiercommnetworks.net	HierComm 744 Winston Way, Hartland, WI 53029 Alt. 2342 NE Lindsey Dr., Hillsboro, OR 97124	30
Mike Sweet	Lead GIS Database Designer	406-532-3239	N/A	N/A	Geodata Services 1121 E. Broadway #133, Missoula, MT 59802	22
Dave Highness	Senior GIS Programmer	406-447-1458	406-447-1458	Dave.highness@tetratech.com	Tetra Tech EC 5655 Falcon Road, Helena, MT 59602	15
Robin Wall	Senior GIS Analyst	406-532-3239	N/A	rwall@geodataservicesinc.com	Geodata Services 1121 E. Broadway #133, Missoula, MT 59802	17
Mary Jo Watson	Senior GIS Analyst	425-482-7728	425-482-7641	Maryjo.watson@tetratech.com	Tetra Tech EC 19803 North Creek Pkwy, Bothell, WA 98011	18
Pete Weber	Telecom Analyst	406-327-0629	406-541-9881	pete@access-consulting.net	Access Consulting 265 West Front Street, Missoula, MT 59802	15
Ellen Jackowski	GIS Analyst	425-482-7723	425-482-7641	Ellen.jackowski@tetratech.com	Tetra Tech EC 19803 North Creek Pkwy, Bothell, WA 98011	4

3.2 Customer Service

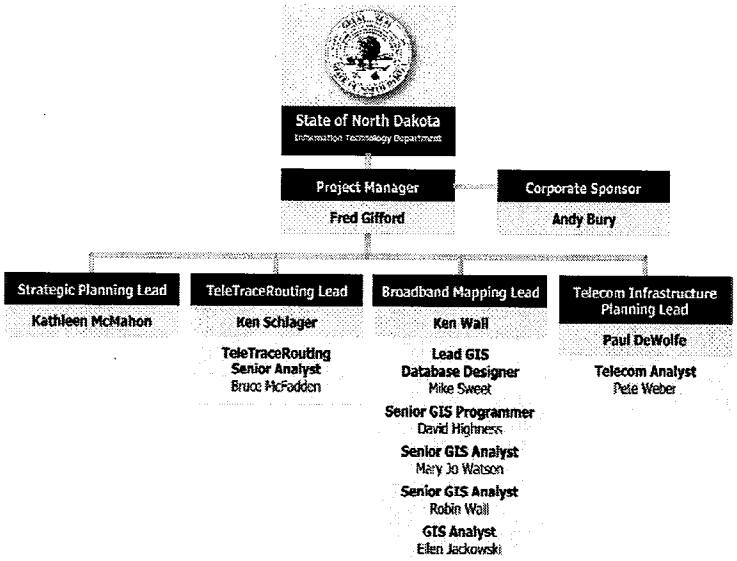
Project Management, reporting and project administration

Management Techniques and Administrative Approach

Tetra Tech has developed solid project management methodologies that are proven to meet schedule, budget, and quality objectives for all work. Tetra Tech has extensive experience directing multi-task projects that require interdisciplinary personnel to work together to achieve coordinated goals and objectives. Proven success in this area is a result of Tetra Tech managers having access to systems that encourage use of established procedures that have been refined over time, as well as the assignment of seasoned management and technical staff who have successfully worked together to meet client objectives on previous projects.

Organizational Structure

The organizational chart, reproduced here from Section 3.3 below, illustrates the organizational structure we intend to utilize to complete the various work tasks associated with this project. As evident in the illustration, we propose that Tetra Tech's project manager, Mr. Fred Gifford, will serve as the primary point-of-contact with the designated State of North Dakota project manager. In his role as Tetra Tech project manager, Mr. Gifford will be supported by Ms. Kathleen McMahon, Mr. Paul DeWolfe, Mr. Ken Schlager, and Mr. Ken Wall as Technical Leads who will provide support for their area of expertise, task level scheduling, reporting, and management.



Management Approach

Successful execution of this contract will be measured by the project team's ability to develop work products that meet the needs of the State. Tetra Tech understands that its management challenge is to concisely define project expectations, structure a team to respond to those expectations, and direct that team throughout execution. Tetra Tech's efforts to meet this challenge will be guided by the following management principles:

- Quality is fundamental
- Clear communication is essential
- Listen to the customer
- Delegate work to the appropriate technical specialist
- Regularly assess performance measures
- Pay attention to detail

Effectively completing work under this contract requires a structured approach to defining and executing individual project tasks. Tetra Tech has quality, project performance, and task management systems in place that have been used successfully on numerous projects.

Controlling and Reporting On Task Elements

Our expectation is that work performed for the North Dakota Broadband Mapping Services Project will involve highly intense activities performed over a relatively short period. Effective controls are necessary to ensure that each task is completed on schedule and under budget. The Integrated Task Control System used by Tetra Tech consists of two major components: 1) tracking progress of work completed (i.e., budgeted cost of work performed compared to budgeted cost of work scheduled), and 2) tracking the cost expended (i.e., actual cost of work performed compared to that budgeted). This control system provides the data necessary to characterize cost/schedule factors and technical progress on a regular basis and to generate monthly progress and management reports.

A monthly Progress and Management Report will be developed by Mr. Gifford and delivered to the State within one week after the close of the report month and will address schedule and technical status of ongoing work tasks. The monthly status report will include the following specific items:

- Reporting period
- Narrative summary of progress
- Major accomplishments
- Issues or problems requiring resolution
- Anticipated issues or problems
- Proposed solutions
- Future activities
- Schedule variance explanation
- Milestone schedule status

Additionally, due to the tight timeframe for work items under this project, Tetra Tech is proposing bi-weekly, informal project updates by email and monthly face-to-face meetings between our project manager and State-designated project leads in Helena.

Task Management and Resource Allocation

Tetra Tech will use our standard project management procedures to guide the daily activities of all professionals working under this contract. Mr. Gifford will be responsible for ensuring that management procedures are fully executed. The Tetra Tech project management procedures provide detailed instructions on topics necessary for successful task execution, including communication, responsibilities, authority, schedule control and tracking, source data cataloging, processing specifications, data storage, archival, backup and recovery, process transaction logs, version control, quality control and audits, client request processing, data dissemination, invoicing, project completion, and project close-out.

Subcontractor Management

Tetra Tech will use the services of several subcontractors on this project. Tetra Tech establishes written subcontracting agreements with its subcontractors that clearly define the work package and product expectations. Subcontractors will use Tetra Tech's established time reporting, version control, and work protocols, and will observe Tetra Tech's existing project management procedures.

Communication Management and Change Control

Effective and open communication is critical to the success of any endeavor. Throughout the course of the project, full and clear communication is necessary to ensure that all stakeholders and involved parties understand any topic that impacts the project's success. These issues may involve positive and negative changes, problems, delays, questions, requests, and general status. The more complex a project is—especially from an organizational standpoint—the greater the importance of clear communication. Because of this, Tetra Tech regularly utilizes standard project communication techniques and protocols.

Tetra Tech's structured communication protocol will manage external communication between Tetra Tech, the State, and identified project stakeholders. Structured communication helps to reduce or eliminate problems that may be associated with information distribution. These problems may include undistributed information, communications to the wrong parties, and distributed information that is not of interest to those who receive it. In addition, formal communication can become burdensome to the program when those receiving the information want the same information in different formats.

Tetra Tech's communication protocol addresses who receives what information, how they receive it, and when. This is an essential element of communication because it establishes the expectations for what documents and work products the stakeholders can expect to receive, and when they can expect to receive them. Our goals in communicating about the project are to:

- Establish and maintain the project credibility by communicating current status to all stakeholders;
- Generate a common understanding of how the activities of this project will improve the partners' ability to achieve the goals;
- Prevent disenfranchising important stakeholders; and
- Garner long-term and broad-based support for developing and maintaining the partnerships that are consistent, reliable, and complete.

Communication Items

Communication items are the regular deliverables or artifacts for the project's communication. They include the following:

- Descriptions of the items required by each audience
- Expectations – what people are expected to do in response
- Results – what result is expected to be achieved as a result of the item

- Distribution method – how the item will be distributed, such as via email
- Frequency of distribution
- Audience

Guidelines

Communication guidelines include the following:

- Communicate with all affected parties.
- Every message should be audience-specific.
- Take advantage of all of the methods of communication available, yet choose a method of communication appropriate to the message being delivered and appropriate to the audience receiving the message.
- Set appropriate expectations.
- Provide regular reporting of project progress.
- Communicate what other people need to know *before* they need to know it. Provide time for people to move past an emotional reaction and on to effective involvement.
- Meet frequently and regularly with project managers regarding developments and tactical concerns.
- Offer opportunities for private communication as appropriate.
- Hold project-wide meetings at important milestones.

3.3 Experience and Qualifications

Company Profile and Experience

Our key senior staff on this project have a combined 63 years of company experience providing services similar to those requested in this RFP: Fred Gifford from Tetra Tech (18 years), Ken Wall from Geodata (16 years), Paul DeWolfe from Access Consulting (13 years), Kathleen McMahon from Applied Technologies (12 years), and Ken Schlager from HierComm (4 years). To better acquaint the State with our team, the following sections briefly describe each company.

Established in 1969, Tetra Tech, a family of companies comprising more than 10,000 associates in 250 offices worldwide, has been a preferred provider of a full range of environmental services nationally, and particularly in the West, since 1981. The Tetra Tech office that will be used to manage this project is located in Helena, Montana, and is backed by offices throughout the country staffed with full-time geographic information system (GIS) technicians.

Tetra Tech's GIS group has a proven track record of developing innovative spatial analyses to provide our clients and resource staff with the information needed to make informed decisions. Tetra Tech has provided a full range of GIS services since 1991 as Ebasco Environmental and Foster Wheeler Environmental. Now, Tetra Tech hosts one of the largest private-sector GIS departments in the environmental services industry with over 130 GIS professionals nationwide.

Our relevant project experience and strengths include:

- Multi-state geodatabase development
- Web-based mapping and information management systems
- Project Management of large teams and multi-million dollar, multi-state projects
- GIS and PM resources of equally-qualified staff available for unanticipated changes in Project Lead/Senior Staff

geodata

Geodata Services, Inc. (Geodata), founded in 1993 and headquartered in Montana, provides multidisciplinary spatial data and analysis for federal, state, and local government agencies, industry and private organizations, and individuals. Geodata provides services in GIS data acquisition and conversion, spatial analysis, image analysis, database development, global positioning system services, GIS needs assessment, and 2D and 3D visualizations. Geodata has been an Environmental Systems Research Institute (ESRI) business partner for more than a decade. Geodata is also a business partner with Lizardtech, distributor of MrSid compression software, and Placeways LLC, which sells CommunityViz decision support software.

Geodata staff have more than 60 years of combined experience with GIS. Our principle GIS analysts have served in many professional capacities including: serving consecutive terms on the State GIS advisory and technical committees, appointed by the Governor of Montana. Geodata analysts have conducted GIS projects for more than 250 clients throughout the United States.

Senior GIS analysts for Geodata have received many awards for their GIS work including the Year 2000 Career Distinguished Service Award and the 2008 Livable Communities award from the Montana Association of Geographic Information Professionals, the Northwest U.S. regional foundation business partner of the year for ESRI in 2008, and the new partner of the year for ESRI in 2000. Geodata has an authorized ESRI instructor and has taught more than 40 short courses and continuing education courses.

HierComm, Inc.

HierComm, Inc., was incorporated in the state of Wisconsin in February 2005 with the mission of planning and developing broadband communications systems for rural and other underserved areas.

With the backing of federal research grants and the Southeastern Wisconsin Regional Planning Commission, HierComm has been able to advance its two core capabilities:

1. Broadband Wireless Communications Systems Development
2. Broadband Regional Telecommunications Planning

Concerning the first capability, HierComm has successfully developed technology in the following two areas:

1. Cost-effective broadband wireless communications systems for rural areas
2. The first area-wide broadband wireless public safety communications system in the U.S.

Both technologies are now in the implementation stage, with an operating rural broadband wireless network serving a rapidly growing set of subscribers in one county. In addition, HierComm has successfully demonstrated, and is soon ready to deploy, a broadband public safety network in an additional county. These two communications technologies independently, or in combination, make economical, cost-effective broadband deployment possible in rural America.

In its telecommunications planning activities, HierComm partnered with the Southeastern Wisconsin Regional Planning Commission to develop a comprehensive regional broadband telecommunications plan for a seven county metro and rural region with 64 percent of the land area still classified as rural. As part of this planning process, broadband service inventories and maps were developed as a foundation for the planning of new broadband networks. The TeleTraceRouting methodology, which is a key element of this proposal, grew out of this planning effort. HierComm also developed a variety of field-testing equipment sets, networks, and procedures to verify the coverage, performance, and reliability of communications networks. HierComm's technological and regional planning experience should serve to ensure excellence in the North Dakota Broadband Mapping Program.

APPLIED COMMUNICATIONS, LLC

Applied Communications, LLC (AppComm) has provided consulting services to local and state governments since the mid 1980s. AppComm principals have extensive experience in telecommunications planning, economic development projects, comprehensive planning, and strategic planning. AppComm involves stakeholder groups as much as possible, integrates complex organizational strategies, and coordinates with any parallel planning processes.

AppComm staff have exemplary facilitation, analytical, planning, communication, and project management skills that enable them to complete projects on time and on budget. Team members have an established record of working with local governments and partnering with community groups to

successfully address planning issues. AppComm uses a variety of participation techniques to support planning programs and provide community outreach.

Kathleen McMahon is the founder of AppComm and has over 25 years of professional experience. Robert Horne joined the firm in 2007 and has over 30 years of professional experience. The firm has no other employees but regularly partners with professional companies and individuals to provide a broad range of services to meet client needs. Affiliate firms can provide GIS mapping, engineering, landscape architecture, legal, marketing, and management services.

On this project, AppComm will primarily be providing project coordination services and coordinating the TeleTraceRouting tasks. Ms. McMahon will also provide support on research, stakeholder outreach, and meeting facilitation.

ACCESS CONSULTING, P.C.

Access Consulting, PC (Access) provides IT infrastructure planning, engineering, and construction management services to public and private sector clients throughout the United States. Established in 1999 by firm owner and founder Paul DeWolfe, PE, Access pioneered the application of objective, vendor-neutral design and analysis techniques to the design of campus cabling infrastructure (inside plant), buried fiber optic circuits (outside plant), wireless LAN and WAN systems, enterprise telephony systems, and purchased telecommunications services such as broadband and dial tone. This objective approach uses detailed technical specifications and competitive procurement to ensure that clients receive the best combination of technical performance and price on every project.

Access' work for state government includes building infrastructure designs, wireless LAN consulting, IT infrastructure assessment, wireless backbone designs and construction, fiber optic design and construction management, and wireless LAN design.

Access also provides broadband master planning, analysis, design, and construction administration services to public and private sector clients. Since 2005, Access has been working with five counties in north-central Idaho to analyze existing broadband service usage and availability and to design infrastructure to meet the needs of underserved and un-served communities in that region. Access is also working with Grand Forks County, North Dakota, to analyze the telecommunications needs of rural communities adversely impacted by the realignment of Grand Forks Air Force Base and to design the common infrastructure required by broadband, cellular, and public safety communications providers. This common infrastructure will be built by a public-private partnership including the county and those providers. In August 2009, Access provided engineering analysis and certification services for four American Recovery and Reinvestment Act Broadband Technology Opportunities Program/Broadband Initiatives Program funding applications for rural broadband projects in Idaho, Montana, and Nebraska. These projects included DSL, cable modem, and wireless broadband expansions. Access Consulting's experience with all of these technologies uniquely enabled them to provide the needed objective

analysis. That experience will also be valuable in assessing and verifying the raw data collected for this project and will enable our team to provide superior results to the State of North Dakota.

Project Team Members

This section describes the Tetra Tech Team's key personnel. Many of our key personnel have worked together since the 1990s on mapping, data compilation, and telecom/broadband projects. Our key personnel know each other, they know the importance of mapping broadband for North Dakota, and they know how to deliver. An organizational chart (Figure 7) showing personnel assignments of key personnel is offered below. Biographies of our proposed personnel for this project are provided in Section 5A (p. 35), and resumes are provided in Appendix B. Project team member's level of effort for each project task is presented in Table 1, as per details presented in RFP Section 1.6.5 Prime Contractor/Third Parties/Subcontractors.

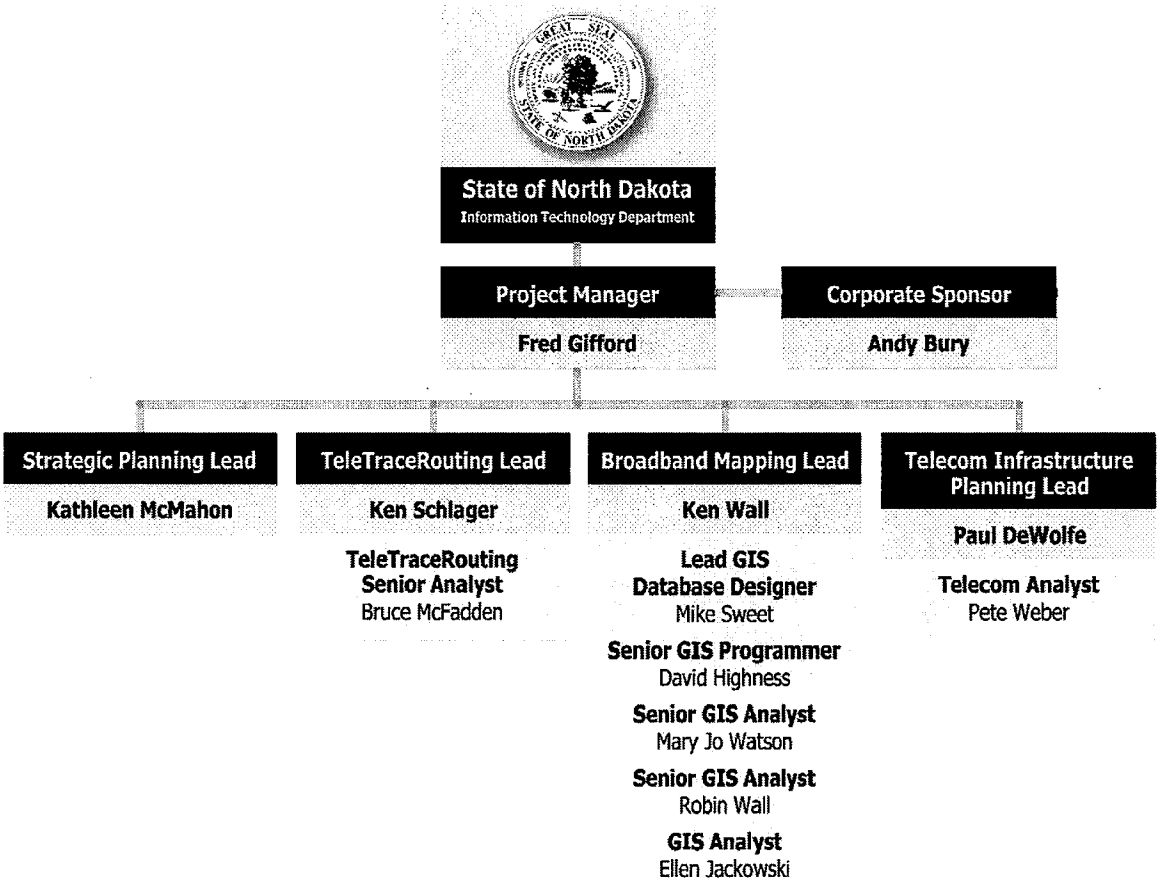


Figure 7. Organizational Chart

Table 1. Project Team Members Level of Effort for Each Project Task

	Tetra Tech	GeoData Services	HierComm	Applied Communications	Access Consulting
Planning					
Task 1 – Kickoff Meeting and Meeting Round 1	48	34	46	128	320
Task 2 – Infrastructure\ Demand Assessment and Meeting Round 2	80		160	148	508
Task 3 – Draft Plan Development and Meeting Round 3	112		120	200	720
Task 4 – Final Plan Development and Meeting Round 4	118		80	388	570
Development					
Task 1 – Interactive broadband web map application	640	112			
Task 2 – Preliminary modeling of broadband infrastructure and coverage	34	160	180		
Task 3 – Anchor institution rural broadband infrastructure assessment	40	360	32		
Task 4 – Map Broadband Infrastructure coverage polygons and develop database	88	380	106		
Task 5 – Broadband infrastructure and coverage NTIA Format	96	40	330		
Data Collection					
Task 1 – Broadband provider data collection	96	120			92
Task 2 – Broadband infrastructure inventory of available public data	84	280			60
Task 3 – Independent infrastructure measurements using web-based TeleTraceRouting	160	80	780	565	
Task 4 – Survey Research across Four North Dakota Rural Strata	54	484			
Management					
Task 1 – Project Management, reporting and project administration	600				

Project Lead(s)/Senior Staff – Professional and Relevant Experience

Mr. Fred Gifford – Project Manager

Dedicated Time to this Project: 75%

Relevant Experience: Mr. Gifford is a professional geographer with over 21 years of experience managing data intensive, multi-disciplinary environmental studies and computer application development projects that utilize GIS technology. His expertise includes project management, requirements analysis, system design, programming, and system implementation. Fred has implemented multi-agency, multi-application GIS projects; large GIS data conversion projects; and focused single-application systems. Mr. Gifford also has extensive expertise with Internet technologies and their integration with GIS. As Tetra Tech's GIS Technical Manager his focus is the implementation and use of best of class GIS technologies. Fred is a seasoned senior GIS professional and his responsibilities include marketing, project and client management, quality assurance, and project execution.

