Ruckelshaus Institute of Environment and Natural Resources Research Project – Final Technical Report

Impacts of Wyoming Water Development Commission Regional Water System Projects on Land Use: An Analysis of Two Case Studies

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List of Commonly Used Acronyms (in alphabetical order)

Basin Advisory Group (BAG)

General Accounting Procedures (GAP)

Geographic Information System (GIS)

Northwest Water Rural District (NWRD)

Natural Resource Conservation Service (NRCS)

Sheridan Area Water System (SAWS)

Sheridan Area Water Supply Joint Powers Board (SAWSJPB)

Shoshone Municipal Pipeline (SMP)

State Engineer's Office (SEO)

Vision 2020: Sheridan County Growth Management Plan (Vision 2020)

Wyoming Department of Environmental Quality (DEQ)

Wyoming Geographic Information Science Center (WyGISC)

Wyoming Water Development Commission (WWDC)

Executive Summary

Water provides essential services to people and natural landscapes. Uses of water are numerous – from drinking and cleaning to irrigating crops, facilitating industrial processes and supporting ecosystems. There is no question about the need to continue to sustain Wyoming's water resources for the long-term. Wyoming is the fifth driest state in the United States, and the state must continue to prepare for the future by evaluating potential demand.

Throughout Wyoming's history numerous state and federal efforts have been initiated to develop and manage water resources and in turn, enhance water supply use in the state. The State of Wyoming and the federal government have invested millions of dollars in water system infrastructure and in repairing and restoring water systems throughout the state to meet a growing water demand.

With water development, though, comes more intensive land use. Water and land are inseparable and the need to consider the availability of a water supply in land use decisions seems intuitive. However, in Wyoming, land use planning falls under the authority of local governments but the local authority for water development is not clearly defined. Local government land use planning includes water development as it relates to "desired land use," but laws or regulations guiding land-water development projects are lacking. As a result, water development and land use planning operate independently of each other. To achieve a linkage, communities should be engaged in decisions about managing growth in order to sustain open space, wildlife corridors, and sufficient water flows for recreation and other values. Additionally, policy options should be considered at the local and state level.

Water development and planning in the state is largely the role of the Wyoming Water Development Commission (WWDC), with regulation and administrative duties conducted by the State Engineer's Office. The Wyoming County Commissioners Association, representing all 23 counties in the state, also plays a significant role and exists to strengthen Wyoming's counties through a program of networking, education and unified action.

The purpose of the research project summarized in this report was to evaluate the relationship between regional water projects funded by the WWDC, and community and rural land development for two specific case studies, including the associated positive and negative impacts of water projects on development. The project team assessed the positive and negative impacts of the case studies on natural and fiscal resources and brought to light the public perspective related to the origin, installation and operation of each case study pipeline and how water is being used. It was the authors' intent that the outcomes of this report would provide some insight for land and water planners when strategizing for managing and funding future water development, particularly as it relates to preserving Wyoming's prime agriculture lands, wildlife habitats and open space.

The information presented in this report is intended to provide data to help inform decision makers about the impacts of different population growth patterns on future water demand, supply and quality. Finding sufficient water to meet the increasing demands of urban and rural areas, while also providing for agricultural, commercial, industrial, recreational and environmental uses, is one of the state's most challenging land use issues.

The central message from this report is the need to better link local and state water planning efforts, and to identify mechanisms to chart a new course toward sustainable land and water development. The economic benefits of better coordination between water development and land use planning should also be considered.

- Cross-jurisdictional collaboration is a necessary principle for successful project planning, development, implementation and operation.

- Public participation should be increased to assess the long-term trade-offs of planning, resource management, fiscal impacts, and infrastructure capacity with public value choices.

- The state Legislature should consider providing funding to reconstitute the State Land Use Commission and the Office of Land Use Administration so that these entities can carry out the provisions in Wyoming statute for a statewide system of land use (Land Use Planning Act, 1975). While current enforcement of land use plans are carried out by local entities through their powers granted by the state Legislature, reconstituting the Commission could prove to be an effective means for enhanced coordination between local and state planning entities.