Ms. Kathleen McMahon – Project Coordinator

Dedicated Time to this Project: 70%

Relevant Experience: Ms. McMahon founded Applied Communications in 1994. This consulting company specializes in helping rural areas plan for telecommunications and on developing technology applications for local governments. Ms. McMahon has conducted telecommunication assessments for rural counties in Colorado, Wyoming, Idaho, Wisconsin, and Montana. She regularly speaks on strategic planning for telecommunications and has written a number of articles on the topic.

In addition to telecommunications planning, Ms. McMahon has been working with local governments since 1997. Planning processes rely on extensive intergovernmental cooperation and stakeholder involvement. Ms. McMahon has been responsible for projects such as Growth Policy Plans, economic development strategic plans, and community development initiatives. Based on the plans prepared by Ms. McMahon, communities in the state have successfully applied for millions of dollars of grant funds to implement strategies.

Ms. McMahon is a member of the American Institute of Certified Planners, Telecommunications CoChair of the American Planning Association Infrastructure Task Force, and past President of the Rural Telecommunications Congress. Ms. McMahon is a member of the Montana Economic Development Association, Montana Association of Planners, and Western Planner.

Mr. Ken Wall – Broadband Mapping Lead

Dedicated Time to this Project: 80%

Relevant Experience: Mr. Wall has worked in the GIS industry for 23 years, beginning at the University of Montana as a GIS research specialist in 1986, and serving in the capacity of professional GIS consultant, founder, and president of Geodata Services, Inc. since 1993. His professional experience includes design, supervision, and senior analyst responsibilities for hundreds of GIS projects throughout the US, Canada, and Australia. Mr. Wall has been project leader on many GIS contracts involving analyzing, manipulating and evaluating GIS databases and geospatial models. Geodata Services has

been a business partner with ESRI and was awarded new partner of the year in 2000, and founding partner of the year for 2008. Mr. Wall served as an instructor on more than 50 short courses and training sessions in GIS and is an authorized ESRI and CommunityViz instructor. Mr. Wall was appointed by Governor Schweitzer to the Montana GIS council (MLIAC) for 2 consecutive two-year terms as GIS technical representative.

Dr. Ken Schlager – Trace Routing Lead
Dedicated Time to this Project: 80%
Relevant Experience: Dr. Schlager, president of HierComm, Inc., has more than 30 years of experience in the development of communications systems and equipment. He and his company have recently developed a long-range broadband wireless system with grant support from the U.S. Department of Agriculture for low-density rural areas that provides fourth-generation performance with an extremely low infrastructure investment. He also has over 8 years of experience in regional telecommunications planning, having recently completed a broadband telecommunication plan for the seven counties of southeastern Wisconsin. This planning process involved all of the service inventory data collection and mapping elements requested in this solicitation. He has been awarded 12 U.S. patents since 1990 with one recently awarded in May 2009. He has a patent pending on new relay-based wireless network architecture and the TeleTraceRoute broadband data acquisition methodology described in this proposal. Dr. Schlager has been awarded 28 federal research grants since 1990. He is a registered professional engineer in the state of Wisconsin.

Mr. Paul DeWolfe – Senior Telecom Analyst
Dedicated Time to this Project: 60%
Relevant Experience: Mr. DeWolfe has more than 30 years of experience in systems engineering, structural engineering, and IT. For the last 10 years, he has worked with public and private sector clients to address the challenges of rural broadband service delivery. In projects ranging from Vermont to Idaho, Paul and his staff have been analyzing service options and designing service delivery systems that have solved rural access issues for Fortune 50 corporate settings, hospitality venues, and local governments. His experience in developing rural telecommunications solutions enables him to work in close cooperation with providers and users. His experience with wired and wireless technologies allows him to provide his clients with an objective assessment of all available solutions and to assist them in choosing the solution that best fits their requirements.

Mr. Andy Bury – Corporate Sponsor
Dedicated Time to this Project: 10%
Relevant Experience: Mr. Bury has more than 23 years of experience in GIS and Image Processing. He has worked extensively with the design, compilation, integration, development, maintenance and dissemination of large natural resources, land management and infrastructure databases. He manages the development of innovative GIS spatial models, database programs and Internet applications. He is Tetra Tech EC's National GIS Discipline Lead and supervises the data management and GIS professional staff in the Seattle GIS Center of Excellence. As Seattle Lead Scientist, Mr. Bury manages a staff of over 40 scientists and is involved in peer review, quality control, and business and technology development.

Mr. Bury has managed over 200 GIS and image processing projects of all kinds, including 120 task orders for the Forest Service Nationwide GIS Data Services contract since 2004, which included a seamless annotation geodatabase for Washington and Oregon; and the Gateway West Transmission Line project for which he managed the development of thousands of parcel-level addresses and the GeoManager Web-based mapping and information management system.

Staff – Professional and Relevant Experience

Mr. Mike Sweet – Lead GIS Database Designer
Dedicated Time to this Project: 20%
Relevant Experience: Mr. Sweet has 22 years of combined GIS experience as a research and information systems specialist, GIS analyst, and geospatial knowledge engineer with the University of Montana College of Forestry and Conservation, and with Geodata Services, Inc. He combines extensive GIS knowledge and experience with a computer science and programming academic and professional experience. His professional experience includes lead design for local, regional and international GIS projects. He has served the State of Montana and the GIS community in leadership capacity for the last decade as a member of the Montana Association of Geographic Information Professionals board, was co-chair of the 2008 Intermountain GIS Conference, and was appointed by the Governor to the State of Montana Land Information Advisory Council, State of Montana Land Information Advisory Council Framework Subcommittee, Land Information Plan Subcommittee, and Grants Subcommittee. Mr. Sweet has provided detailed leadership and guidance in thousands of hours of policy and technical contributions to the Montana GIS framework layers and geodatabase models. Mr. Sweet also has extensive experience with multi-state and national projects, including authoritative national GIS web services. Mr. Sweet was awarded the first Career Distinguished Service Award by the Montana GIS Users' Group (now the Montana Association of Geographic Information Professionals) in 2000.

Dave Highness – Senior GIS/Systems Analyst
Dedicated Time to this Project: 25%
Mr. Highness has 15 years of experience as a professional GIS analyst and cartographer for Tetra Tech, the State of Montana, University of Montana, and as a private consultant. He has been GIS project leader for a large economics research project and several large environmental modeling projects. He has completed many large-scale cartography, GIS and programming projects, including creation of the official Montana highway map; the Idaho Transportation Department District 6 environmental planning GIS database; Ingham County, Michigan CACVoices Mapper; and the Idaho Water Quality Web Site. He has a working knowledge of data management, GIS and cartographic tools and programming languages used by federal and state agencies.

Ms. Mary Jo Watson – Senior GIS Analyst
Dedicated Time to this Project: 60%
Relevant Experience: Ms. Watson has 18 years of experience developing, integrating, and maintaining GIS databases for large, multidisciplinary projects for federal, state, and local entities. Project duties have included data input and export, digitizing, coordinate editing, topology generation, attribute data

input, database update and maintenance, modeling and analytical operations, programming, and network systems administration for the GIS network, primarily for large NEPA EIS projects. She has worked on many large projects, one of which covered over 16 million acres. Most recently, Ms. Watson has been the Senior Analyst in charge of developing the parcel level addressing for the Gateway West project.

Ms. Ellen Jackowski – GIS Analyst
Dedicated Time to this Project: 60%
Relevant Experience: Ms. Jackowski has more than 5 years of experience as a GIS Analyst and a BS in geography. Her experience includes maintaining and updating GIS database records, producing a variety of map products and reports for government and commercial clients, including Seasonal Constraints mapping and parcel mapping for the Gateway West project. She also has experience with digitizing data and CAD data conversion and manipulation, and coordinate system conversions for a variety of GIS applications.

Ms. Robin Wall – GIS Analyst
Dedicated Time to this Project: 60%
Relevant Experience: Ms. Wall has 17 years of experience in GIS, beginning at the University of Montana as a GIS technician in 1992 and serving in the capacity of professional GIS consultant, co-founder and vice-president of Geodata Services, Inc. since 1993. Her professional experience includes GIS Analyst responsibilities for hundreds of GIS projects throughout the US, Canada, and Australia.

Mr. Pete Weber – Telecom Analyst
Dedicated Time to this Project: 60%
Relevant Experience: Mr. Weber has more than 15 years of hands-on experience in the design and construction of IT infrastructure. For the last 10 years, he has been responsible for the design, procurement, and construction management of telephone company (telco) services, campus cabling systems, wireless WAN and LAN systems, and enterprise telephony systems for public and private clients at Access Consulting. Mr. Weber began his career installing and supporting structured cabling systems for trading floors on Wall Street. After relocating to Montana, he expanded his skill set to include enterprise telephony and telco service procurement. His current projects benefit greatly from his prior work installing and maintaining telephony systems and network infrastructure. Mr. Weber was personally responsible for the design and construction of a wireless mesh network that brought broadband service to the town of Elk River, Idaho, for the first time in 2008.

Tetra Tech has over 130 GIS professionals on our staff, which allows us to quickly add personnel to adjust to increases in workload, as necessary.

Data Technology and Mapping Reference Projects

This section includes reference and contact information for four projects in the areas of data technology and mapping for which the Tetra Tech team was responsible. Please see Appendices A and C for additional relevant projects.

Project 1: North Dakota Broadband Business Development Roadmap

Organization: Grand Forks County Base Realignment Impact Committee
Location: Grand Forks, ND
Contact: Diane Blair
Telephone: (701) 746-2723
Email: dianeb@grandforks.org
Dates Services Provided: 2007

Project Description:

Relevance:

- Identified underserved and un-served communities
- Identified community anchor institutions and broadband needs/applications of same
- Integrated other telecommunications requirements of local government and public safety
- Recommended and received local government approval for public-private partnership as basis for broadband development plan
- Wrote broadband development plan and established framework for implementation and on-going support by local working group

In 2007, Access Consulting worked with Grand Forks County to develop a "Broadband Business Development Roadmap". The objective of the Roadmap was to provide a plan for improving broadband services in the rural communities that surround Grand Forks Air Force Base. The Base is undergoing realignment, and the County was engaged in a multifaceted effort to mitigate the economic impacts of the predicted reduction in Base staff. Improved broadband services are viewed as a crucial component of diversifying the economies of those communities and enabling them to absorb the impact of the base realignment.

Through a series of community meetings and targeted interviews with local government, technology businesses, public safety and telecommunications providers, it became apparent that the telecommunications challenges encountered in rural Grand Forks County were not limited to broadband. The interviews uncovered serious coverage issues with cellular voice and public safety radio services. The same infrastructure deficits that impeded broadband deployment were also impacting cellular voice and public safety radio. Access then recommended expanding the study to include these services, and the County concurred.

Based on the meetings and interviews, and complimented with targeted field observations of service availability, Access developed a plan for four tower sites to provide the common infrastructure needed to support broadband, cellular, and radio services. The four sites were selected from a list of approximately 20 sites based on their adjacency to existing power and telecommunications utilities and on their ability to cover un-served regions of the county. The plan included detailed specifications for the tower structure, blockhouse, and site utilities required at each site. The plan also included a

recommendation that the County develop the sites as part of a public-private partnership, making the sites available to broadband, cellular, and two-way radio providers. The County Commissioners concurred with this recommendation and the County is currently seeking funding to begin construction.

Project 2: Southeastern Wisconsin Regional Telecommunications Planning Project

Organization: Southeastern Wisconsin Regional Planning Commission
Location: Southeastern Wisconsin
Contact: Phillip Evenson, Former Executive Director, SEWRPC
Telephone: (262) 547-6721 x240
Email: Pevenson@sewrpc.org
Dates: 2005–2007

Project Description:

Part 1: Wireless/Wireline Inventory

Relevance:

- Developed a methodology for the data acquisition and mapping of broadband telecommunications coverage, performance, and infrastructure in a multi-county urban-suburban-rural region
- Carried out a broadband inventory and mapping program for the seven counties of southeastern Wisconsin in 2006 and 2007, representing 1.97 million people
- Utilized a combination of service provider, field measurement, and web site data along with public records to inventory and map the broadband service areas and network infrastructure of the region

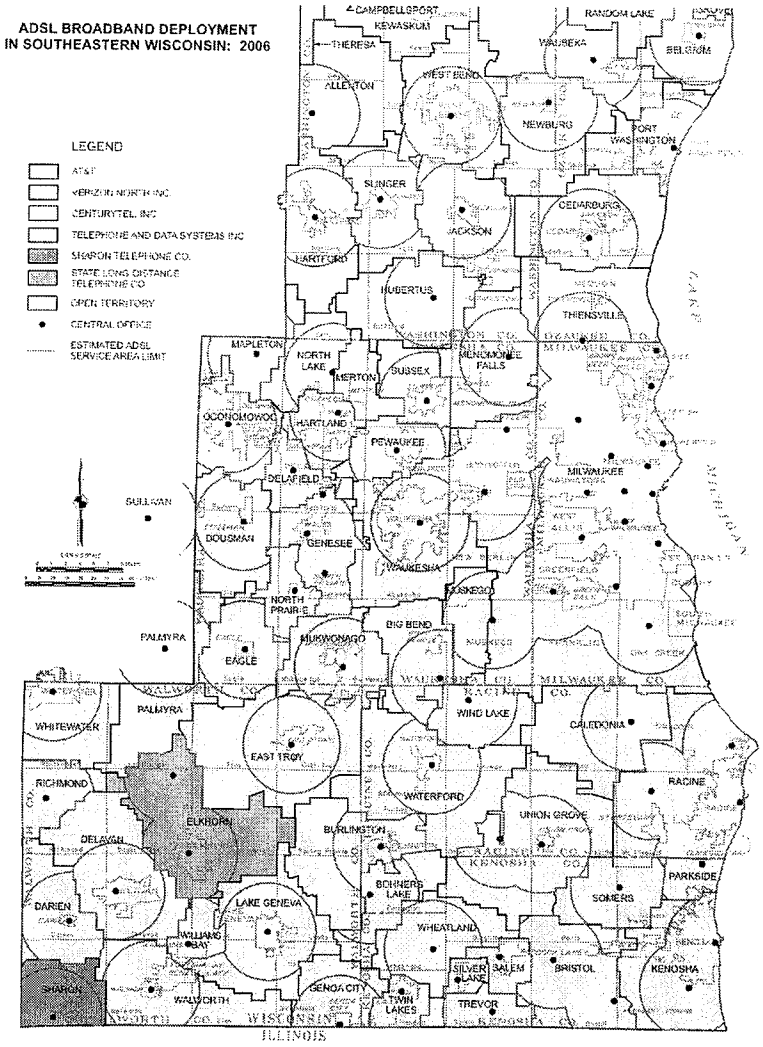
The end goal of the telecommunications planning program initiated in 2004 at the Southeastern Wisconsin Regional Planning Commission was to develop a comprehensive broadband telecommunications plan for the seven-county southeastern Wisconsin region. A vital part of the planning process was the compilation of broadband services and infrastructure inventory and its subsequent mapping region wide. The acquisition of such an inventory and related mapping represented a significant challenge both in its scope coupled with the difficulties encountered in obtaining data from the service providers.

The seven counties of southeastern Wisconsin cover 2,689 square miles and have a population of 1.97 million people. Although parts of the region are classified as under either the Milwaukee or Chicago metropolitan areas, 64 percent of the land area and about 10 percent of the population are rural. This rural area is generally un-served or underserved with broadband communications. Some low-income central city areas also fall under the same category. Both were major concerns of the telecommunications planning program.

Each of the broadband communications technologies presented its own set of challenges for this project. Telephone-based DSL networks are organized around central offices and remote terminals. Information on the locations of these network nodes is sometimes available in public records; however, it has increasingly become proprietary information that is rarely released by service providers. For this reason, data acquisition was based on a mix of public sources and field measurements and investigation.

An interesting correlation was found between DSL coverage and sanitary sewer coverage throughout the region. Such a correlation provides a confirmation of mapping from other sources.

Wireless broadband services, both mobile and fixed, are located around access points or antenna base stations. Locating these base stations and their heights and technical characteristics along with radio propagation modeling will serve to estimate wireless service areas. Improved mapping was the result of field measurements to calibrate and check these models in different terrain environments.



Source: Wisconsin Department of Administration Office of Land Information Services and SEWRPC.

Hybrid fiber coax (HFC) cable networks presented the most formidable challenge because of their network structure and the lack of public regulatory records. Two data sources, however, opened the door to cable coverage determination: community franchise agreements, and cable deployment economics. The franchise agreements identified the cable service providers in each community, and cable deployment decision rules based on housing densities allowed for informed coverage estimation. Again, the correlation with sanitary sewer coverage provided a very accurate confirmation check.

Part 2: Wireless Telecommunications Performance Inventory

Relevance:

- Tailored a methodology and a supporting set of equipment and software for performance and reliability monitoring of any fixed or mobile wireless communications system
- Carried out a 16-week, 7-county, 5-mobile wireless carrier service inventory that objectively measured the performance and reliability of mobile wireless networks in southeastern Wisconsin
- Extended the technology for future field surveys of broadband DSL and cable HFC networks

This project, conducted from November 2005 to March 2006, measured the performance and reliability of five mobile wireless cellular carriers in the seven counties of southeastern Wisconsin. Field measurements were made at four sites in each county. Over 127,000 automated calls were made over the 16-week period with equal allocation between the wireless service providers. Results were tabulated by provider, by technology, and by wireless technology generation (second or third). Summary performance results for the new third generation (3G) service were well below advertised rates. The two 3G providers (Sprint and Verizon) had the best performance of all carriers, but their measured down/up throughput rates of 331/74 and 341/84 kilobits per second were well below the advertised rates exceeding 1 megabits per second down and 250 kilobits per second up, respectively.

The monitoring system used a central server computer and a supervisory desktop computer along with a number of portable remote laptop computers to carry out the performance measurement as shown in Figure 8. These remote laptop computers and their associated provider-specific communications equipment were rotated on a planned schedule throughout the region over the 16-week project time period. An existing software package, Net IQ AppManager, was modified to control all data acquisition operations.

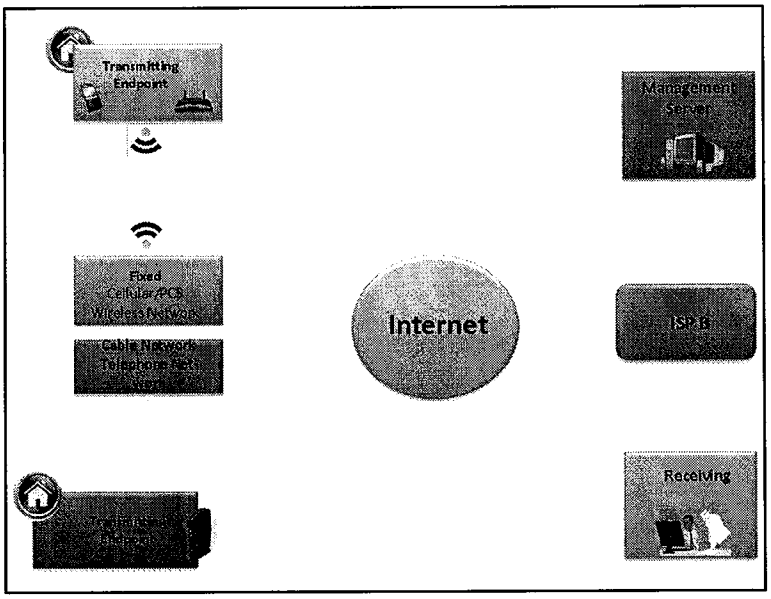


Figure 8. Packet Switched Monitoring System

A total of 42 randomly selected monitoring locations were used within the region. Town, village, or city halls were the preferred sites because the Planning Commission had excellent relationships with most local units of government who were very cooperative in supporting the project.

Results of the mobile wireless performance monitoring indicated a wide variation in carrier availability (or reliability). Availability was measured in a binary fashion as either connected or not connected. During every monitoring session, lack of network availability in time duration was recorded and accumulated along with network up-time to determine the availability as measured in percent of uptime. Carrier availability during the 16-week monitoring period varied from 72.06 percent on the low end to 94.33 percent at the high end. Availability also varied considerably in different parts of the region with one county recording a 56.60 percent value during the monitoring period. The 3G technology was separately tested for two of the carriers who at that time had installed 3G network upgrades in one county. Considerable improvement in both performance and availability was observed, but average throughput was still substantially below advertised rates.

Part 3: Wireless Infrastructure Inventory

Relevance:

- Developed a methodology for acquiring data on existing wireless communications antenna site locations to correct for errors and omissions in existing FCC and FAA databases.
- Carried out data acquisition and regional mapping of all 615 mobile and fixed wireless sites in southeastern Wisconsin during the 2005 to 2006 time period
- Project involved working closely with 153 local units of government and 10 wireless service providers

Comprehensive and accurate wireless telecommunications infrastructure inventories are a rare commodity. Although national databases on antenna sites have been compiled by the Federal Communications Commission (FCC) and Federal Aviation Administration (FAA), these databases tend to be inaccurate and incomplete. Neither agency has attempted a comprehensive antenna site compilation; therefore, an accurate antenna site inventory requires compilation of data from at least four major sources as listed below. The FAA database is primarily concerned with the location and height of antenna structures near airports, but this data is more conveniently and accurately collected from the other databases used. Therefore, while the FAA database was obtained, it was not used in the compilation of the inventories.

1. FCC Database

This database provided a good starting point for an inventory of antennae sites for traditional cellular networks in the 800- to 900-MHz range, but is a poor source of data for personal communication system (PCS) wireless networks in the 1900-MHz range.

2. Mobiledia Website

This database provided PCS network information of fair quality.

3. Local Units of Government

The county and municipal units of government within the region constitute a good confirmation source for antennae site locations providing cellular and PCS service, and provide the only independent source of data for fixed wireless antenna sites.

4. Network Operators

The network operators comprised the final confirmation source for all four classes of wireless networks as well as a critical check on the coverage element of the inventory.

Using all four of the above sources, the Planning Commission compiled a comprehensive inventory for regional antenna sites. Geographic and technical data for each site then provided the foundation for radio propagation studies to determine the radio coverage of individual sites and the overall radio coverage of the region. Figure 9 shows the results of antenna mapping efforts in Kenosha County.

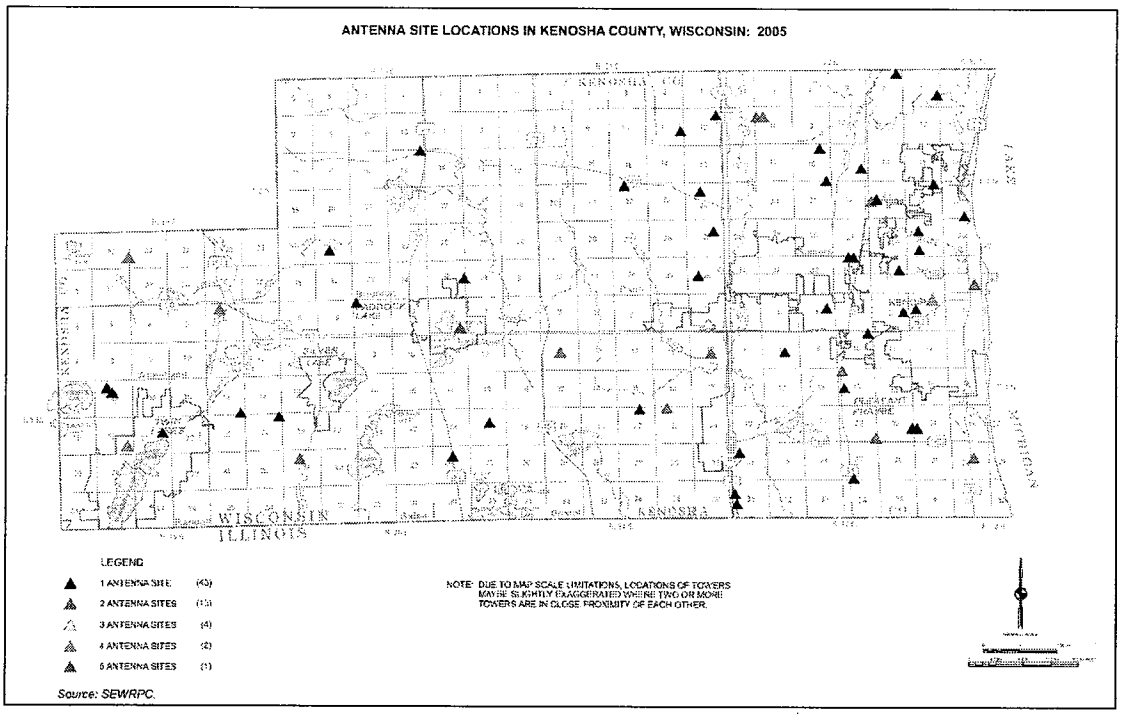


Figure 9. Results of Antenna Site Mapping in Kenosha County

Project 3: Montana Critical Infrastructure Mapping and Geodatabase Design

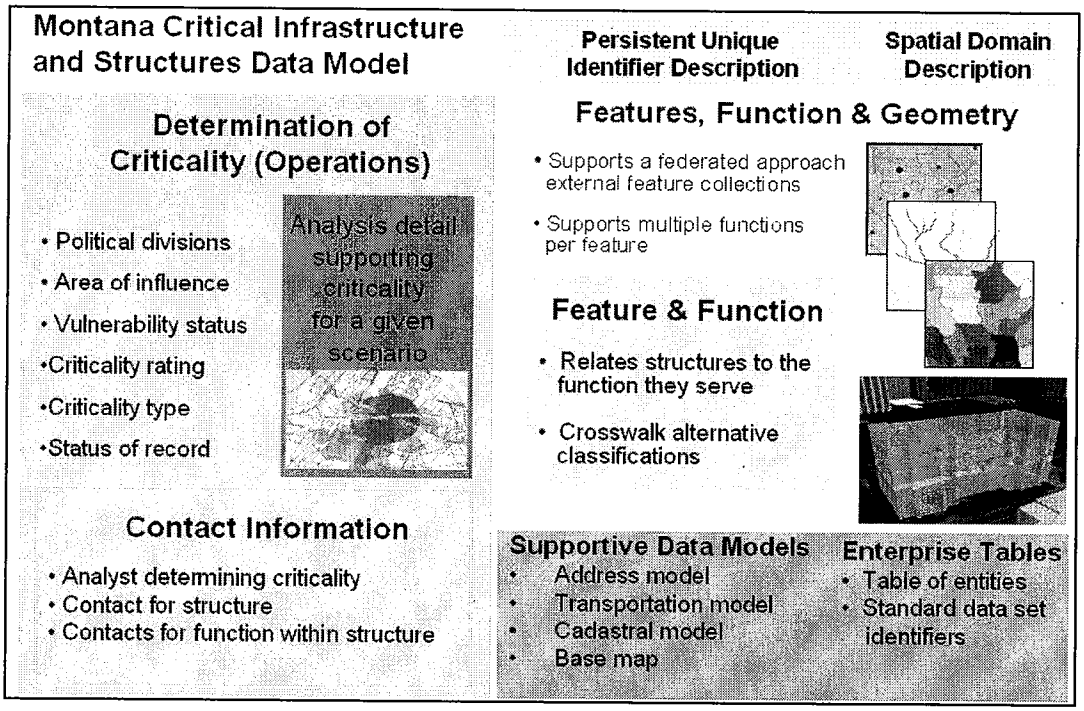
Organization: Information Technology Services Division, Montana Department of Administration
Location: Montana, statewide
Contact: Stewart Kirkpatrick, Montana GIS State Coordinator, ITSD
Telephone: (406) 444-9013
Email: skirkpatrick@state.mt.us
Dates: August 2004–November 2006

Project Description:

Relevance:

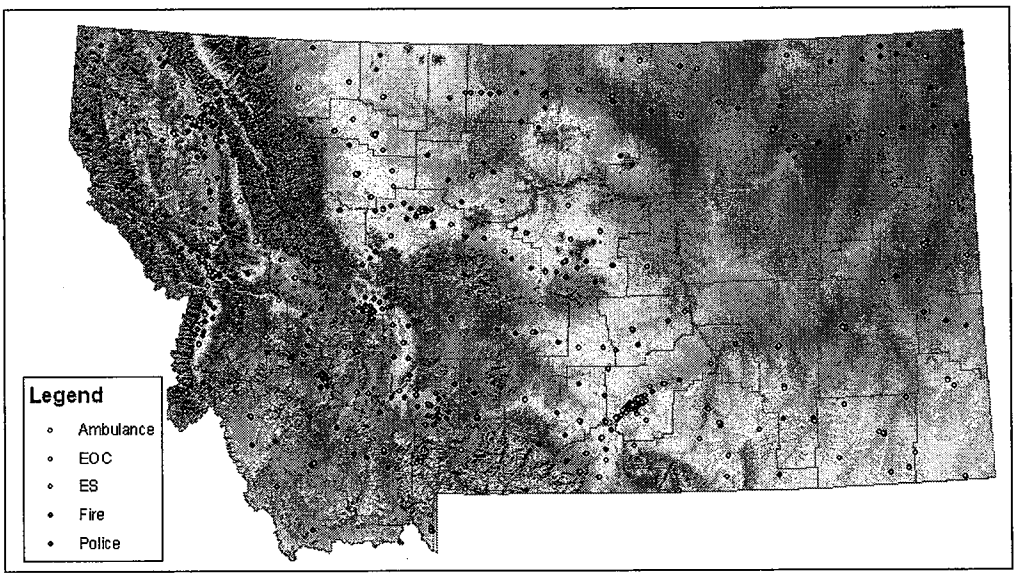
- Designed a federated geodatabase model for critical infrastructure in Montana, integrated with the Montana Transportation and Rural Addressing geodatabase models.
- Completed a requirements analysis and functional testing of the model and comprehensive mapping of critical infrastructure categories including police and fire stations, ambulance services, emergency operations centers and emergency shelters throughout Montana.
- Verified and documented mapped locations through mail and phone inventories and surveys, supplemented by web mapping services and interactive WebEx enabled conference calls and web meetings with local officials throughout all counties and towns in Montana.
- All work in compliance with Montana federated geodatabase and system oriented architecture standards.

Geodata Services, Inc. (Geodata) was awarded a competitively bid contract with the Montana Information Technology Services Division (ITSD), Department of Administration to map critical structures throughout the state of Montana in 2004. Another competitively bid contract was awarded to Geodata by ITSD in 2005, in conjunction with the GIS subcommittee of the Montana Homeland Security Taskforce to design a multi-user geodatabase model for critical structures data in Montana.



The federated geodatabase, framework model, statewide GIS database, and state critical infrastructure coordinator position resulting from this effort form the foundation for a critical component of the common operating environment for Montana's federated statewide geodatabase, and the framework for critical infrastructure. The system was designed to accommodate several hundred critical structure map layers, comprising many thousands of critical infrastructure components statewide, in both urban and rural communities. The critical infrastructure point locations collected in the broadband mapping effort will be integrated with this data framework and geodatabase, and other components will assist in the linkages between the critical infrastructure framework model and the rural addressing and cadastral models. In the initial phase of this multi-contract series of competitive contract awards Geodata mapped 1,211 critical structures throughout the state of Montana. These included police stations, (including University police), county sheriff offices, highway patrol stations, fire stations, ambulance services, emergency operations centers, and emergency shelters (including those in hospitals and schools). The project involved compiling existing information, validating data content, mapping the results, and collecting additional feature attribute content and creating FGDC compliant metadata. The process involved initial base mapping, developing web services, telephone and mail surveys, and online surveys, web enabled conference calls, and census methods to contact local officials in every county and town in Montana to verify the mapping results and provide opportunities for review and verification. Extensive documentation was maintained and provided to the State upon completion of the project.

In developing the critical infrastructure geodatabase model, Geodata initially researched efforts in other states and prepared a State of the State report. Subsequently, a conceptual model was prepared incorporating Montana's data holdings, existing data models and standards, and federal programs, and geographic representations and relationships. A logical model integrated the conceptual model, defining tables, feature classes and attributes, groups feature classes, attribute domains, use subtypes, relationship classes, relates and joins, geometric networks, geodatabase topologies and map topologies. This model also examined the potential physical design regarding spatial reference and schema. In June, 2005 the model was evaluated in statewide DES Homeland Security exercises, followed by developing a final geodatabase design and schema and report.



Subsequent contracts were awarded to Geodata and completed for requirements analysis and functional testing of the model, between 2005 and 2006, and Geodata provided transition support to a full time state coordinator for critical infrastructure mapping at ITSD.

Quality of Services

- Stewart Kirkpatrick and the Montana Homeland Security task force committee were very satisfied with the quality of the geodatabase design and infrastructure mapping produced and coordinated by Geodata. The task force committee met monthly with Geodata during the two year project period, reviewed all work and insured a high quality final product.

Timeliness of Performance

- Geodata kept the critical structures mapping, geodatabase design and implementation projects on schedule throughout the three year period, meeting and exceeding all project milestones and deadlines.

Customer Satisfaction

- All project task orders were completed within project budgets with no over runs or negotiated modifications or revisions. ITSD staff have continued to build on this initial mapping and geodatabase design since 2006. Some of this work provides the foundation and basis for the methods we propose using for anchor institution work and rural addressing for this broadband mapping project.

Business Relations

- Our familiarity with GIS federated models, data sources, and state GIS standards enables us to properly scope, staff, and manage tasks at realistic budgets, resulting in lower costs to the client. Two of our team members served as the sole technical representatives appointed by the Governor of Montana to two consecutive 2-year terms to the State MLIAC GIS advisory council on State GIS matters.

Project 4: Gateway West Transmission Line

Organization: Rocky Mountain Power and Idaho Power
Location: Glenrock, Wyoming to Boise, Idaho
Contact: Pam Anderson, Project Manager
Telephone: (801) 220-2481
Email: Pam.Anderson@Pacificorp.com
Dates Services Provided: 2007–Ongoing

Project Description:

Relevance:

- GeoManager Web-based mapping and information management system implementation and maintenance for near real-time Right-of-Entry, Cultural and Geophysical survey information mapping, query, data entry and reporting.
- Coordination with two state governments, 12 BLM field offices in two states, two U.S. Forest Service District Offices, one tribe, 16 counties, and numerous public and private stakeholders.
- Extensive Public Involvement across Multiple States.
- Extensive GIS Modeling and Mapping of over 1,500 miles of proposed and alternative routes using over 90 GIS data layers, often from agencies reluctant to share their data sets.
- Effect of the project on local and regional socioeconomic conditions.

Idaho Power and Rocky Mountain Power submitted a Right-of-Way Application (ROW) in October, 2007 to construct a series of eleven transmission line segments of 230 to 500 kV, to carry up to 3,000 MW, from the new Windstar Substation near the Dave Johnston Power Plant at Glenrock, Wyoming to the new Hemingway Substation, approximately 20 miles southwest of Boise, Idaho. Total length of all proposed segments is approximately 1,100 miles, however over 1,500 miles of proposed and alternative routes were sited using Tetra Tech's proprietary GIS program, the Linear Routing Tool or LRT. Similar projects are being conducted simultaneously for Idaho Power from Boise to Boardman Oregon, and for PGE from Boardman to Oregon coast, for an additional 700 miles of transmission line.

For Gateway West, approximately 42 percent of the total proposed length traverses federally-administered land in Idaho and Wyoming, crossing 12 BLM field offices, two units of the National Forest System, and land administered by the Bureau of Reclamation. Route alternatives have been analyzed across Idaho and Wyoming state lands, tribal lands, and private property as well.

Parcel Level Mapping

As part of the Right-of-Entry (ROE) and Right-of-Way (ROW) effort on Gateway West, land parcels with their situs address where developed along the entire project. This included thousands of parcels all along the 1,500 miles of proposed and alternative routes.

The quality of parcels and addresses across Wyoming and Idaho varies greatly, with few of the 21 counties in the project area providing digital GIS data sets that were easy to incorporate into our geodatabase. Most counties had digital CAD data layers or paper maps linked to either digital databases of property information or property information printed out in long paper lists. All of the property

information was compiled into a single geodatabase and populated with its address, which was used to notify landowners or lease holders that the transmission line was may pass near their land.