Today, land development continues to drive water development, rather than water availability guiding land development. As many regional experts have said, "the New West is, build it and the water will come; grow it and more water will come." The authors of this report hope this study has validated the need for state and local governments to collaborate and build consensus while working to promote sound land and water resource development and use in Wyoming.

Chapter I Introduction

1.1 RESEARCH CONTEXT - ISSUES AND NEEDS

Water Development in Wyoming – In 1975, the Wyoming State Legislature passed W.S. 41-2-112(a), establishing the Wyoming Water Development Program. The goal of the program is to promote the optimal development of the state's human, industrial, mineral, agricultural, water and recreational resources. In 1979, the Wyoming Water Development Commission (WWDC) was established to implement the Wyoming Water Development Program and conduct water and related resource planning http://wwdc.state.wy.us/about/about.html.

The Wyoming Water Development Program receives funding support from severance tax distributions to fund three state water development accounts. From these accounts the WWDC funds projects in three major categories: new development, rehabilitation, and dam and reservoir projects. WWDC-funded projects may serve one or more of a wide range of functions, including agriculture, municipal, industrial, rural-domestic, recreation, environmental, flood control, erosion control, and hydropower (WWDC, 2006).

This report focuses on the new development category of projects funded by the WWDC. Development of unused and/or unappropriated supplies of water is carried out primarily through the funding of storage projects and new supply projects or new supply systems. The WWDC classifies such projects as "new development" (WWDC, 2006). Applications for "new development" projects can sometimes stem from increased water demand associated with city and county population growth. New supply systems, major water transmission facilities delivering water to distribution systems or water treatment facilities serving regional areas have become a widely used solution to address multi-purpose projects, often supporting both municipal and rural domestic demands.

Increasing Impacts of Population Growth and Land Development – The Rocky Mountain West continues to be one of the fastest growing regions of the United States (Riebsame, 1996; Bowers, 1999). Even though the State of Wyoming has not experienced the same rates of population growth as surrounding states in the region, pressures for growth are increasing (Lieske and Taylor, 2007). Such growth has and will continue to impact both land and water resource availability and quality (Platt, 2004; Travis, 2007).

The relationships between population and economic growth, land use, and water resource development are not widely understood.

> *Historically, land use and water planning have occurred separately from one another in most parts of the United States. Water is allocated by state agencies, and land use planning is done by local officials. Water resource managers juggle many competing demands within a watershed, and they tend to focus on encouraging economic development. In turn, local land use authorities have safely assumed that water would be available to satisfy continued growth (Public Policy Research Institute, 2007, p.5).*

Today, Wyoming's local communities and state government are grappling with the impacts of both urban and rural population growth and associated land development activities. One such impact is an increase in demand for municipal and rural residential water supplies.

Addressing Water Development-Land Use Relationships – As noted by Sarah Bates, formerly with the Public Policy Research Institute at the University of Montana (2007), water development is typically subordinated

both planned and unplanned land development. Development of new water supplies usually occurs in to response to anticipated increases in water demand associated with expected population growth. However, water development may, in turn lead to additional, often unplanned land development activities.

The WWDC would like to gain a better understanding of the possible unintended consequences of current and future WWDC-funded regional water supply systems. In particular, such systems could result in unplanned rural residential development stimulated by increased water availability. These land subdivisions are characteristic of exurban "sprawl" – unplanned development spreading out across the rural landscape from urban areas and consisting of a combination of distinct, "exurban," low-density residential and commercial land uses (Daniels, 1999; Duany et al., 2001). Sprawl-type land use patterns may in turn lead to the loss of agriculturally productive lands, damage to wildlife habitat, and fiscal impacts to the county tax base as well as a reduction in the life span of regional water projects. The need exists to better understand the relationship between state-funded regional water projects and rural residential development to promote better coordination of land and water resource development and use in Wyoming.

1.2 PROJECT OVERVIEW

Purpose and Objectives – The purpose of this research project was to evaluate the relationship between state-funded regional water projects and community and rural land development for two case studies, including associated positive and negative impacts of water projects on development. The objectives of the research were as follows:

- Assess the positive and negative impacts of the case study water projects on natural and fiscal resources, and;

- Conduct interviews and compile the responses of local elected officials and other stakeholders about the origin, installation, and operation of each case study pipeline and their opinions of the project in general.