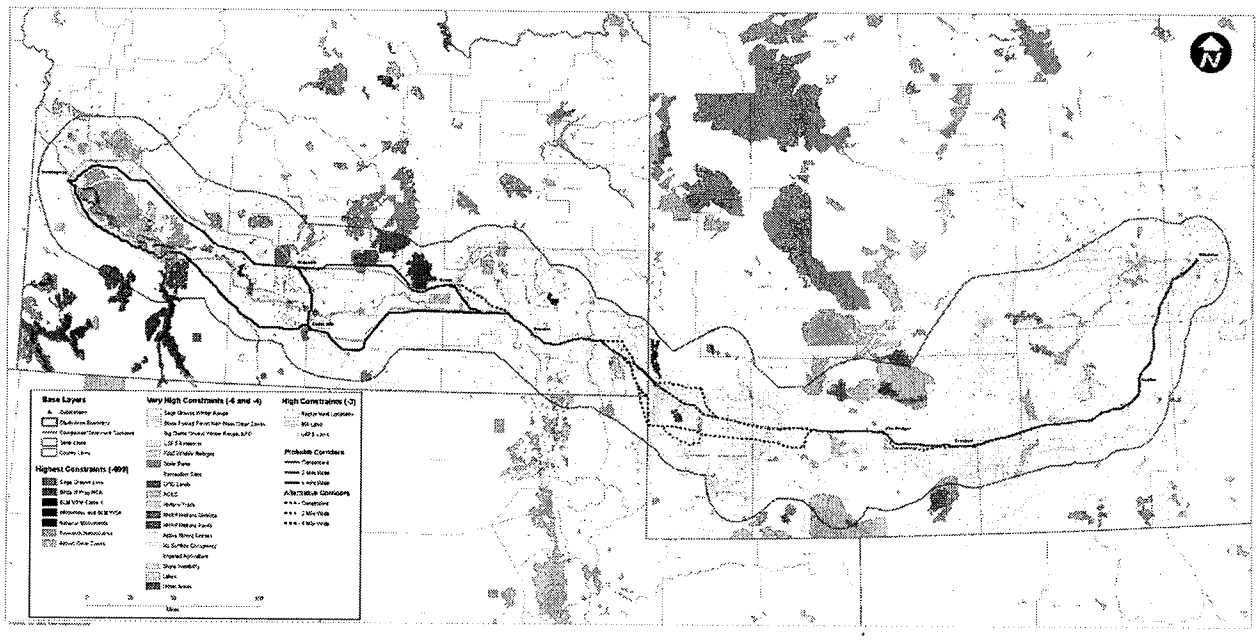
As landsmen visited all the properties along the route, ownership and address information was updated through a custom web interface directly into the GeoManager for near real-time status reporting, mapping and information distribution.

GeoManager

The GeoManager is an internet-based, interactive information management system developed by Tetra Tech. The GeoManager's core capabilities facilitate mapping, queries, reporting, and database edits through a Web browser. Tetra Tech designed the system to integrate project GIS databases with the data, querying, and viewing capabilities of Google Maps. With the GeoManager, any project data can be viewed over Google Maps reference datasets, such as street maps and aerial photography.

In addition to the standard Internet GIS capabilities of pan and zoom, data query, line and area measurement, and layer display control, notable features of the application include:

- Ability to update attribute data of land parcels through the browser
- Custom user "geo notes" that allow project staff to add comments at any location (free floating) or attach them to a parcel
- Ability to attach images, such as scanned documents or photographs to geo notes



Tetra Tech has enhanced the GeoManager for Gateway West to include ROE, Cultural Resources, and Geotech custom reports; data entry forms; special access restrictions and custom queries for field staff; links to a "landowner comments" database by land parcel; tools to select parcels by attribute and date; an Excel export tool, and more . The result is a powerful and flexible tool that Rocky Mountain Power

and Idaho Power can use to view, query, update and report on project information through an easy-to-use interface.

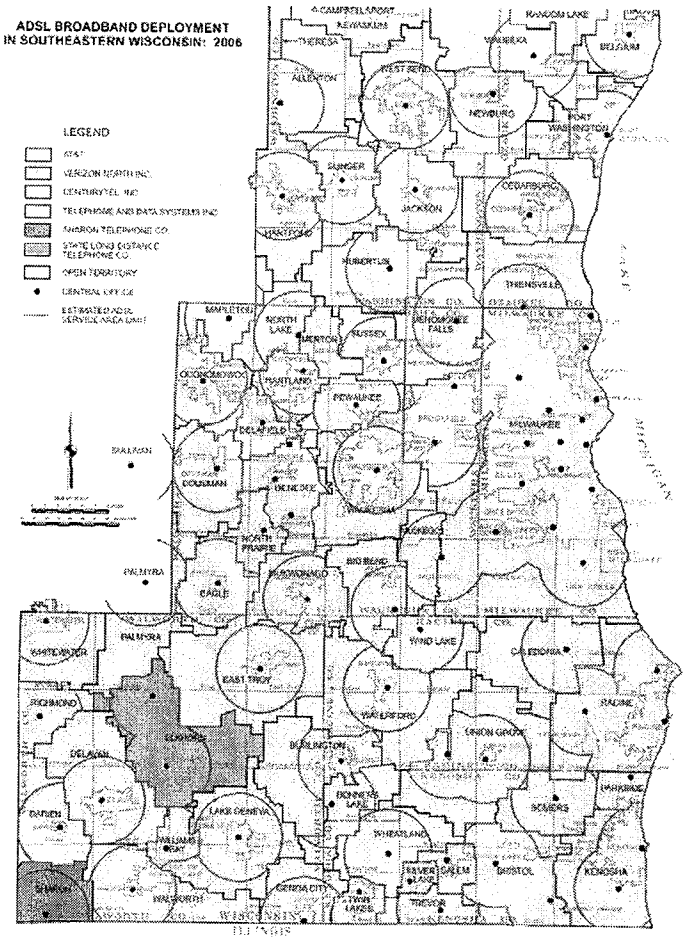
Public Involvement

In coordination with the Companies, Tetra Tech developed an extensive public involvement/ participation program that was implemented throughout the two-state study area. Public participation activities included agency and public scoping meetings, community meetings, newsletters, public workshops and anticipate public review of scoping and the public meetings on the Draft EIS document.

Sample Work Products

Sample work products from similar projects are included in this section. Products included in this section include the Southeastern Wisconsin Regional Telecommunications Planning Project (Figures 10a and 10b), the Montana Geodatabase Design and Critical Infrastructure Mapping project (Figure 11), the Gateway West Transmission Line project (Figures 12a through 12d), the North Central Idaho Telecom Assessment and Implementation Plan (Figure 13), and the Colorado Multi-Use Network – Network Implementation Plans (Figure 14). In addition, work products from projects entitled "Annotation Geodatabase for Region 6" and "Aerial Hazards Geodatabase" have been included as examples of data collection projects on a large geographical scale.

An example of the **Southeastern Wisconsin Regional Telecommunications Planning Project's** findings, titled "Wireless Telecommunications Performance Inventory Findings," is provided in Appendix C



Source: Wisconsin Department of Administration Office of Land Information Services and SEWRPC

Figure 10a. Southeastern Wisconsin Regional Telecommunications Planning Project: Map of Broadband Deployment in Southeastern Wisconsin in 2006

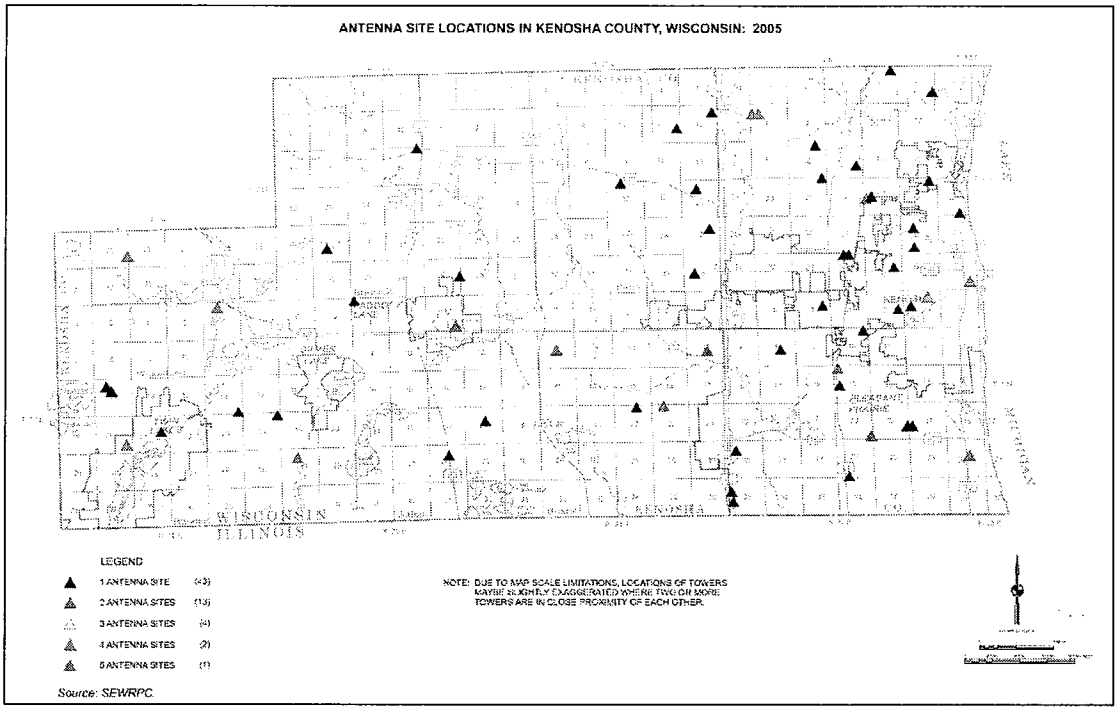


Figure 10b. Southeastern Wisconsin Regional Telecommunications Planning Project: Results of Antenna Site Mapping in Kenosha County

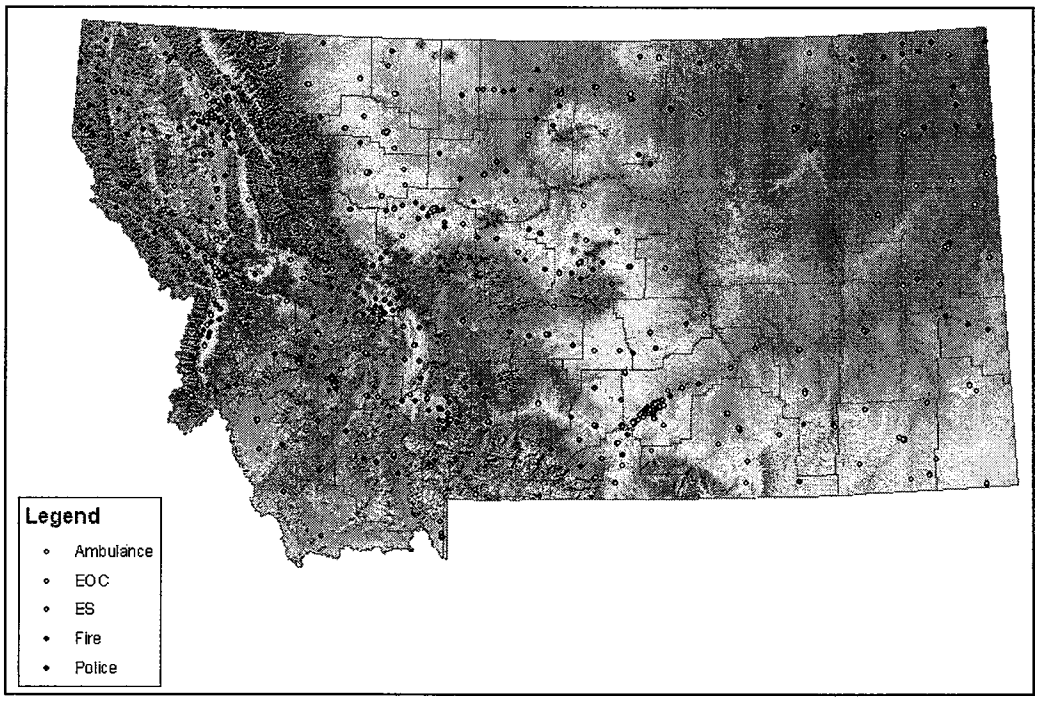


Figure 11. Montana Geodatabase Design and Critical Infrastructure Mapping project: Map of Critical Infrastructure in Montana.

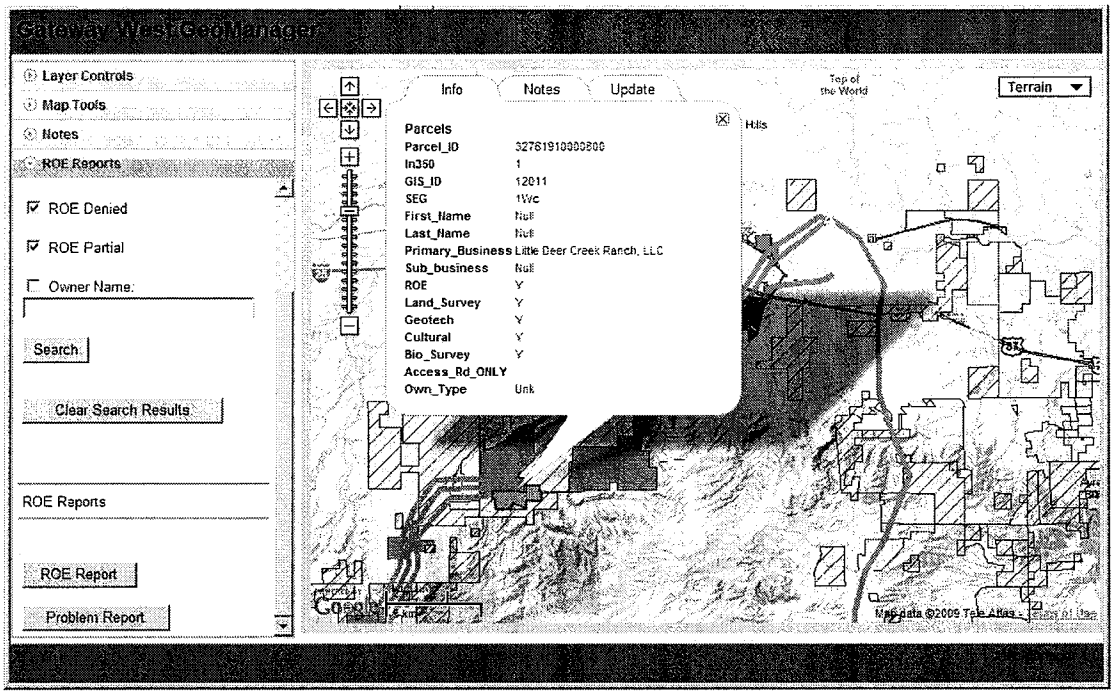


Figure 12a. Gateway West Transmission Line Project: GeoManager Mapping and Information Management System Showing Parcels Coded by Right-of-Entry Status, Information Bubble Listing Land Status, Parcel Info, Notes, and Database Update Tabs

Gateway West Right of Entry Status Report - Created 9-13-2009

Project Summary	1992 Private Parcels (584.48 miles)				795 Public Parcels (573.88 miles)				
Agreement Type	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Percent Secured
Right of Entry	769	401	324.92	1	70	2	66.31	0	33.74%
Land Survey	766	35	324.97	1	70	0	66.31	0	33.61%
Geotech	765	38	324.92	1	70	0	66.31	0	33.57%
Biological	731	72	291.41	1	70	0	66.31	0	32.21%
Cultural	738	58	309.43	1	70	0	66.31	0	32.49%

Project Notes
No outstanding issues.

Segment Summaries

Segment 1Wc	29 Private Parcels (4.49 miles)				10 Public Parcels (3.88 miles)				
Agreement Type	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Percent Secured
Right of Entry	21	6	3.42	0	6	0	2.44	0	69.23%
Land Survey	21	2	3.42	0	6	0	2.44	0	69.23%
Geotech	20	3	3.42	0	6	0	2.44	0	66.67%
Biological	20	3	2.4	0	6	0	2.44	0	66.67%
Cultural	21	2	3.42	0	6	0	2.44	0	69.23%

Segment Notes
No outstanding issues.

Segment 2	70 Private Parcels (52.12 miles)				62 Public Parcels (45.22 miles)				
Agreement Type	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Secured	Denied	Miles Secured	9/6/09 To 9/13/09	Percent Secured
Right of Entry	59	6	47.06	0	11	0	9.11	0	53.03%
Land Survey	59	0	47.06	0	11	0	9.11	0	53.03%
Geotech	59	0	47.06	0	11	0	9.11	0	53.03%
Biological	45	14	35.4	0	11	0	9.11	0	42.42%
Cultural	48	11	38.4	0	11	0	9.11	0	44.7%

Segment Notes
No outstanding issues.

Figure 12b. Gateway West Transmission Line Project: An Example of a Geomanager ROE Report Generated On-The-Fly; Reports are Accompanied by Custom Maps that are Also Generated In Real-Time

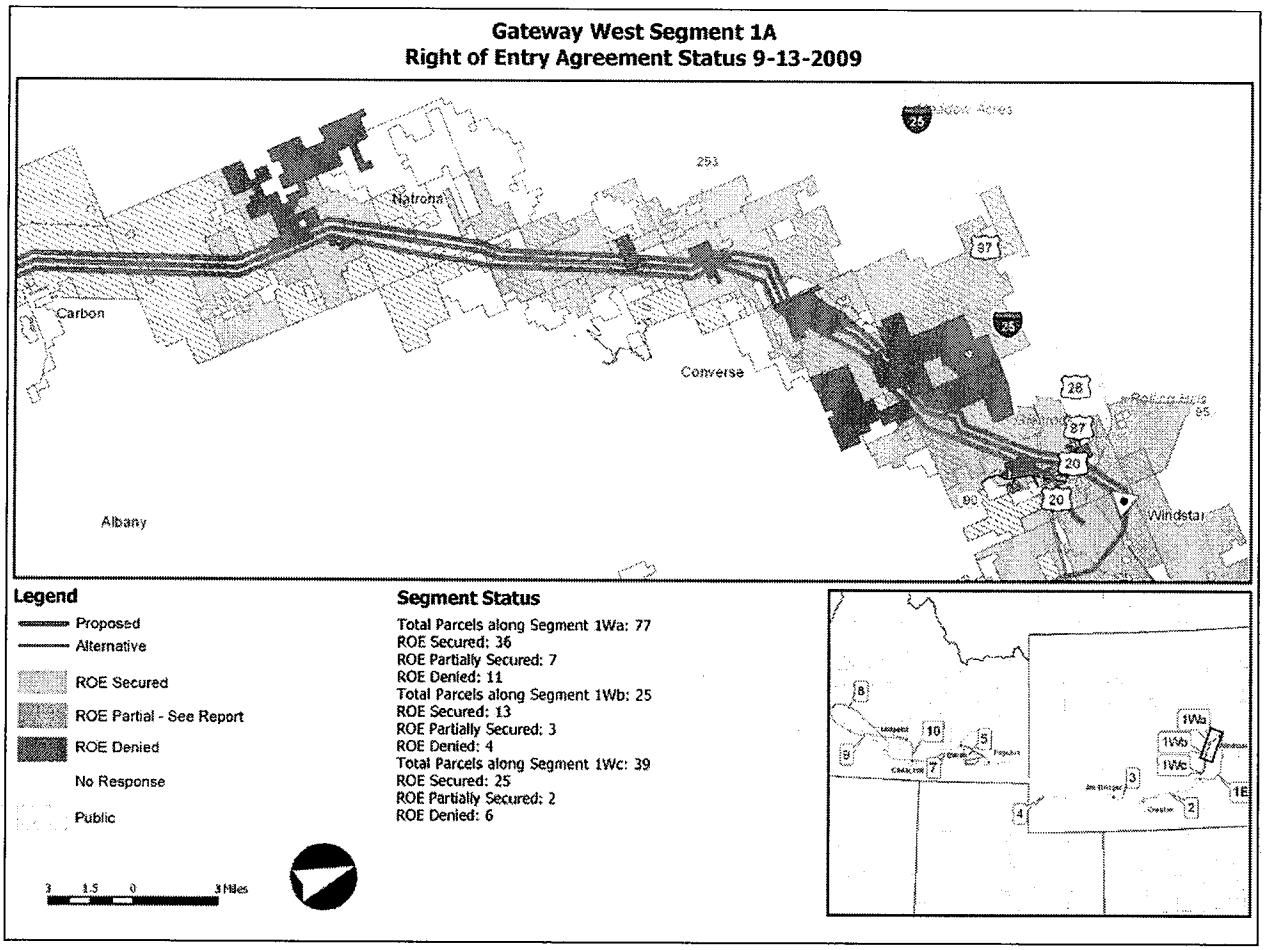


Figure 12c. Gateway West Transmission Line Project: GeoManager PDF Report Map Example

Gateway West Right of Entry Report Generator

Select the reports and maps you would like in the report, enter the time period, to look back for the recently aquired ROE, and finally, click the Make PDF button to create the report PDF. PDF creation can take up to 5 minutes depending on the number of maps selected. PDF size is dependent upon the number of maps included. Popup windows must be allowed for this site to work.

Segment	Parcels	ROE Aquired	ROE Partial	ROE Denied	Generate Report	Generate Map
1E	158	79		17	☐	☐
1Wa	77	36	7	11	☐	☐
1Wb	25	13	3	4	☐	☐
1Wc	39	25	2	6	☐	☐
2	132	56	14	6	☐	☐
3	66	26	10		☐	☐
4	486	246	2	42	☐	☐
5	230	58		63	☐	☐
7	292	25		56	☐	☐
8	470	165		112	☐	☐
9	286	68		86	☐	☐
10	173	3			☐	☐
Select					All None	All None

ROE Aquired Time Period

Start Date (default is 7 days prior to today):
9/6/2009

End Date (default is today):
9/13/2009

Make PDF

Figure 12d. Gateway West Transmission Line Project: One of the GeoManager Report Generator Interfaces

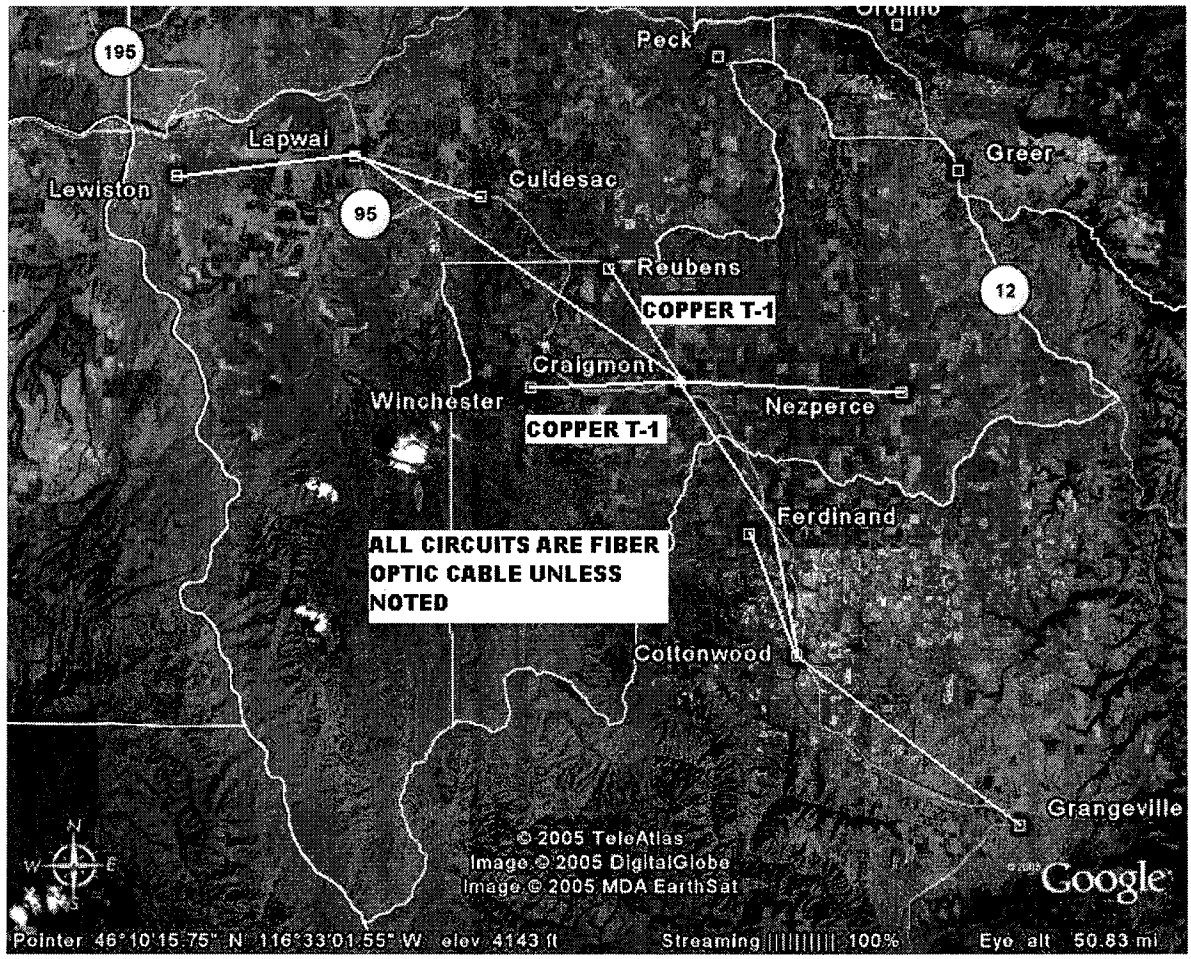


Figure 13. North Central Idaho Telecom Assessment and Implementation Plan: The Qwest Network Serves Eight Communities in the Study and Links Most of the Central Offices with Fiber Optic Cable

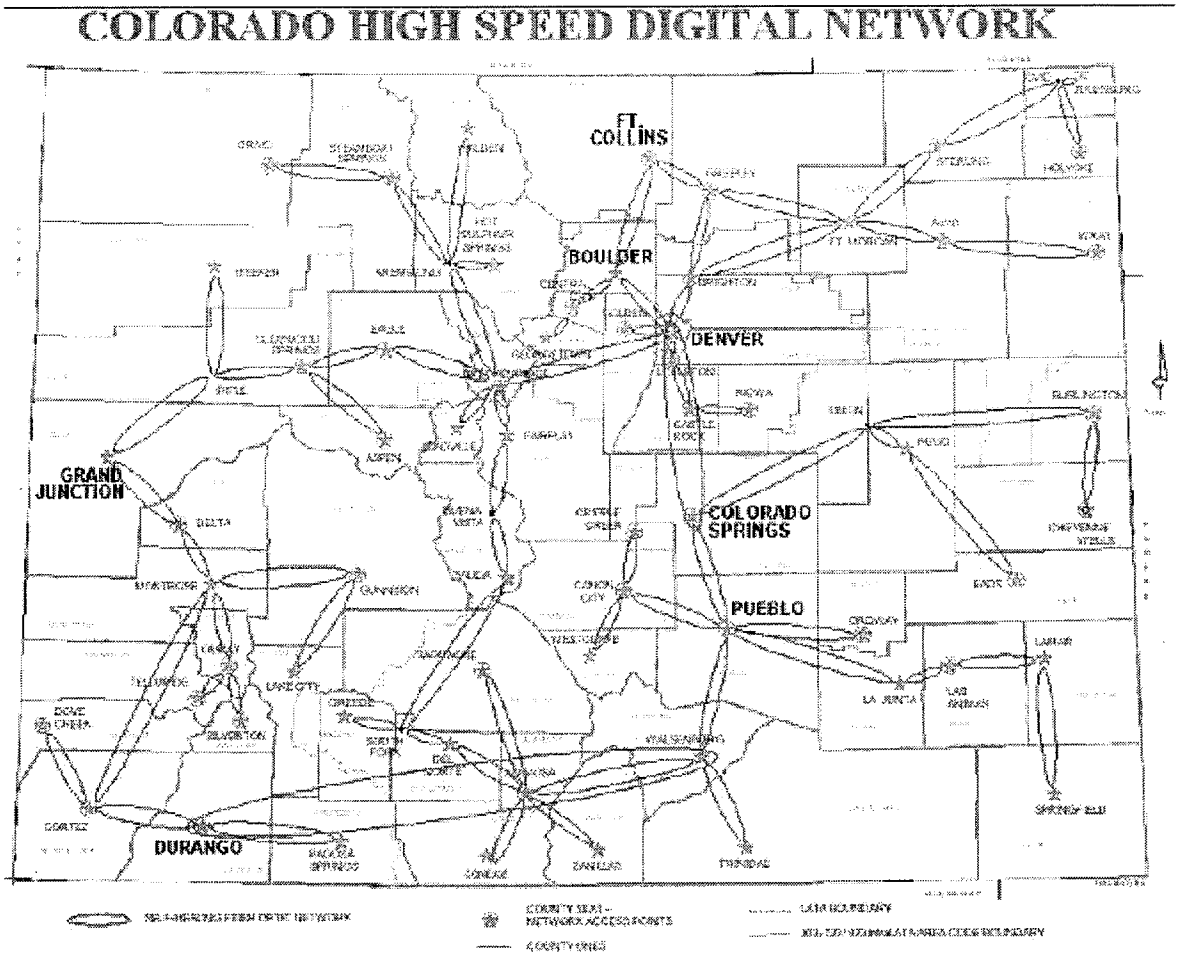


Figure 14. Colorado High-Speed Digital Network

Seamless Annotation Geodatabase for Region 6, USDA Forest Service

Figure 15 shows an annotation geodatabase for Washington and Oregon covering all USDA Forest Service Lands in the Region. To expedite and streamline annotation processing and to ensure a high level of quality, Tetra Tech developed a complete Region 6 annotation specification, including font size, type, and placement for every feature. As part of this documentation, a "Rules of Thumb" manual was developed to guide analysts and help maintain a consistent product. Scripts were also created to automate importing of annotation text files from the GSTC and for mapping the correct font characteristics to each feature font after import.

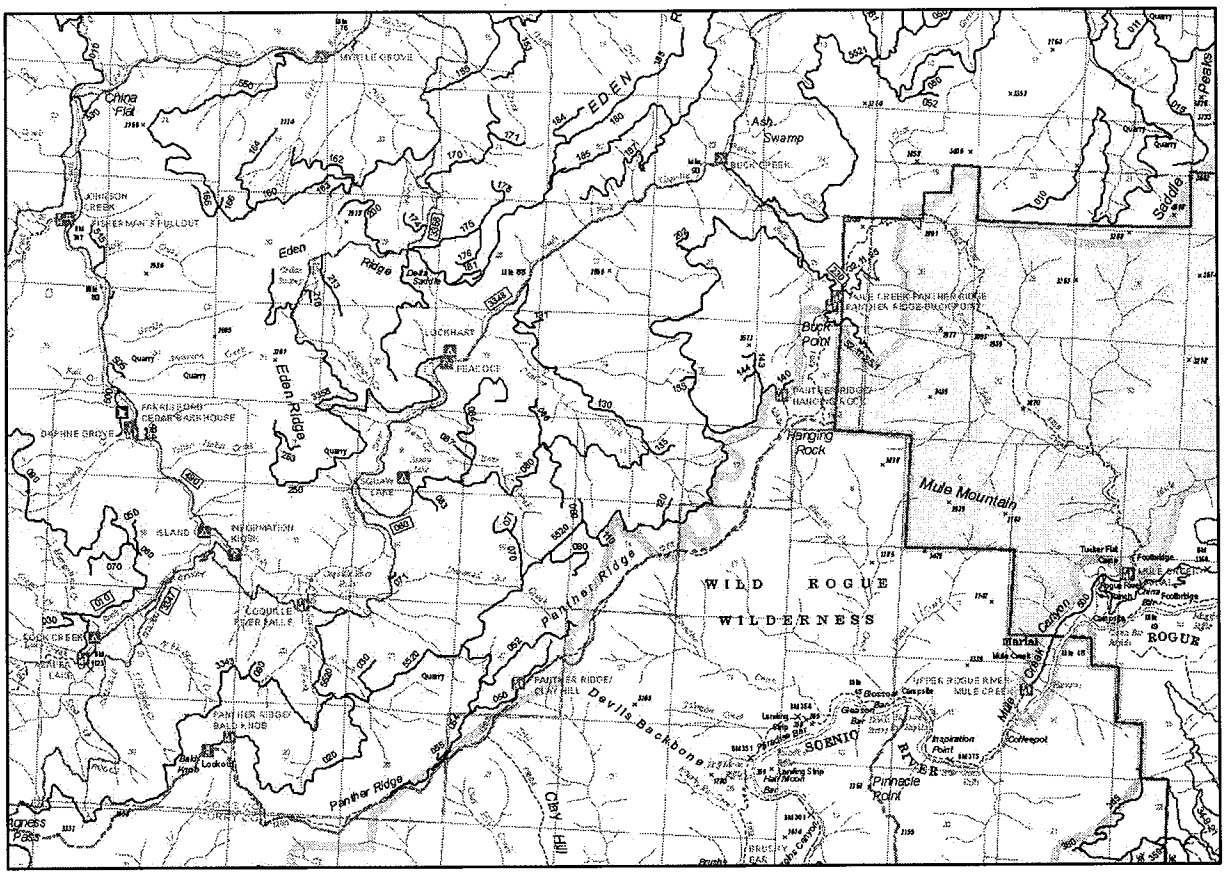


Figure 15. Annotation Geodatabase for USDA Forest Service Region 6

Aviation Hazards Database Management

Tetra Tech obtained and integrated digital and hard copy data files from Forest Service and BLM districts that represented potential low altitude flight hazards. The hard copy data were georeferenced, digitized, and converted into a geodatabase (Figure 16). The data were then validated by referencing to ortho photography and digital raster graphics. The aviation hazards geodatabase is updated annually and we continue to support the Forest Service fire and aviation staff by producing maps to be used for forest firefighting efforts.

In addition to downloading data sets, an Internet Map Service was developed and maintained, using ESRI's ArcIMS technology, so that the Forest Service and BLM units could access the data sets through an on-line map server.

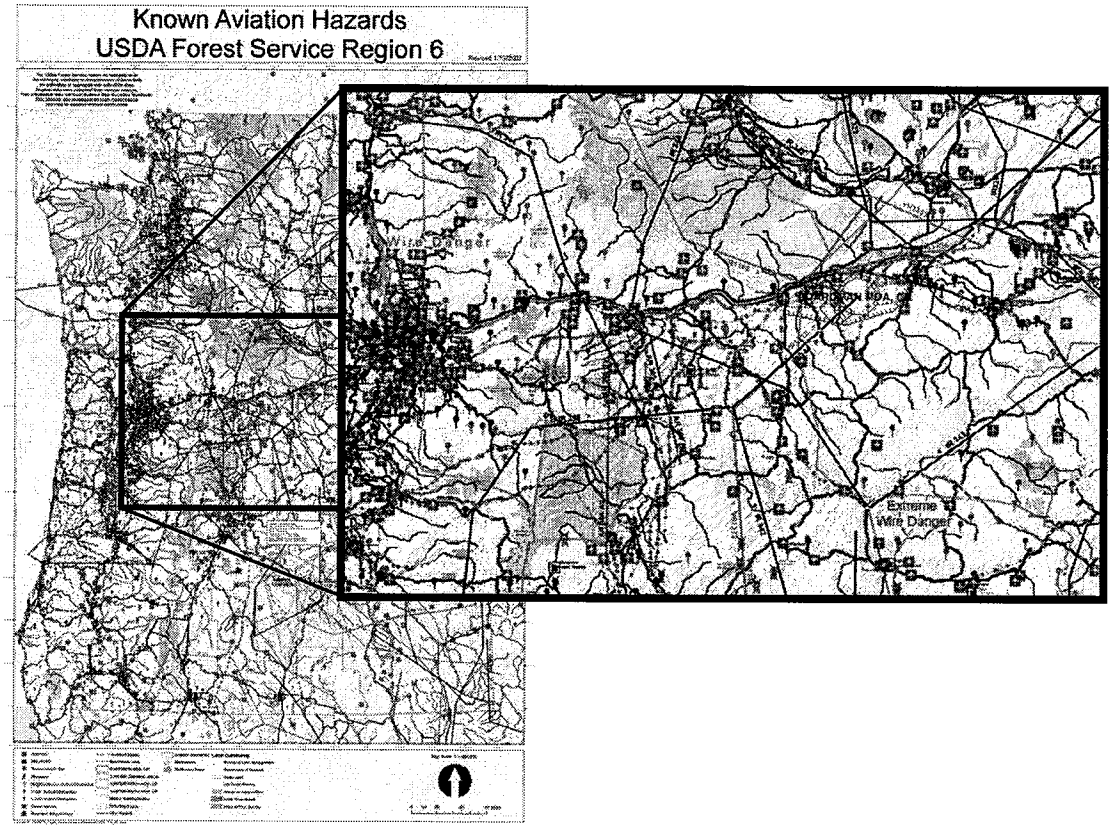


Figure 16. Aviation Hazards Geodatabase for USDA Forest Service Region 6

4. Financial Requirements

A. We have provided financial information that the State can use to formulate a determination about the stability and financial strength of Tetra Tech EC, Inc. in the form of a current Dun and Bradstreet report that includes a financial analysis. Please refer to Appendix D for the full Dun and Bradstreet report.

B. Tetra Tech has no judgments, pending, or expected litigation, or other real potential financial reversals, that might materially affect the viability or stability of our organization.

C. The Dun and Bradstreet report included in Appendix D is considered proprietary and confidential information and cannot be distributed without written approval from Tetra Tech EC, Inc.

5. Costs Proposal

Tetra Tech's bid to provide the services outlined in our proposal is included in a separate Cost Proposal, provided in a separate sealed envelope with our proposal delivery package. Therein, we have provided a detailed itemized budget for all tasks in as requested in the RFP, and as described in this proposal. The itemized budget depicts level of effort as well as costs for all tasks in our proposal. Costs are broken out for labor, direct costs, and travel for each task.

APPENDIX A

ADDITIONAL RELEVANT PROJECTS

Grand Forks Broadband Connectivity Business Development Roadmap:

In March 2007 the County of Grand Forks retained Access Consulting, P.C. of Missoula, Montana to prepare a Broadband Connectivity Business Development Roadmap. The study was commissioned as part of their efforts to mitigate the economic impacts of a pending reduction in the mission of Grand Forks Air Force Base. The rural communities surrounding the Base recognized the need to diversify their economies and further recognized the importance of the role of broadband service in that diversification.

We used the same three-pronged approach (provider data, community meetings, anchor institutions) for identifying available telecommunications services and infrastructure that had proven successful in our North Central Idaho project. During this process, it quickly became apparent that the telecommunications needs of this region went beyond the availability of broadband service. These communities also lacked reliable cellular voice, public safety radio, and public safety mobile data service. The providers of these services all cited the high cost of common infrastructure (towers, power, backhaul, etc) and the minimal return on investment provided by a sparsely populated rural region as roadblocks to service improvement.