In particular this project intended to explore the link between the environmental and fiscal impacts of dispersed rural residential development and water supply development. The impacts of unplanned rural residential growth have been well documented in previous work in regards to Wyoming and across the nation.

1.3 RESEARCH DESIGN

The project addressed four major tasks. (Due to the cross-task nature of the case study-based methodology employed, the organization of project tasks as presented here differs slightly from the task descriptions in the project's original *Scope of Work*.) The format of this report follows the tasks and provides a summary and recommendation section in the report's conclusion. We also used a case study approach to examine the two project areas.

Task One (Chapter 2) – Task One involved a survey of statutory and regulatory issues germane to water development and local land planning in Wyoming, including a summarization of mandates and operating guidelines for state-funded water development projects, and a review of enabling legislation and guidelines for city and county land use planning.

Task Two (Chapters 3-4) – Task Two addressed fiscal impacts associated with case study analyses of two existing regional water supply projects funded by the WWDC. The water projects selected as case studies were the Sheridan Area Water System (SAWS) in Sheridan County, and the Shoshone Municipal Pipeline (SMP) in Park and Big Horn counties. Case study selection was based on a number of factors, including the availability of geospatial and fiscal impact data, local interest and support for the research by local collaborators, and the appropriateness of selected projects to provide insight applicable to other locations across the state.

Fiscal impact modeling activities addressed whether the development and operation of regional water supply projects and their associated housing developments increase the cost of county government service provision.

Task Three (Chapters 4-5) – Task Three addressed natural resource management issues associated with the two case study analyses. Analysis of natural resource management issues centered on potential trade-offs between local resource impacts and potential alternate routes for the water pipelines. Additional concerns around the potential disconnect between land use and water planning were addressed through phone interviews with local officials, elected officials, members of joint powers boards, and citizens intimately involved with each of the two case studies.

Task Four (Chapters 5-6) – Task Four involved a synthesis of case study results and an interpretation of their applicability in assessing similar projects statewide. Finally, the conclusions of the data and research were summarized and conclusions were drawn about the relationship between land use and water planning.

1.4 CASE STUDY SELECTION

This effort reviewed two previously funded WWDC projects – the Sheridan Area Water System (SAWS), located in Sheridan County; and the Shoshone Municipal Pipeline (SMP), which spans Park and Big Horn counties. These two projects are representative of the state's major water supply projects.

The two case studies were selected for various reasons. Both are mature projects that have been operational long enough to determine the positive and negative impacts on land uses and local communities. The projects were also selected for their differences. SAWS is contained within one county and involved one municipality, whereas SMP spans two counties and multiple municipalities. This allowed for some comparisons of multi-jurisdictional coordination.

Chapter II Legal Framework for Land and Water Resource Development in Wyoming

This chapter presents the current regulatory framework of federal and the State of Wyoming water development authority, land use, and planning authority.

2.1 WYOMING WATER AUTHORITY

Water in Wyoming is Owned by the State – Wyoming's constitution provides that all waters within the boundaries of the state are the property of the state. Use of that water is allocated through a permit system, based on priority, and requires beneficial use of the water (Wyoming Constitution, Article VIII).

Water Management Agencies – Three key agencies are engaged in the management and regulation of water: the State Engineer's Office (SEO), the Wyoming Water Development Commission (WWDC), and the Wyoming Department of Environmental Quality (DEQ).

State Engineer's Office: The SEO is responsible for the regulation and administration of water resources in Wyoming. It is the responsibility of the Surface Water and Engineering Division of the SEO to review and allocate surface water through permit applications that demonstrate the water will be put to beneficial use. Water rights are adjudicated by the Board of Control, upon application and approval by the SEO. The Board of Control is comprised of four superintendents and the State Engineer, and is responsible for overseeing any changes in the water right such as a change in the point of diversion, change in use, change in the area of use, or abandonment of a water right (Wyoming State Engineer's Office, 2008).

The State Engineer can deny an application when "denial is demanded by the public interests" (Wyoming Constitution, Article VIII, §3, 2005). Circumstances that can warrant denial of an application as demanded by the public interests are: (1) "where there is no unappropriated water in the proposed source of supply;" (2) "where the proposed use conflicts with existing rights;" or (3) where the permit would "prove detrimental to the public interest" (Wyo Statute §41-4-503, 2005). The State Engineer's duty to reject applications for the above conditions cannot be extended to allow the State Engineer to impose conditions on permits (Big Horn Power Company vs State, 148P 1110 (Wyo. 1915)).