Based on these findings, Access recommended that Grand Forks County consider forming public-private partnerships with the providers to share common costs for infrastructure. Under this partnership, the County would fund the construction of towers, equipment shelters, and required utilities. Service providers would be able to lease space at the towers for their equipment. The County accepted this recommendation and directed Access to develop a schematic design for the necessary common infrastructure. The final design recommended four new tower sites located to provide the desired service coverage and to take the best advantage of existing power and fiber optic services. This design provided the basis for an ARRA BTOP/BIP grant application submitted in August 2009.

Reference: Diane Blair, Coordinator, Base Realignment Impact Committee, County of Grand Forks, 600 Demers Avenue, Suite 501, Grand Forks, ND 58203

Colorado Multi-Use Network – Network Implementation Plans

Client: Colorado Rural Development Partners
Reference: Dr. Flo Raitano
Dillion, CO
(970) 390-0782
fraitano@earthlink.net

Relevance:

- Developed Network Implementation Plans for 10 counties to assist anchor institutions in connecting to the state of Colorado "Multi-Use Digital Network"
- Completed telecommunications infrastructure inventories in each of 11 counties
- Worked with various telecommunications providers across the state of Colorado to compile information for the plans

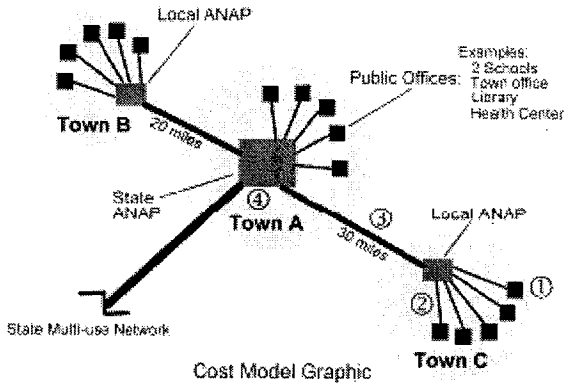
Facilitated intergovernmental approaches to meeting broadband needs in rural counties

Project Description:

In 1998, the State of Colorado Commission on Information Management, Multi-use Network Task Force (MNT), released the report "Colorado Strategic Plan for Statewide Telecommunications Infrastructure". The report recommended that various state agencies aggregate their telecommunications purchasing power to be more effective in negotiating with the private sector for investment in telecommunications infrastructure.

The primary mechanism to accomplish this goal was to establish a backbone of Aggregated Network Access Points (ANAP) in each county seat. The ANAP would aggregate traffic from multiple state offices in the county to a common point. In addition to state traffic, local agencies and businesses would also be able to connect to the ANAP.

In 2000, the State of Colorado provided funding for rural counties to prepare a "Network Implementation Plan" that would indicate how local public offices could connect to the state multi-use network. Applied Communications prepared the Network Implementation Plans for 11 individual counties.



Cost Model Graphic
Community Based Access Grant ("Beanpole") Bill

The planning process included completing telecommunication infrastructure inventories, administering community surveys, and conducting application analysis with each anchor institution in the community. Anchor institutions included local government, libraries, schools, and hospitals. Applied Communications met with every anchor institution in each county to assess current telecommunications services and determine future bandwidth needs.

Quality of Services

- The State of Colorado used the methodology for the plans that was developed by Applied Communications as a model for all counties.

Timeliness of Performance

- Applied Communications worked individually with each county and completed every plan on time. Completion of the plans in a timely manner was critical in order for counties to meet subsequent deadlines for grant applications.

Customer Satisfaction

- All project tasks were completed within negotiated budgets. Applied Communications was invited to present the methodology for the planning process at several national and state conferences.

Business Relations

- Applied Communications uses a project management model that relies on a high degree of collaboration with state and local officials to establish the appropriate communication and management processes necessary for a successful project.

GIS Statewide Ownership Data Acquisition

The purpose of the project was to create a statewide ownership GIS map in ArcInfo coverage format for all state trust lands, based on the master list provided by the DNRC lands staff at a scale of 1:100,000. A list of legal descriptions composed of aliquot parts for state owned parcels was provided by DNRC. DNRC's objectives were to compare and identify anomalies between the legal descriptions and a developed public land ownership GIS layer created by the Montana State office of the Bureau of Land Management. The scope of Geodata's task was to parse the legal descriptions and construct a process to update and correct the previous public land ownership layer. The scope included multiple challenges, including thousands of incorrectly identified state parcels in the original GIS layer, and inconsistencies in the aliquot parts descriptions. To address these issues, Geodata developed a methodology of using the BLM geographic coordinate database (GCDB) for automated processing of the public land survey system and pure aliquot parts descriptions, and a process to assign legal descriptions to quarter sections and government lots, similar to the methodology subsequently adopted by the Montana Cadastral Project for ownership mapping.

Montana Attorney Generals Office

Geodata successfully completed a one-year term contract with the Montana Attorney General's office in 2008 to assist in court proceedings, expert testimony and exhibits relating to a major state court case involving state assessments and fees resulting from use of state lands by several private sector corporations.

Blackfoot Challenge

Geodata provided primary GIS support and modeling for the Blackfoot Challenge, an organization of landowners and ranchers in the Blackfoot Watershed in Montana. The Challenge has been recognized with many national conservation awards and is recognized as one of the leading models for collaborative conservation in the nation. The GIS data and models were used in developing a comprehensive conservation plan for the region and assisted in providing the groundwork for the largest land exchange in the nation for conservation efforts.

Geodata also developed an eight-year program that used GIS to support noxious weed monitoring, management and control. Funded with assistance from the Bureau of Land Management and the Blackfoot Challenge, we assisted ranch and land owners in mapping weeds in the Lower Blackfoot Valley.

Montana Rural Fire Districts Digital Data Creation and Acquisition

The project purpose was to digitize boundaries of local government fire departments for 24 counties in Montana. The deliverables for this project included GIS map layers in ArcView shapefile digital format,

and documentation in Federal Geographic Data Committee (FGDC) metadata format. Another project purpose was to overlay local government fire jurisdictions with US Forest Service lands and commercially viable private forest lands and assess structural fire protection geographic coverage throughout Montana. The digitizing for this project was relatively simple, but the acquisition of local base maps from all counties in Montana was a logistical challenge. Encouraging cooperation, identifying existing digital sources, and project liaison were the primary roles of Geodata in this project in addition to GIS digital data conversion.

Heart of the Rockies Initiative Land Trust Working Group

Geodata has coordinated GIS data development, modeling, and collaborative mapping workshops since 2002 for a consortium of 24 local, state and national land trusts with a common objective to identify high value private land for conservation and establish shared 10 year conservation goals for the areas surrounding and linking three world class ecosystems in the Northern Rockies of Alberta, British Columbia, Idaho, Montana and Wyoming. Working farms, ranch and forest land, and many small and medium sized towns are interspersed with public lands, including many wilderness areas, wildlife corridors, crown jewel National Parks of the US and Canada including Glacier and Yellowstone National Parks, and world class ecosystem and wilderness reserves. The process included development of over 75 data layers representing community, agricultural and biological resources, suitability analysis, residential growth modeling, and threat assessment. Applying a collaborative analytical hierarchical process for transparent weighting, the GIS data was combined in weighted suitability models and used in live GIS support for local workshops throughout the region to map high value conservation lands. Stakeholders from local communities, land trusts, watershed groups, state wildlife managers, and federal land managers used the process to provide information, to inform local conservation priorities, and to engage a broad consensus to support plan implementation. The land trusts have used the results to develop Conservation Plans with feasible 10-year goals, track projects in identified high value conservation areas, and for detailed strategic plans.

Hunchy, Queensland, Australia Evaluating Rural Economic Opportunity

Geodata, in partnership with the Wyoming Geographic Information Science Center, and Spatial Information Services Pty Ltd, advised in scenario planning and 3D visualization to assist rural landholders in evaluating economic opportunity under the changes brought about by the 2005 South East Queensland (SEQ) Regional Plan. The analysis interpreted the new legal framework to yield parcel-specific results for agriculture, forestry and residential development suitability. Landholders found the 3D scenes to be an immediately and intuitively understandable way to communicate planning and development ideas.

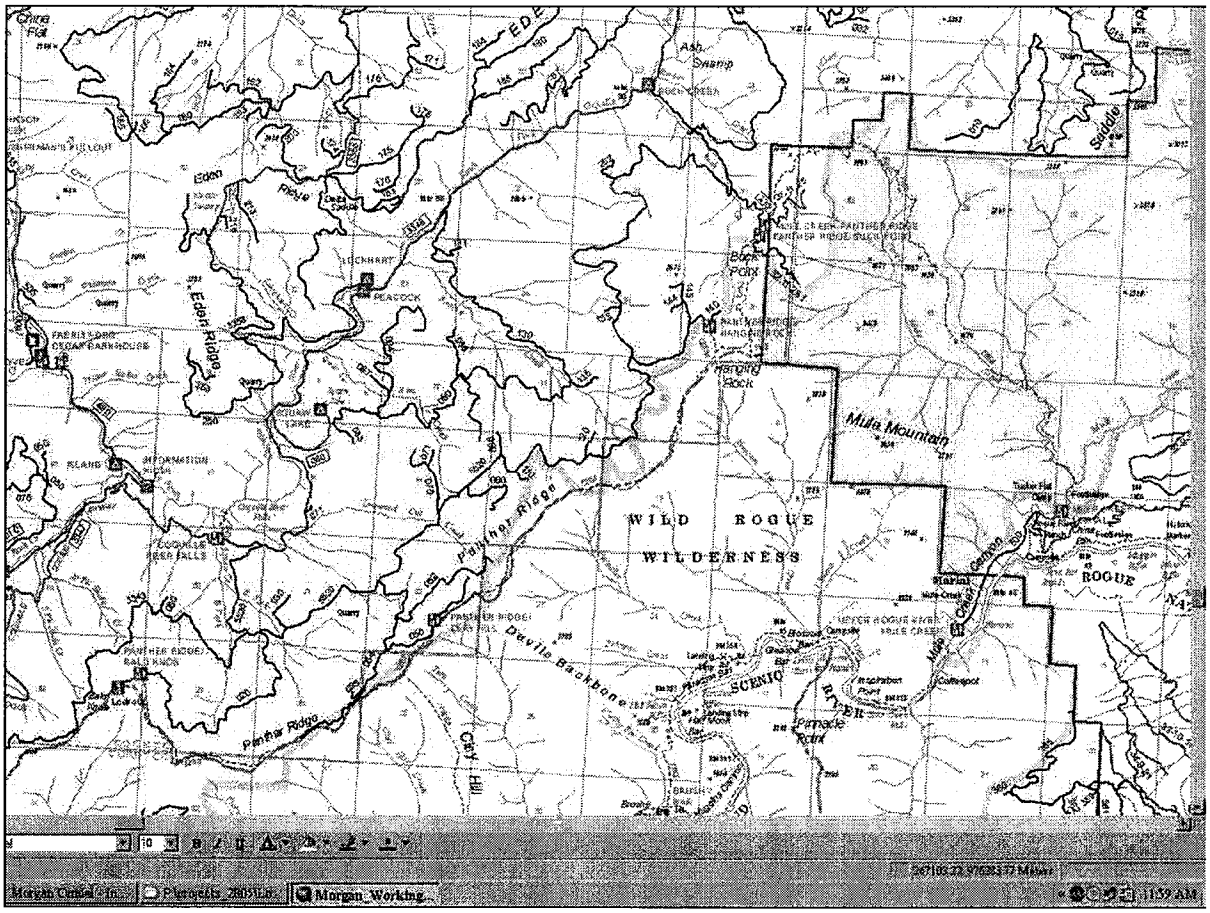
US Forest Service Base Map Digital Data Acquisition

The purpose of the project was to create a series of GIS maps covering the digital map layers contained in a subset of the US Forest Service cartographic feature files (CFF) for all lands in the northwest and southwest DNRC land offices, at a scale of 1:24,000. The scope of Geodata's task was to select specific

features, creating a subset of all CFF feature files, based on a list of feature codes provided by DNRC. These features include roads, streams, structures, and multiple administrative line classes. These were combined in thematic layers or coverages and merged and edgematched between map tiles to create continuous coverages. All initial processing was done in ESRI format in ArcInfo and Arcview, and subsequently converted to Pamap format for DNRC. The deliverables for this project included several Pamap GIS map layers in digital form with full topology, divided into the two land offices, and documentation in Federal Geographic Data Committee (FGDC) metadata format.

US Forest Service, Annotation Geodatabase Development, Washington and Oregon

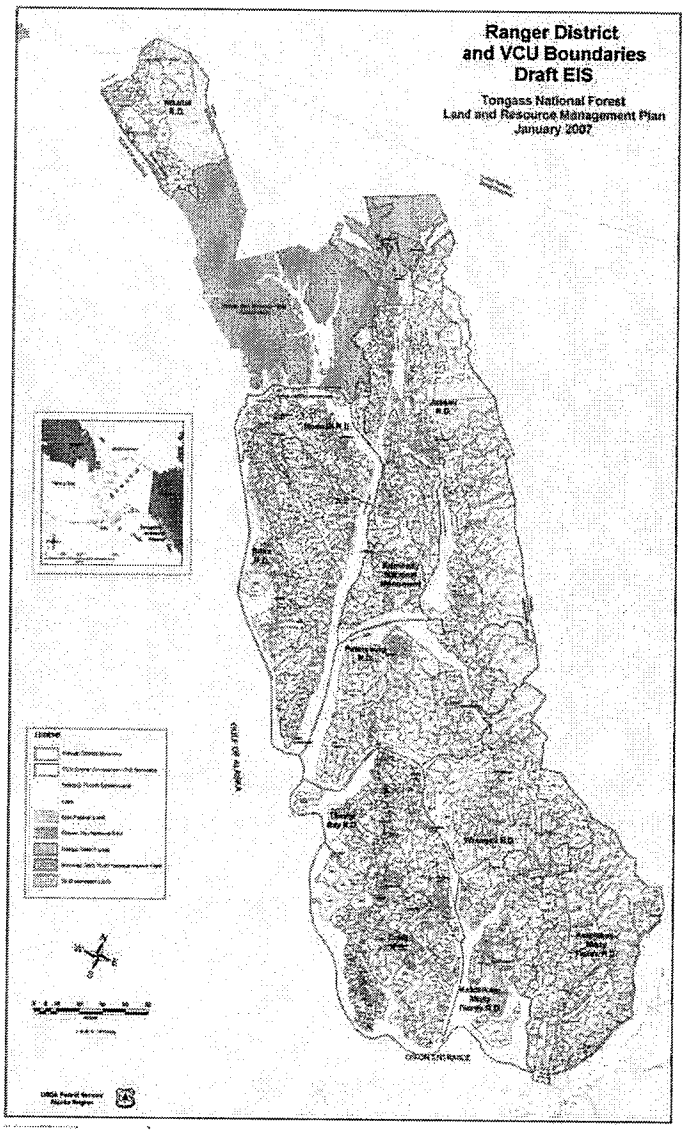
The Pacific Northwest Region (Region 6) uses digital annotation files for map production purposes. Historically, the GSTC supplied annotation to Region 6 as E00 or TXT files (quad-based annotation); however, these files were awkward to use and did not cover the entire Region. In addition, Region 6 wanted a seamless ArcGIS annotation feature class geodatabase, rather than individual quad-based files.



Tetra Tech produced an ArcGIS 9 seamless annotation feature class geodatabase for the annotation features from all of Region 6's 1:24,000-scale quad maps. This 2-year-long effort involved positioning, aligning, and sizing feature labels for 98 annotation classes in compliance with the USDA Forest Service

cartographic and symbol standards. Precisely duplicating the annotation from 1:24,000-scale maps was not the objective. Instead, the objective was to place annotation for ½ inch = 1 mile scale (1:126,720) Forest Service maps, according to the location of annotation on the 1:24,000-scale Softcopy Primary Base Series (SCPBS) quad maps or Digital Raster Graphics (DRG) quad maps. To achieve a seamless transition from one quad map to the next, edges are matched and checked for label redundancy, feature overlap, and distribution. This hybrid specification allowed Tetra Tech to develop annotation appropriate for 1:126,720-scale maps, while maintaining much of the information contained within the 1:24,000-scale maps.

To expedite and streamline annotation processing and to ensure a high level of quality, Tetra Tech developed a complete Region 6 annotation specification, including font size, type, and placement for every feature. As part of this documentation, a "Rules of Thumb" manual was developed to guide analysts and help maintain a consistent product. Scripts were also created to automate importing of annotation text files from the GSTC and for mapping the correct font characteristics to each feature font after import. Region 6 was very satisfied with the final product and they use the annotation daily. Annotating maps is much easier than before, saving the Region both time and money. Because the annotation is placed to precise specifications in a geodatabase, the Region can now produce higher quality maps in a more cost-effective and timely manner.



Tongass National Forest Land and Resource Management Plan Amendment EIS

Tetra Tech assisted the Tongass National Forest in developing a significant amendment to their Land and Resource Management Plan and in preparing an Environmental Impact Statement (EIS) for the amendment. At 17 million acres, the Tongass is the largest National Forest and represents the largest tract of intact temperate rainforest in the world. This project was generated by a Ninth-Circuit

Court decision, which mandated that the Tongass evaluate the estimated market demand for timber, consider a wider range of harvest alternatives, and more quantitatively consider the cumulative effects of all Southeast Alaska timber harvests. The subsequent National Environmental Policy Act (NEPA) EIS analyzed seven Tongass Forest Plan alternatives that met a wide range of timber demand levels, while balancing entry into roadless areas and cumulative effects on fish, wildlife, recreation, subsistence, and other issues.

Tetra Tech provided overall support in data preparation, analysis, planning, and product/document preparation associated with adjusting the Tongass Forest Plan. We completed an analysis of all lands considered suitable for timber production, and designed a road network and harvest plan for each logging setting. This was used to determine the supply of available timber under each alternative. We used GIS to analyze the effect of each alternative on a wide range of resources, including local communities, economics, roadless areas, cultural resources, fish, wildlife, vegetation, soils, wetlands, hydrology, scenery, and recreation. We created and/or updated a variety of Tongass-wide GIS layers and prepared detailed alternative maps, which included the State's transportation plan for future road and bridge development on National Forest System lands. We updated Forest-wide data layers using aerial photography / Digital Ortho Quad (DOQ) interpretation, field data, conversion from hard copies, edge-matching, and other methods. Layers updated included: land use designation, land status, shoreline, streams, roadless areas, recreation opportunity spectrum (ROS), existing visual condition (EVC), visual quality objectives (VQO), landscape character types (LCT), logging system and transportation plans (LSTP), and common land units (CLU). Tetra Tech developed and continues to maintain a Forest Plan Amendment Web site http://tongass-fpadjust.net/, several associated Web sites, and a Weblog http://tongass-fpadjust.net/FPA_Blogs.htm for keeping the public informed throughout the project and for collecting feedback as the project developed.

Aviation Hazards Database Management

Tetra Tech obtained and integrated digital and hard copy data files from Forest Service and BLM districts that represented potential low altitude flight hazards. The hard copy data were georeferenced, digitized, and converted into a geodatabase. The data were then validated by referencing to ortho photography and digital raster graphics. The aviation hazards geodatabase is updated annually and we continue to support the Forest Service fire and aviation staff by producing maps to be used for forest firefighting efforts. In addition to downloading data sets, an Internet Map Service was developed and maintained, using ESRI's ArcIMS technology, so that the Forest Service and BLM units could access the data sets through an on-line map server.

Boardman to Hemingway Transmission Line Project

Relevance:

- Parcel level address geodatabase development for thousands of parcels.
- GeoManager Web-based mapping and information management system implementation and maintenance for near real-time Right-of-Entry, Cultural and Geophysical survey information mapping, query, data entry and reporting.
- Coordination with two state governments, BLM field offices in two states, the U.S. Forest Service, tribes, counties, and numerous public and private stakeholders.
- Extensive Public Involvement Across Multiple States.
- Extensive GIS Modeling and Mapping of over 300 miles of proposed and alternative routes using over 90 GIS data layers, often from agencies reluctant to share their data sets.
- Effect of the project on local and regional socioeconomic conditions.

Description:

Idaho Power submitted a Right-of-Way Application to construct a 500 kV transmission line, to carry up to 3,000 MW, from a to be built substation near Boardman, Oregon to the new Hemingway Substation, approximately 20 miles southwest of Boise, Idaho. Total length of all proposed transmission line is approximately 300 miles. The requested ROW width varies from 150 to 300 feet. Construction is projected to start in 2011. The proposed route generally follows existing transmission lines and proposed Section 368 Energy Act corridors. Approximately 30 percent of the total proposed length traverses federally-administered land in Oregon and Idaho and crosses 4 BLM field offices and two units of the National Forest System.

Parcel Level Mapping

As part of the Right-of-Entry (ROE) and Right-of-Way (ROW) effort on Boardman to Hemingway (B2H), land parcels with their situs address where developed along the entire project. This included thousands of parcels all along the 300 miles of proposed and alternative routes.

The quality of parcels and addresses across Oregon and Idaho varies greatly, with few of the counties in the project area providing digital GIS data sets that were easy to incorporate into our geodatabase. Most counties had digital CAD data layers or paper maps linked to either digital databases of property information or property information printed out in long paper lists. All of the property information was compiled into a single geodatabase and populated with its address, which was used to notify landowners or lease holders that the transmission line was may pass near their land.

As landsmen visited all the properties along the route, ownership and address information was updated through a custom web interface directly into the GeoManager for near real-time status reporting, mapping and information distribution.

GeoManager

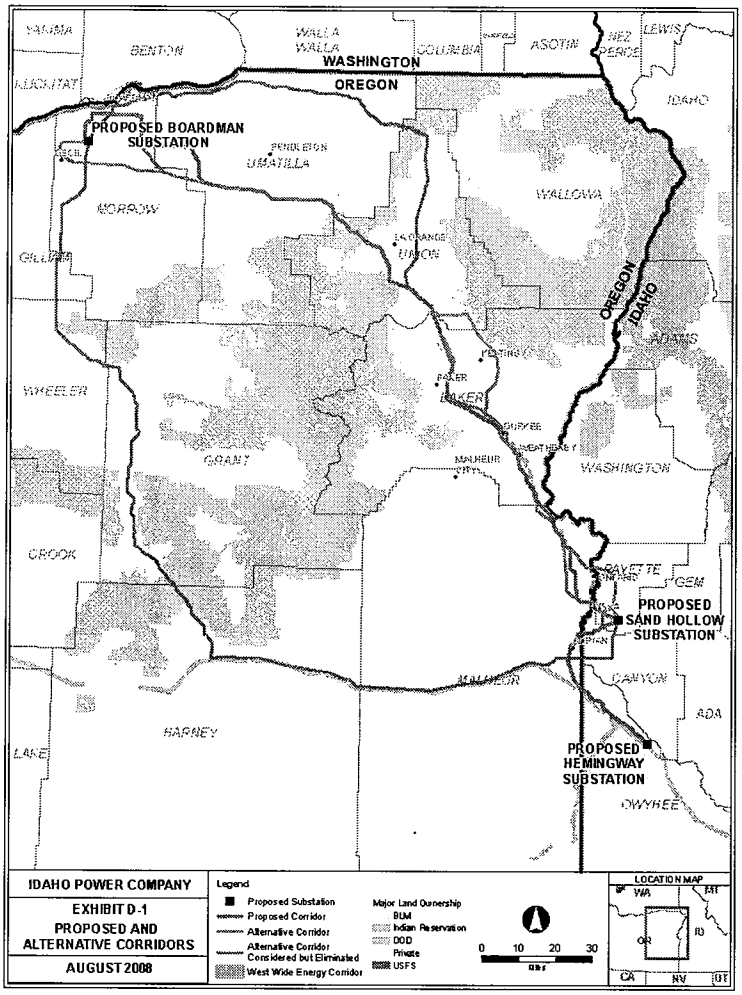
The GeoManager is an internet-based, interactive information management system developed by Tetra Tech. The GeoManager's core capabilities facilitate mapping, queries, reporting, and database edits through a Web browser. Tetra Tech designed the system to integrate project GIS databases with the

data, querying, and viewing capabilities of Google Maps. With the GeoManager, any project data can be viewed over Google Maps reference datasets, such as street maps and aerial photography.

In addition to the standard Internet GIS capabilities of pan and zoom, data query, line and area measurement, and layer display control, notable features of the application include:

- Ability to update attribute data of land parcels through the browser
- Custom user "geo notes" that allow project staff to add comments at any location (free floating) or attach them to a parcel
- Ability to attach images, such as scanned documents or photographs to geo notes

Tetra Tech has enhanced the GeoManager for B2H for ROE custom reports; data entry forms; special access restrictions and custom queries for field staff; links to a "landowner comments" database by land parcel; tools to select parcels by attribute and date; an Excel export tool, and more . The result is a powerful and flexible tool that Idaho Power can use to view, query, update and report on project information through an easy-to-use interface.



Public Involvement

In coordination with Idaho Power, Tetra Tech developed an extensive public involvement/participation program that was implemented throughout the two-state study area. Public participation activities included agency and public scoping meetings, community meetings, newsletters, public workshops and anticipate public review of scoping and the public meetings on the Draft EIS document.

Public Broadband Networks: A Decision Maker's Guide

Relevance:

- Guidebook was developed to assist public officials in evaluating alternative business models for public broadband networks.
- Guidebook is based on research and on the actual experience of communities across the country. The appendix includes a summary of 50 case studies representing fiber, wireless, broadband over powerline, and cable technologies.
- The Guidebook provides an overview of business models based on operating structure, cost-revenue considerations, and community benefits.
- Findings from the research has been presented at both State and National conferences.

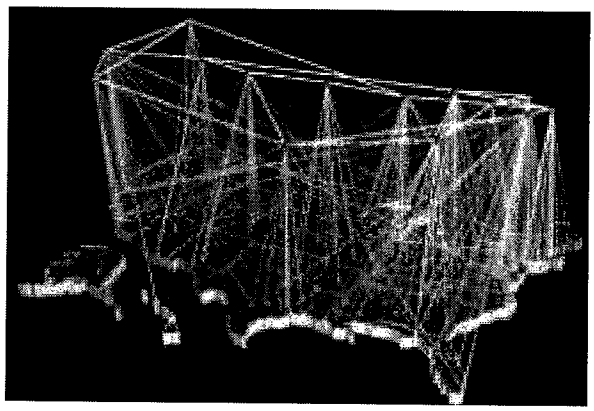
Description:

Public officials in rural areas are concerned that the local telecommunications infrastructure will not be able to meet these demands of the 21st Century. Consequently, local economies will suffer and it will become more expensive to deliver basic services. Many officials are asking if it is the role of local governments to promote a more robust telecommunications network. The purpose of this guidebook is to help public officials evaluate alternatives for taking an active role in the deployment of broadband networks.

Local officials must balance investments in broadband with being fiscally responsible and accountable to the entire community. Funds for broadband networks must compete with other priorities such as road construction, water treatment, and public safety. Officials must justify the investment in technology through sound analysis and planning.

The audience for this guidebook includes technical staff, community development professionals, elected officials, local government staff and public utility districts that are considering investments in a publicly owned broadband network. Cities have made national headlines with initiatives to provide Internet access over public wireless networks. Electric coops are providing cable services and fiber-to-the-home offerings. Public safety agencies are deploying mobile wireless applications. These and other examples have sparked immense interest from government officials.

Much of the information covered in this guidebook is compiled from a database of over 50 case studies that systematically examine various operational and business models of existing broadband networks. The case studies represent both small towns and large metropolitan areas and include a cross section of technologies and business models.



APPENDIX B

RESUMES

Summary of Qualifications

- Environmental services and GIS professional with over 21 years experience. Extensive experience with all phases of environmental management and GIS services including: business development, client management, staffing, project management, and technical oversight. Specializes in managing data intensive, multi-disciplinary studies and computer application development projects that utilize GIS technology. Primary application expertise relates to environmental and natural resource studies (16 years) but also includes local government, transportation, and utilities applications. Expertise includes project management, requirements analysis, system design, programming, and system implementation. Implemented multi-agency, multi-application GIS projects; large GIS data conversion projects; and focused single-application systems.
- Currently the GIS Technical Manager for Tetra Tech EC, Inc. focusing on the implementation and use of best of class GIS technologies. Seasoned senior GIS professional and responsibilities also include marketing, project and client management, quality assurance, and project execution.

Education

- BA, Geography, University of Texas, 1984

Select Project Experience

Gateway West and Boardman to Hemingway Transmission Line – Designed and developed the GeoManager application, a spatially enabled information management system for web-based map visualization, query, update, reporting and map production for all aspects of the proposed transmission line from planning through operations. GeoManager is a web-GIS application built upon ESRI ArcServer, Microsoft SQL Server, and Google Maps API technology. In addition to standard web-GIS query and visualization tools, GeoManager has fully integrated data update capabilities that allow non-GIS experts to maintain data used by the system. Data updating capabilities include editing attributes, adding and deleting spatial features, and integrating text, image, and other files associated with features. GeoManager also includes robust reporting functionality that allows user controlled data export and reporting in text, pdf, and excel formats as well as generation of sophisticated custom reports containing tabular data and maps in high resolution pdf files.

Montana State Library: Helena, MT –GIS program focused on natural resource applications, GIS data dissemination, statewide GIS coordination, and technology transfer. Supervised five programmer/ analysts in developing applications in spatial analysis, cartographic production, and information delivery.

Clearinghouse for Montana Natural Resource Information System (NRIS): Implementation of Internet-based GIS Data – Project Manager, System Designer. Developed integrated system using Internet, database, search engine, and GIS technologies to provide online access to public domain natural resource data and information. In 1996 the NRIS GIS data clearinghouse received international recognition as an excellent system in government from the Urban and Regional Information Systems Association.

Development of Multi-user, Countywide Cadastral Basemap: San Bernardino County, CA – As GIS Coordinator for San Bernardino County, coordinated development activities, supervised GIS programmer/analysts, and designed and implemented contractor selection procedures. San Bernardino County has the largest land area of any county in the United States, covers extremely diverse topographical and climatic landscapes, and has significant development pressures that make systematic mapping and database development extremely challenging. Also developed custom software programs for input and quality assurance automation, and wrote design specifications for databases and operations that are still in use.

US Forest Service: GIS Application Development, Western US. Project Manager, Application Design, Programmer – Led team of programmers using ESRI ArcObjects and Microsoft Visual basic to develop custom extensions to ArcGIS ArcMap. Applications developed included:

- BioSummatic GIS - Application for automating calculation of biomass fuel availability
- Fire Incident Mapping Tool (program modification and update) - Application for comprehensive mapping and management of fire incident information

- Automated Lightning Mapping System – Application for automated download and mapping of real-time lightning strike data.
- Geodatabase Conversion Tool - Managed and developed software development project to convert SBS ArcInfo coverages to personal geodatabases. The programs/tools are compatible with ArcGIS 9.1 and accessible from ArcToolbox.
- GenTools ArcMap Extension. Managed and developed the GenTools ArcMap Extension, which is designed to aid editing and generalization tasks associated with rescaling 1:24,000 scale Cartographic Feature File data up to 1:127,620 scale map data. The GenTools toolbar is designed to streamline the usage of built-in ArcGIS functionality to the benefit of cartographers.
- Legislative Map Tool. Implemented a single standard for legislative maps (LM) and developed a workflow that facilitated LM production for anyone in the Forest Service or the public. The workflow included software applications, tutorials, user documentation, standards, templates and map styles.
- Lands Data Extract Tool. The objective of this project was to build a server-based geoprocessing application which allowed a GIS user to request a real-time export from the Forest Service Land Status Records System (LSRS) for a selected area of interest using a Web interface.
- GIS Annotation Extract Tool. The objective of this project was to build a server application which would allow a GIS user to request a real-time export from the Forest Service CPS for all or part of the annotation for a given local area using a web interface.

ArcIMS Application Development: Ingham County, MI – Served as Project Manager and Lead Technical Consultant. Designed and developed a regional, multipurpose ArcIMS based Internet GIS application for Ingham County Michigan and the surrounding region. Ingham County's primary focus was the statistical analysis and displaying of public health data. The application implemented incorporated many innovative techniques and algorithms to allow on-the-fly analysis and mapping of the County's health data. Design requirements also included the need for the frequently required updates to the health data to be easily integrated into the overall application. Ingham County also requested the incorporation simple parcel query and crime mapping functionality into the application. The additional functionality was able to be easily integrated into the overall application using previously developed and tested ArcIMS program modules.

Internet GIS Application Development: Gallatin County, MT – As Project Manager and Lead Designer, developed a comprehensive web-enabled GIS application to provide distributed access to Gallatin County spatial data holdings. The goal of the Gallatin County Internet GIS project was to facilitate access by County staff, other governmental entities, and the general public to the County's GIS databases and other cross-agency information resources. The applications developed were designed to work with any web browser and provide interactive GIS capabilities to the public and over low bandwidth dial-up connections. This project included a first generation system developed with MapObjects technology in 1999 and a second generation system utilizing ArcIMS deployed in 2005.

Oil and Gas Development Environmental Impact Statement (EIS): Helena National Forest, MT – Managed a project for USFS to support EIS for oil and gas development. Analyzed over 50 GIS databases in different combinations to develop criteria for evaluating seven development alternatives.

Transportation Database Design, ITD: ID – Manager and Lead Technical Consultant for Database design of statewide transportation database for Idaho. Tasks included requirements definition, logical design, physical design, implementation, and technical support. System implemented using ESRI geodatabases, ArcSDE and Microsoft SQL Server.

State of Idaho GIS Clearinghouse Development: Moscow, ID – Lead Technical Consultant, assignments included requirements development, system design, system implementation, programming, and overall project consulting. Technologies implemented included ESRI ArcSDE, ArcIMS, ArcInfo, and MapObjects, Microsoft Windows 2000, SQL Server, IIS, and ASP.

Programming, Cartographic Design, and Database Development to Support U.S. Forest Service (USFS) Ecosystem Management – Project Manager. Developed a fifth-code watershed database, an ecological units database, and a land-type associations database. Analysis, which included characterization by vegetation, parent material, topography, land use, and demographics, required developing various models for mapping regions by geology, landform, topography, and stream character.

Andy Bury
CORPORATE SPONSOR

Summary of Qualifications

- More than 23 years of experience in GIS and Image Processing, working extensively with the design, compilation, integration, development, maintenance and dissemination of large natural resources, land management and infrastructure databases, and managing the development of innovative GIS spatial models, database programs and Internet applications.
- As GIS Discipline Lead with Tetra Tech EC, Inc., responsible for expansion and improvement of client-oriented GIS and data management skills throughout the company, and bringing GIS hardware and software to state-of-the-art levels nationwide. Supervises data management and GIS professional staff. Responsible for incorporation of GIS and data management into natural resources, water resources, energy resources, landscape assessment, industrial, DoD, and engineering projects.
- Seattle Lead Scientist responsible for managing and staffing our Seattle Science Group consisting of over 40 geoscientists, chemists, GIS analysts, and terrestrial and aquatic biologists.
- Managed over 200 GIS and image processing projects, including 120 task orders since 2004 including seamless annotation geodatabase, GIS, GeoManager projects, transmission line and pipeline linear routing in the USA, Canada and the Middle East; land cover classifications for the island of Taiwan and millions of acres around the USA, Canada and the Middle East, 1-m digital orthophoto creation for all of Texas; online real estate website development for Austin, Texas, including all parcels and situs addresses for Travis and surrounding counties, and GIS software application development projects.
- Experience with ESRI software (ArcInfo, ArcGIS) since the mid-1980s. Expert in ESRI's ArcGIS suite of software, including ArcInfo, ArcView, Network, GRID, TIN, Spatial Analyst, 3D Analyst and Geostatistical Analyst. Developed ERDAS-ArcInfo Live Link and played a key role in ERDAS Imagine product design. Expert with the ERDAS Imagine Professional suite, including RADAR Interpreter, Model Maker, Expert Classifier and Spectral Analysis.

Education

- BA, Geological Sciences, University of California, 1988

Select Project Experience

USDA Forest Service, GSTC, National GIS Data Services – Program Manager since 2004 for over 120 task orders, development and implementation of the marketing plan and marketing materials, proposal development, and contract management. Some of the projects that Mr. Bury has managed that are relevant to the Montana Broadband project include:

- Region 6 Annotation Feature Class. Create annotation feature class geodatabase for all of Forest Service Region 6: Washington and Oregon. One geodatabase was developed that contains all of the annotation from all Forest System Lands, and then they were combined into one master geodatabase.
- Administrative Boundary Updates. Increase the accuracy of state boundaries, county boundaries, U.S. congressional district boundaries, national forest proclaimed boundaries, and ranger district boundaries by adjusting them to match their legal descriptions and to spatially coincide with data layers of higher spatial accuracy. Increasing the accuracy of these boundaries will enable the Forest Service to accurately calculate the PILT for equitable settlements.
- Timber Operability Analysis for the Tongass National Forest. Develop two detailed Study Plans for conducting all work items necessary to respond to Court-related inadequacies and potential adjustments to the Forest Plan; one will follow the 1982 Planning Rule and one will follow the 2005 version. Also, develop a consolidated LSTA for the entire Tongass National Forest with uniform coding, to serve as the basis for many of the required analyses.
- Forest Service Region 6 Data Compilation. This task order was in support of US Forest Service Fire and Aviation GIS Information Management efforts. In general the goal was to provide support for collecting data sets from individual Forest Service and BLM units, standardizing these data to the Forest Service data dictionary, merging them into regional data sets, and making them available for download by the units. In addition, a basic Internet Map Service was developed and maintained, using ESRI's ArcIMS technology, so that the Forest Service and BLM units can access the data set(s) through an on-line map server.

- Metadata Mining Tool Programming. Managed the design and development of an Attribute Mining Tool for ArcGIS to facilitate the development of metadata as a regular part of business. The Metadata Wizard enables the user to populate metadata for geospatial datasets, stand-alone tabular datasets, or any other data source that ArcCatalog can read.

GIS Manager, Gateway West Transmission Line Project, 2007-Present – Designed data management system and data management plan. Managed data compilation, creation, standardization and maintenance for 1200 mile transmission line. Generated maps and statistical analyses for routing, siting, EIS and NEPA, and for construction planning. Developed lands parcel database with situs addresses. Orchestrated GIS-based linear routing using Tetra Tech EC's Linear Routing Tool (LRT) and created a custom Web-based Lands Information System. Oversee GeoManager implementation, an information management system for web-based visualization, query, reporting and map production for all aspects of the transmission line from planning through operations.