Department of Environmental Quality: The DEQ is charged with protecting surface and groundwater quality in the state. DEQ's programs include: the groundwater program, watershed program, wastewater program, underground injection control program, and the point source discharge program. Some of these programs may require permits or review of water supply projects that involve construction of a water treatment system, include a point-source discharge, or impact wetlands (Wyoming DEQ, 2008). DEQ may require additional procedures and requirements for a water project to address water quality, if there are issues related to surface or groundwater contamination.

Municipalities, water and sewer districts and counties have the authority (with the approval of the director of DEQ) to permit the construction, installation, modification or operation of any public water supply and sewerage system, subdivision water supply, treatment works, disposal system, or other facility capable of causing or contributing to pollution (Wyoming Statute § 35-11-304).

Wyoming Water Development Commission: The WWDC engages in development projects and water resource planning. This includes providing funding assistance to public entities for water supply projects, engaging in

state water planning, performing technical services for public entities and other state agencies, and serving as the lead state agency in managing Wyoming's water investment portfolio (Wyoming State Government Annual Report, 2005).

The WWDC has a New Development Program for unused and/or unappropriated water. New development projects can be divided into three categories: (1) projects developing water for a present or defined need; (2) projects developing water for present needs and generating a surplus for future needs; and (3) projects developing water for which there is not a present need sufficient to warrant immediate expenditure of design and construction funds. The WWDC relies on a preferential/eligibility list to prioritize projects, which includes multipurpose projects, storage projects, new supply projects, new supply systems, hydropower projects, purchase of existing storage, watershed improvement projects, recreation, and the drinking water state revolving fund (WWDC, 2004).

If all of the criteria are met and the WWDC chooses to recommend the project for financing, the project is assigned a study level (I, II, or III). Level I is a reconnaissance study, which is the preliminary analyses and comparison of development alternatives. Level II is a feasibility study which consists of two phases: (1) project feasibility; and (2) refinement of the project for a Level III funding request. Level III is project development and includes the final design, permitting, land acquisition, and construction of the project. Level III projects represent those projects, which the sponsor and state are committed to completing. The final level requires that construction and operation plans be managed by the sponsor and proceed under the guidance of the WWDC as approved by the legislature (WWDC, 2004).

The Rehabilitation Program provides funding assistance for the improvement of water projects completed and in use for at least 15 years. The Rehabilitation Program also follows the New Development Program's three levels of study and implementation system. Rehabilitation programs usually begin at the Level II status because of the existence of a current project. The Rehabilitation Program allows improvements of existing systems, continuing safety of projects, a long-term decrease in overall costs, and a more efficient utilization of the existing water supply (WWDC, 2004).

WWDC also has post development authority and responsibilities. These include: (1) responsibility for the operation and maintenance of state owned facilities constructed under the direction and control of the WWDC; (2) management of contracts and agreements entered into by the WWDC; (3) the ability to fix charges, rates, rents, fees and tolls for any project constructed; and (4) the ability to contract with, contribute to or receive contributions for the operation, management and maintenance of any project. The WWDC operating criteria specifies that if the sponsor of a water project does not use all of the water from the project, then the state and sponsor must share in the revenue from the excess water (WWDC, 2004).

WWDC, in cooperation with the SEO, also develops the water resource plans, including basin-wide plans for each of the major drainage basins that identify and prioritize water development opportunities, as well as documenting the state's plan to utilize its compact and decree allocations. Each of the seven river basins has a corresponding Basin Advisory Group (BAG) (WWDC, 2004; Jacob, et. al., 2001).

Local Authority in Water Development – Local authority for water development is not clearly defined. Despite the favorable constitutional provisions, the Wyoming Supreme Court has limited municipal authority by stating municipalities can exercise *only* those powers conferred expressly or impliedly from the state Legislature (Coulter v City of Rawlins, Wyo 1983). Municipalities and counties must rely on individual grants of water authority contained within other general authority granting provisions, and authority granted generally to municipal or county operations (Smith, 1996).

One key authority municipalities have is to establish water rates. Municipalities establish rates when supplying water within its corporate limits and when a municipality that owns its own water system enters into agreements with landowners residing outside city limits who would like the municipality's water system extended to their property. Rates imposed must be reasonable, reflecting a fair return on the investment and taking into consideration the cost of construction and operation of the supply system (Wyoming Statute § 15-7-601, 2007; Laramie Citizens for Good Government v. City of Laramie, 1980). A municipality also has the power to purchase water from outside its corporate limits (Wyoming Statute § 15-7-605, 2007).

2.2 LAND USE AUTHORITY

This section focuses on the authority of state and local entities to control land use.

State Authority in Land Use –Wyoming's ability to manage and regulate land use stems from its general police power, conferred through Article II of the Wyoming Constitution. This power includes the government's ability to regulate private activities and property usage without compensation as a means of promoting and protecting public health, safety, morals and general welfare (Cheyenne Airport Board v. Rogers, 1985).

In 1975, the Wyoming State Legislature enacted the Land Use Planning Act (Land Use Act), which established a statewide system of land use governed by the State Land Use Commission (Wanker et. al., 1995). This commission was designed to consist of nine members appointed by the governor. The original commission identified three items as essential to the local planning process: (1) citizen involvement; (2) a methodology for evaluating land use decisions in regard to their effects on environmental quality; and (3) an analysis of the conditions and trends in the area's economy (Wyoming State Land Use Commission, 1976).

The statewide goals, policies and guidelines include 14 topic areas related to the three items listed above with each topic having specific goals, policies, and suggested guidelines for local governments. In general, the 14 topic areas focus on recommendations for the local planning process and for the preparation and evaluation of local land use plans, the identification of existing conditions and basis for evaluating land use decisions, and provisions for evaluating the social, economic and environmental consequences of land use decisions (Wyoming State Land Use Commission, 1976).

The State Land Use Commission also developed the State Land Use Plan. The State Land Use Plan is Wyoming's land use policy. This plan is general in nature, leaving specific land use decisions, goals, and policies under the jurisdiction of local governments. It also has specific goals, policies and guidelines for water. The goal for water is to conserve water and to relate water resources and developments to desired land use. The State Land Use Plan's goal for water illustrates an overlap between water development and land use by noting that water development should be related to desired land use. Important goals such as this are even timelier now and support the reconstitution of the State Land Use Plan, even though the plan is limited because it merely contains goals, policies, and guidelines rather than laws, rules, or regulations (Wyoming Statute § 9-8-301, 2007).

While provisions remain in the Wyoming statutes for the State Land Use Commission, it no longer exists in practice. After completion of the State Land Use Plan in the late 1970s, no further financial support was provided for the State Land Use Commission or the Office of Land Use Administration. The rationale given for the expiration of the two entities was that the enforcement of land use plans was to be done by the local entities through their powers granted by the state Legislature (Opinion from the Wyoming Attorney General, Wyo 16, 1984).

Local Authority in Land Use – Local authorities in land use include county commissioners, planning and zoning commissions (county and municipality) and municipalities (incorporated and unincorporated). Wyoming law requires that local governments develop a land use plan and counties develop a countywide land use plan. Any unincorporated city or town may develop a land use plan, but is not obligated to do so (Wyoming Statute § 9-8-301, et seq., 2007).

The main delegation of land use authority is to the county commissioners, with the county planning commission and the planning and zoning commission assisting in the process. County commissioners have the power to regulate and restrict the location and use of buildings and structures and the use, condition of use, or occupancy of lands for residence, recreation, agriculture, industry, commerce, public use, and other purposes in the unincorporated area of the county in accordance with the restrictions of the police power (Wyoming Statute § 18-5-202 et seq., 2007).

County commissioners also have the authority to regulate subdivisions in their county. There are, however, a few exemptions to subdivision control by the Board of County Commissioners. Until recently, counties were not allowed to regulate the division of unincorporated lands of 35 acres or larger. In the 2008 legislative session, the Wyoming Legislature passed a law allowing counties, by resolution, to regulate subdivisions between 35 and 140 acres in addition to existing subdivision regulations (Wyoming Statute § 18-5-316/7, et seq., 2008). However, the law still contains an exemption that allows landowners to divide up to 10 parcels of 35 or more acres without subdivision regulation (Wyoming Statute § 18-5-316/7, et seq., 2008).