GIS Manager, Boardman to Hemingway Transmission Line Project, 2007-Present – Designed data management system and data management plan. Managed data compilation, creation, standardization and maintenance for 300 mile transmission line. Generated maps and statistical analyses for routing, siting, EIS and NEPA, and for construction planning. Developed lands parcel database with situs addresses. Orchestrated GIS-based linear routing using Tetra Tech EC's Linear Routing Tool (LRT) and created a custom Web-based Information Management System for all environmental and engineering data. Oversee GeoManager implementation, an information management system for web-based visualization, query, reporting and map production for all aspects of the transmission line from planning through operations.

GIS Manager, August 2003 – Present, Linear Routing Tool Development – Managing the development of a GIS-based tool to help solve the complex multivariate analyses associated with linear projects in a flexible and reproducible way. The tool takes into consideration physical, engineering, environmental, permitting, and social characteristics to minimize costs and schedule delays, and outputs a Best Route (least cost path) with mile marker posts, summary reports, and a project cost estimate.

GIS Manager, October 2000 – February 2003, HomeCity, Incorporated, Austin, TX – Managed all GIS- and mapping-related components for this full-service real estate company, including database development and maintenance, spatial analyses, database maintenance procedures and documentation, map making, data research, and staffing. Developed the GIS database for the Austin TX and Park City, UT. Researched and acquired existing data; created parcel boundaries, address points, and network ready roads files; developed flow diagrams, procedures and documentation for ongoing maintenance of these databases. Directed programmers to develop standard method for geocoding daily addresses and to develop standard methodology for routing photographers by least cost path to new homes daily. Developed documentation for quality assurance and error correction.

Project Manager, April 1999 – October 2000, 3Di, LLC, Texas Orthoimagery Program, Texas Digital Ortho Quarter Quad (DOQQ) Project, Austin, TX – This $2.6 million project, completed in October of 2000, covered Texas with 1-meter resolution, color infrared digital orthographic photography. Developed production system, custom programming, txdoqq.com Web site, ImageViewer™ software, distribution and archiving of over 9,000 data CDs.

Director, December 1995 – April 1999, Earth Information Systems Corporation (EISYS), Austin, TX – Project, Program and Account Manager for various clients within the Real Estate, Environmental and State and Local Government vertical markets. Wrote proposals and gave presentations. Responsible for the hiring and management of employees. Performed complex image processing and GIS analyses.

Director of GIS Services, December 1993 – December 1995, South Carolina Department of Natural Resources, Marine Resources Division, Charleston, SC – Responsible for the design and implementation of the GIS for the Marine Resources Division. Applied GIS and image processing to marine-related research projects and facilities management. Contributed to or co-authored two Final Reports to the Minerals Management Service (MMS) and one to the Southeast Area Monitoring and Assessment Program.

Kathleen McMahon

PROJECT COORDINATOR

Summary of Qualifications

- Twelve years of strategic planning for rural telecommunications and broadband services including infrastructure inventories and application analysis. Completed telecommunications plans in Colorado, Wisconsin, Idaho, and Montana.
- Twenty-five years of experience working with local and state governments on a variety of planning projects involving extensive intergovernmental cooperation and stakeholder involvement.
- Past President of Rural Telecommunications Congress, grant reviewer for NTIA Technology Opportunity Program, and Telecommunications Co-Chair of American Planning Association Infrastructure Task Force.

Education

- BA, Urban and Regional Planning, University of Illinois, 1980
- MS, Educational and Information Technology, George Washington University, 1998

Select Project Experience

Telecommunications Strategic Planning: Morgan County, CO; Door County, WI; Juneau County, Sandpoint, ID; and Havre, MT – Applied Communications has completed telecommunications strategic plans for each of these communities. The planning involved a telecommunications infrastructure inventory, key informant interviews with Anchor institutions, community surveys, market analyses, and action plans.

Colorado Multi-Use Network Implementation Plans: Pitkin, Fremont, Eagle, Garfield, Custer, Morgan, Yuma, Lincoln, Kit Carson, Cheyenne, and Sedgwick Counties; and the Telecommunication Region of Eastern Colorado – In 2000, the state of Colorado provided funding for localities to prepare a Network Implementation Plan that would indicate how local public offices could connect to the state multi-use network. The state of Colorado used the methodology for the plans that was developed by Applied Communications as a model for all counties. Applied Communications prepared the Network Implementation Plans for eight individual counties as well as the five-county TREC region. All plans included telecommunications inventories and working closely with anchor institutions to connect to the statewide network.

Telecommunications Strategic Plan, Marshfield, WI – Completed a strategic plan for the City of Marshfield that included a needs analysis, identification of strategies, and a preliminary evaluation of priority projects for expanding broadband services in the area.

Central Idaho Telecommunications Strategic Plan – Partnered with Access Consulting to develop wide area networking strategies for a five-county area in central Idaho. Preliminary network designs were developed for a wireless network, satellite back-haul for remote areas, and future fiber backbone services.

Publicly Owned Broadband Networks Database – Applied Communications has created a searchable database to collect planning information on publicly owned broadband and municipal networks. The data can assist policymakers to conduct trends analyses and to help municipalities locate information on similar projects throughout the country. The database includes information on costs, business models, penetration rates, and potential funding sources.

Small Business Innovation Research Grant, Mesh Wireless Study, Rusk County, WI – Applied Communications was part of a team headed by HierComm to complete a Phase 1 Feasibility Study for a mesh wireless network in Rusk County, Wisconsin. The project is funded through a Small Business Innovative Research grant. The mesh wireless network would provide high-speed Internet (10 mbps) that covers the entire county. Applied Communications conducted the marketing analysis for the study while other team members focused on the actual network engineering, technology, software, and support systems that would be necessary to make this design feasible.

National Telecommunications Infrastructure, Technology Opportunity Program, Grant Reviewer – Conducted lead reviews on seven applications and supplemental reviews on 20 additional grant applications to expand broadband services to underserved populations.

Ken Schlager

TELETRACEROUTING LEAD

Summary of Qualifications

- Over 30 years of experience in the engineering development of communications equipment and systems
- Over 8 years of experience in regional telecommunications planning with recent experience in broadband inventories and mapping.
- Awarded 12 U.S. patents in communications and instrumentation since 1990.
- Registered professional engineer in the State of Wisconsin.
- Principal investigator or project manager on over 28 federal research grant programs since 1990.

Education

- PhD, Electrical/Biomedical Engineering, Marquette University
- MS, Industrial Management, Massachusetts Institute of Technology
- MSEE, Electrical Engineering, University of Wisconsin
- BS, Engineering, US Naval Academy

Select Project Experience

USDA SBIR Grant: Broadband Telecommunications for Rural America, Washington County, WI – The basic problem with most rural wireless communications systems is an economic one. In the majority of rural environments, the projected and actual return on infrastructure invested is marginal at best and negative at worst. In a research and development program sponsored by the U.S. Department of Agriculture, HierComm under my direction developed not only a system with much lower cost but with enhanced fourth generation performance that is now fully operational in Washington County, Wisconsin.

USDA SBIR Grant: Advanced Telemedical Rural Healthcare Delivery System, Rusk County, WI – Extended travel distances present a major problem in rural home healthcare. Under a separate USDA research grant, a low cost home-based video conferencing system was developed for nurse-patient communications. Such distance problems can be helped by more frequent video conferencing. This system made use of the high speed streaming video capability of the broadband wireless system developed under the previous grant. The system was field tested with home nursing staff and real patients in Rusk County in northern Wisconsin.

Regional Broadband Telecommunications Plan: Southeastern WI – Developed and initiated implementation of what is believed to be the first regional broadband telecommunications plan in the U.S. This plan which applies to the seven counties of Southeastern Wisconsin required the same broadband inventories and mapping foundation called for in this solicitation. It pioneered the concept of field measurement as a supplement to provider information as the basis for service inventories. The final regional broadband plan called for a joint 4.9/5.8 GHz public safety/commercial network that is now in the state of implementation in two counties in Wisconsin.

Broadband Public Safety Communications Demonstration Project – A major result of the regional broadband telecommunications plan in southeastern Wisconsin was the initiation of a broadband 4.9 GHz public safety communications system development and demonstration program funded by Kenosha County. This project initiated in September, 2007 was successfully completed in April, 2009 with a series of field tests and demonstrations. Plans now call for full-scale deployment in Kenosha and for introduction to cities and counties throughout the U.S.

Numerous (28) Other Communications/ Instrumentation Research and Development Projects since 1990 – Completed a wide range of projects ranging from new methods of signal amplification to new forms of network architecture.

Bruce McFadden

TELETRACEROUTING SENIOR ANALYST

Summary of Qualifications

- Over 30 years of general management experience, with responsibilities for product and technology development, in medium and high technology companies.
- Experience includes 2 years in network planning and communications equipment, and more than 10 years in semiconductor test systems used heavily in communications chip development.
- Part of the team that built a wireless network in rural SE Wisconsin to make broadband internet available in unserved and underserved areas.
- Awarded one U.S. patent.

Education

- MS, Management, Massachusetts Institute of Technology
- BS, Engineering, Virginia Polytechnic and State University
- AEA, Stanford University Executive Institute Course for Technology Executives

Select Project Experience

Seattle Fiber Optic Highway Project – Seattle is among a few large US cities that retained rights to share pole and conduit space with telecommunications utilities within its boundaries. In the mid 1990's Seattle planned to offer use of a city-owned fiber optic "backbone" and its "pole rights" to a private partner to build and operate a network that would provide low-cost access to broadband telecommunications and video services for all of its residents and businesses. Mr. McFadden was one of the participants in Metropolitan Communications Consortium Partners, a group formed for this project that ultimately included AT&T Network Systems and Fluor-Daniel, and was the leading contender after several proposal/qualification rounds. He was one of the initial members involved in determining the financial feasibility and planning the overall network consisting of 12 packet-switched network nodes, linked by fiber optic rings. Users would be connected via fiber-to-the-hub in neighborhoods and either by coax cable or fiber to the home or business. The city dropped this project after intense lobbying by incumbent telecommunications providers.

Rural Wireless Broadband Internet Provider in Southeastern Wisconsin – Based on the very successful demonstration of an enhanced fourth generation wireless internet pilot project in Washington County, Wisconsin, HierComm, Inc. decided to prove the capability of its technology by building a wireless internet service provider to serve that rural area. Mr. McFadden has been directly involved in determining the financial viability of the service, organizing the business entity, and managing ancillary services. Current connection speeds range from a minimum of 3 Mbps to 9 Mbps for both downloads and uploads - superior to any alternative service - at a very competitive prices. This network affords the opportunity to prove out new technologies and network optimization methods that will increase the performance of larger networks.

Broadband Public Safety Communications Demonstration Project – A major result of the regional broadband telecommunications plan in SE Wisconsin was the initiation of a broadband 4.9 GHz public safety communications system development and demonstration program funded by Kenosha County, WI. This project was successfully completed in April 2009 with a series of field tests and demonstrations. Plans now call for full-scale deployment in Kenosha and for introduction to cities and counties throughout the U.S. Mr. McFadden was involved in estimating project costs and in assessing the economic viability of an optional hybrid 4.9/5.8 GHz public safety/commercial network.

Ken Wall

BROADBAND MAPPING LEAD

Summary of Qualifications

- Twenty-three years of experience in GIS data analysis, modeling, and applications in natural resource management, rural and urban planning, and decision support systems.
- Designed and managed GIS projects for more than 200 clients from federal, state, local, and tribal governments, private corporations, and non-governmental organizations.
- Provided consulting and support services for more than 150 additional projects, including live collaborative GIS support for in-person and web enabled workshops.
- Extensive expertise with geodatabase design; GIS decision support systems; and the full suite of ESRI GIS programs and modules including ArcMap, ArcServer, Business Analyst, Spatial Analyst, and 3D Analyst. Experience with many extensions to ESRI, including CommunityViz decision support and Scenario 3D. Experience with integrating decision support tools with GIS.

Education

- BS, Forestry, 1976, University of Montana
- Graduate Work, 1990-93, 45 credits – resource conservation, University of Montana

Select Project Experience

Montana Critical Infrastructure Mapping and Geodatabase Design, MT – Project Manager for a series of competitive contracts between 2004 and 2006 with the Montana Department of Administration to map critical structures throughout the state of Montana and design a multi-user geodatabase model for critical infrastructure. Over 1,200 critical structures throughout the state of Montana were mapped and attributed.

Montana Forest Stewardship Program – Project Manager for a statewide assessment of forest stewardship potential for non-industrial forest managers and landowners. A model was developed with statewide coverage for vegetation, wildlife, population characteristics, insect and disease, economic variables, and other factors. A regional assessment was also developed, supplemented by a weighted average model, to support a large regional ecosystem analysis. This project was an innovative approach to the Healthy Forests Restoration Act of 2003, or Healthy Forests Initiative.

DNRC State Trust Lands Division GIS Services and Support for Programmatic EIS for Special Uses, MT – Senior GIS analyst, coordinating with forest economists and economic advisors from the Montana Bureau of Business and Economic Analysis in assisting the DNRC in the geospatial modeling and economic forecasting of the potential value of school trust lands in Montana. Geodata provided support with ESRI Business Analyst for demographic and economic analyses and residential growth modeling at a fine-filter geographic scale on a statewide basis for all state trust lands in Montana.

GIS Statewide Ownership Data Acquisition – Project Manager creating a statewide ownership GIS map for all state trust lands, based on the master list provided by the DNRC lands staff. The scope of Geodata's task was to parse the legal descriptions and construct a process to update and correct the previous public land ownership layer.

Montana Rural Fire Districts Digital Data Creation and Acquisition, MT – Project Manager to digitize boundaries of local government fire departments for 24 counties in Montana. The project purpose was to overlay local government fire jurisdictions with U.S. Forest Service lands and commercially viable private forest lands and assess structural fire protection geographic coverage throughout Montana.

Rocky Mountain Elk Foundation M.A.P. Habitat™ – Senior GIS consultant for RMEF for the last 12 years, supporting national strategic planning efforts with GIS mapping, modeling, and collaborative support. Under an indefinite delivery contract with the Rocky Mountain Elk Foundation, Geodata conducted the GIS support for the M.A.P. Habitat™ North American Elk Habitat Project, an expert system wildlife habitat mapping project completed in 1999 throughout North America. Mr. Wall was Project Manager for the GIS portion of this cooperative effort, sponsored by the Rocky Mountain Elk Foundation and USDA Forest Service. Initially conducted 1998 through 2000, this project was updated in 2006.

Nebraska Statewide Biomass Energy Assessment – Senior GIS Analyst working with Camas Creek Enterprises, Inc. to conduct an assessment of biomass energy potential for the state of Nebraska. Using ESRI Business Analyst and other GIS tools, the project surveyed via mailed questionnaires, all the secondary wood processors in Nebraska. Combined with independent research from the Nebraska Forest

Service, municipal urban forestry programs, and other sources, a complete inventory was conducted of woody biomass potential supply and demand for the state.

U.S. Fish and Wildlife Service Strategic Planning Processes – Senior GIS Analyst, supported USFWS staff for two regional ecosystem plans involving extensive GIS data development and modeling for two large ecosystems in the Northern Rockies and the Great Plains, covering Montana, Wyoming, Colorado, Nebraska, Kansas, and Oklahoma. The strategic planning process for both regional ecosystems was developed at a watershed level, and mapped entire multi-state regions for listed species, migratory birds, native habitat, landscape factors, adjoining conservation and protected lands, public/private partnerships, and threats to watersheds.

Highway Wildlife Linkage Area Mapping, MT and ID – Senior GIS Analyst between 2004 and 2008 consulting with the U.S. Fish and Wildlife Service, the Idaho Transportation Department, and Idaho Fish and Game to develop highway-wildlife linkage areas in western Montana and the entire state of Idaho. Idaho recently was awarded the 2009 Exemplary Human Environment Initiatives and the Exemplary Ecosystem Initiatives by the Federal Highway Administration for these efforts.

Sonoran Institute Growth Model for the Western U.S. – Project Manager, developing a growth planning and allocation model joined with a geospatial statistical model using random choice logic. This model combined macro- and micro-economic and demographic analyses with fine-scale distance to amenities and services measures to develop an adaptable model and GIS methodology for predicting and allocating residential growth in urban interface communities throughout the Western U.S.

Army Corps of Engineers Term Contract – As Senior GIS Analyst, completed a 5-year indefinite-term, indefinite-quantity term contract with the Army Corps of Engineers in 2005. This contract was to assist four surveying firms in GIS mapping of U.S. Air Force bases and other significant ACE project areas in the Pacific Northwest.

Montana Attorney Generals Office – As Senior GIS Analyst, completed a 1-year term contract with the Montana Attorney General's office in 2008. Assisted in court proceedings and expert testimony and exhibits relating to a major state court case involving state assessments and fees resulting from the use of state lands by several private sector corporations.

American Bird Conservancy Species Habitat Models for Western U.S. – Project Manager for regional bird habitat assessment spanning bird conservation regions 9 and 10 covering an area from the U.S.-Canada border to Mexico in nine western states. The project included spatial modeling of habitat for 21 bird species, integrating the northwest and southwest regional GAP (REGAP) analyses, conversion and analysis of regional land cover and wetland mapping, and integration of National Resource Conservation Service (NRCS) private conservation lands such as EQIP, WHIP, and CRP.

Heart of the Rockies Initiative Land Trust Working Group – As Project Manager, coordinated GIS data development, modeling, and collaborative mapping workshops since 2002 for a consortium of 24 local, state, and national land trusts. Their common objective was to identify high-value private land for conservation, and to establish shared 10-year conservation goals for the areas surrounding and linking three world-class ecosystems in the northern Rockies of Alberta, British Columbia, Idaho, Montana, and Wyoming.

Mike Sweet

LEAD GIS DATABASE DESIGNER

Summary of Qualifications

- Geodatabase design lead for statewide critical infrastructure, and contributor to geodatabase design on statewide transportation and addressing framework data projects in Montana.
- Principle GIS Analyst for the College of Forestry and Conservation supporting data analysis and geographic data management leadership on local, regional, and international projects. This encompasses multi geodatabase designs and content maintenance architectures.
- Principle architect of geographic information server applications for College of Forestry and Conservation research and development activities. This includes an authoritative national Wilderness Areas map service, as well as services to deliver raw raster and vector data feeds to client-side and serve-side geoprocessing workflows.
- Geospatial Software Coordinator, The University of Montana and affiliated campuses. Committee member on Certificate in GIS Sciences and Technologies, The University of Montana. Recently held professional positions on Montana Association of Geographic Information Professionals board, co-chair of 2008 Intermountain GIS Conference, State of Montana Land Information Advisory Council, State of Montana Land Information Advisory Council Framework Subcommittee, Land Information Plan Subcommittee, and Grants Subcommittee member.

Education

- MS, Computer Science, University of Montana
- BA, Sociology, University of Montana
- BS, Resource Conservation, University of Montana

Select Project Experience

Montana Spatial Data Infrastructure (MSDI) Framework Data – Principle participant (1998 through 2006) in the development and advancement of multi-user geodatabase models for the Montana Transportation Framework and the Montana Addressing Framework. Currently engaged with team members on the development and advancement of a statewide multi-user geodatabase model for Montana Geographic Names utilizing geosynchronization services to support a federated data maintenance approach.

Montana Critical Infrastructure Geodatabase Design – GIS Analyst and principle geodatabase designer for a multi-user geodatabase model for critical infrastructure for the State of Montana that integrated structures with Disaster and Emergency Services requirements for deriving and identifying critical infrastructure, and integrating those elements with the Montana Address Data Model and federal structure classifications (U.S. Department of Homeland Security).