While planning encompasses an overall concept for the future physical development of the total area and services of the community, zoning is the legal control a community uses to shape the physical configuration of development. In Wyoming, local governments have authority to engage in zoning to conserve and promote the public health, safety and welfare of its citizens. County planning commissions recommend boundaries and regulations and then the Board of County Commissioners acts on these recommendations and determines how regulations, restrictions and boundaries of the districts are established and enforced (Wyoming Statute §§ 18-5-101 to –315; 15-1-601 to –611, 2007). The planning and zoning commission (for the county), created by the Board of County Commissioners, assists with the development of a comprehensive plan, which includes zoning for unincorporated areas. All 23 Wyoming counties have county planning and zoning commissions (Wyoming Statute § 18-5-102 to -105, 2007).

Municipalities also have authority in planning and zoning. Each city and town may have a planning commission, the terms of which are determined by the appropriate governing body for the city or town. The role of a planning commission is to make reports and recommendations to public officials/agencies, organizations, and citizens relating to the master plan, including development of the municipality, and to recommend public improvements and their financing to executive or legislative officials. A planning commission is primarily tasked with the preparation and development of the municipality's master plan, including recommendations for development, location of public buildings and public utilities, zoning plans, and the location of community centers and neighborhood units (Wyoming Statute § 15-1-101 to –1103, 2007).

A municipality may regulate water when in accordance with the municipality's comprehensive plan. In addition to the specific powers to zone and plan, cities and towns also possess other powers relevant to land use. A city or town has the power to pursue annexation provided that specified statutory conditions are fulfilled. Cities and towns can also make local and public improvements, such as to streets and sewage. Cities and towns also have broad authority regarding urban renewal (Wyoming Statute § 15-1-507, 2007).

Limitations on Land Use Authority – While local governments have the ability to regulate private activities and property use to promote and protect public health, safety, and general welfare, there are limits on the

authority that protects property owners from unreasonable government control. Land use regulations must advance a legitimate governmental purpose, and landowners must be given reasonable notice and a meaningful opportunity to be heard when a government action may substantially affect their property interest. In addition, private property cannot be taken for public use without just compensation (Cheyenne Airport Board v. Rogers, 1985). That said, regulations that restrict land use rarely constitute a "taking" of property. For example, it is common in Wyoming to restrict land use to agricultural purposes. Such restrictions are allowable when there is still value in using the land for agricultural purposes (Mandelker, 2003).

2.3 WYOMING JOINT POWERS BOARDS

The Wyoming Joint Powers Act (WJPA) grants authority for interagency cooperation and assistance and allows counties and municipalities to exercise powers jointly, which previously were held separately (Wyoming Statute § 16-1-102, 2007). Before a joint powers board can exercise these powers, the agencies must specify the transfer of authority to the joint powers board. Specifically with regard to water, the WJPA allows two or more agencies to jointly plan, own, lease, finance, and operate water facilities such as surface water drainage, sewerage, water and soil conservation and solid waste facilities (Wiener, 1979).

Wyoming law limits the water rates charged by a joint powers board. Any joint powers board which owns, constructs, operates or maintains a municipal or rural domestic water supply system funded in whole or in part by state grants or loans is limited in what it can charge for water to the amount necessary to cover the actual costs of providing and delivering water. One-time "connection fees" may be also charged (Wyoming Statute § 16-1-108, 2007).

2.4 COMPLEMENTARY, OVERLAPPING AND CONFLICTING LEGAL AUTHORITIES

Authorities and powers related to the WWDC can complement, overlap, or conflict with the authorities and powers of other local and state government entities. WWDC requirements support entities that sponsor projects, local planning and zoning commissions, community planning efforts, municipalities, and others by formalizing processes to acquire input from a wide variety of stakeholders about water development projects.

WWDC regulations overlap with several local and state agencies and departments, including planning and zoning commissions, entities that oversee water storage, county comprehensive planning bodies, and land use and planning authorities.

WWDC regulations could potentially conflict with local, state, and federal entities, and particularly with state protections of agriculture, water regulatory offices such as Wyoming's State Engineer's Office, and federal agencies with land use mandates. The WWDC should take this into consideration with future modifications to agency operating criteria and related policies and procedures.

Chapter III Case Study Descriptions

This effort reviewed two previously funded WWDC projects as case studies: the Sheridan Area Water Supply (SAWS) Project and Shoshone Municipal Pipeline (SMP). The SAWS project is located in Sheridan County, Wyoming and the SMP project spans Park and Big Horn counties in northwest Wyoming.

3.1 SHERIDAN AREA WATER SUPPLY (SAWS)

The SAWS project (Figure 1), in Sheridan County, is located on the eastern slope of the Bighorn Mountains in north central Wyoming. As of July 1, 2007, Sheridan County has an estimated population of 27,988 (Wyoming Division of Economic Analysis, 2008). The largest city is Sheridan with a population estimate of 16,429, as of July 1, 2006 (Wyoming Division of Economic Analysis, 2007, 2). Other major towns in the county are Clearmont, Dayton and Ranchester with a combined estimated population of 1,594, as of July 1, 2006 (Wyoming Division of Economic Analysis 2007, 2). Major economic activities include health care and social assistance, retail trade, construction and educational services (Headwaters Economics, 2007a).

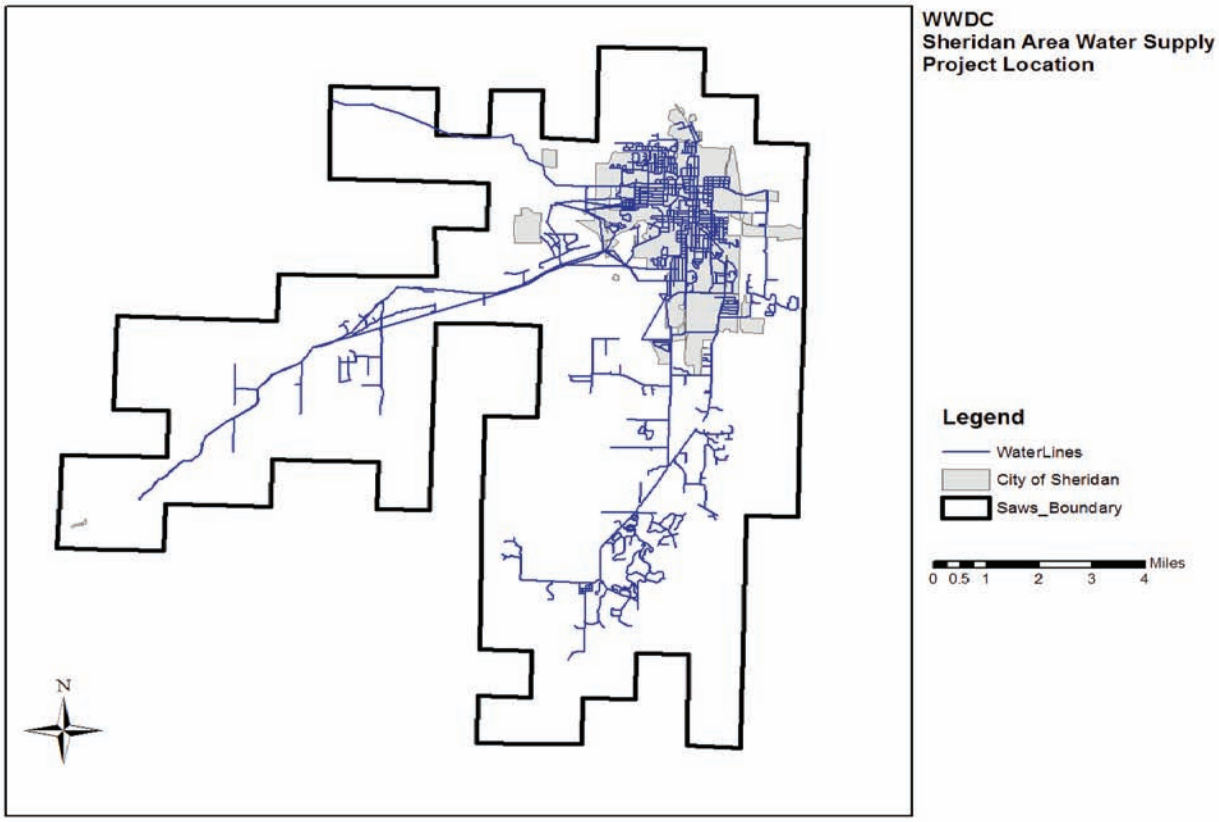
SAWS Background and Costs – The SAWS Project originated in 1985 with a WWDC study that focused on the evaluation of alternatives for resolving water supply and delivery problems in Sheridan County, particularly the Big Goose Valley, Little Goose Valley and the City of Sheridan (Howard Needles Tammen & Bergendoff, 1987). The goals were to develop a raw water supply for the City of Sheridan that would meet demands to the year 2035; provide a feasible solution to eliminate the raw water tapping problem on the existing transmission mains; and assess a centralized water system for Big Goose Valley residents.

The WWDC became involved in the Sheridan project because the Environmental Protection Agency (EPA) determined that the city was in violation of the Safe Drinking Water Act. The city delivered untreated water to approximately 102 homes on the system's raw water supply lines between the diversion works on Big Goose Creek and the treatment plant located north of Sheridan. During the analysis of this problem, other water supply problems were identified. Sheridan's Twin Lakes supply reservoirs were in need of rehabilitation, as were other components of the system. Sheridan was also seeking a supplemental source of supply to meet peak day demands and provide for future growth.

More than 1,000 homes in Little Goose Valley and over 200 homes in Big Goose were once dependent on shallow wells of poor water quality and declining quantity. Both the mediation process (involving the city, the EPA, and area representatives) and WWDC studies concluded that the best solution to the raw water delivery violations was a comprehensive area-wide water supply and treatment system. During the 1989 legislative session, at the request of the Sheridan Area Water Supply Joint Powers Board (SAWSJPB) and the recommendation of the WWDC, the legislature approved an appropriation of $15.5 million for the main frame of the project, which included the enlargement of Twin Lakes Reservoir and related major water transmission facilities. In addition, the SAWSJPB requested an appropriation of $6.75 million from the Permanent Mineral Trust Fund to serve as a 100 percent loan for the construction of a water treatment plant in Big Goose Valley, which was approved by the legislature.

Figure 1.

Sheridan Area Water System (SAWS) Project Location



During the 1990 legislative session, funding was requested and approved for the transmission pipelines necessary to serve the rural areas. In 1992, the Level II conceptual designs and cost estimates for the last project component were completed, and consisted of a raw water transmission pipeline from the intake structure on Big Goose Creek to the city's existing water treatment plant. The pipeline was needed because two existing raw water pipelines were to be abandoned due to deterioration. They were losing approximately 1 million gallons of water per day, and a third raw water pipeline had been converted to a treated water pipeline to deliver water from the new Big Goose Water Treatment Plant.

During the 1993 legislative session, funding was requested and granted for a 30-inch diameter, 11.5-mile long pipeline for the East Side Transmission Main needed to adequately serve a portion of the service area. Funding was also to be used for budget adjustments to the Twin Lakes Enlargement, which was necessary to accommodate design changes and environmental mitigation. The construction of the raw water transmission pipeline was completed by the spring of 1996. To date, there have been 20 separate construction projects completed as part of the SAWS Project. These include new pipelines, storage facilities, and a new water treatment plant http://wwdc.state.wy.us/legreport/1996proj72.html. In total, the legislature appropriated funds to the WWDC in the amount of $37.2 million for construction of SAWS (Wyoming Statute § 99-1-206, 2007). The design, permit procurement, construction and operation of the project were completed by the SAWSJPB through a contract with the WWDC (Wyoming Statute §§ 99-1-201, -203, 2007).

SAWS Water Use – During a discussion with Jay Stender, administrator for SAWS, he indicated that water started flowing in the project in 1992 (Jay Stender, personal communication, April 2008). As of December 2007, there are 1,638 taps on the SAWS pipeline. The original number of tap commitments was 1,180 in 1992 (Stender, personal communication, Dec. 17, 2007). In December of 2007, all but six taps were residential. The non-residential tap uses include industrial, schools, a golf course club house, and a trailer park.

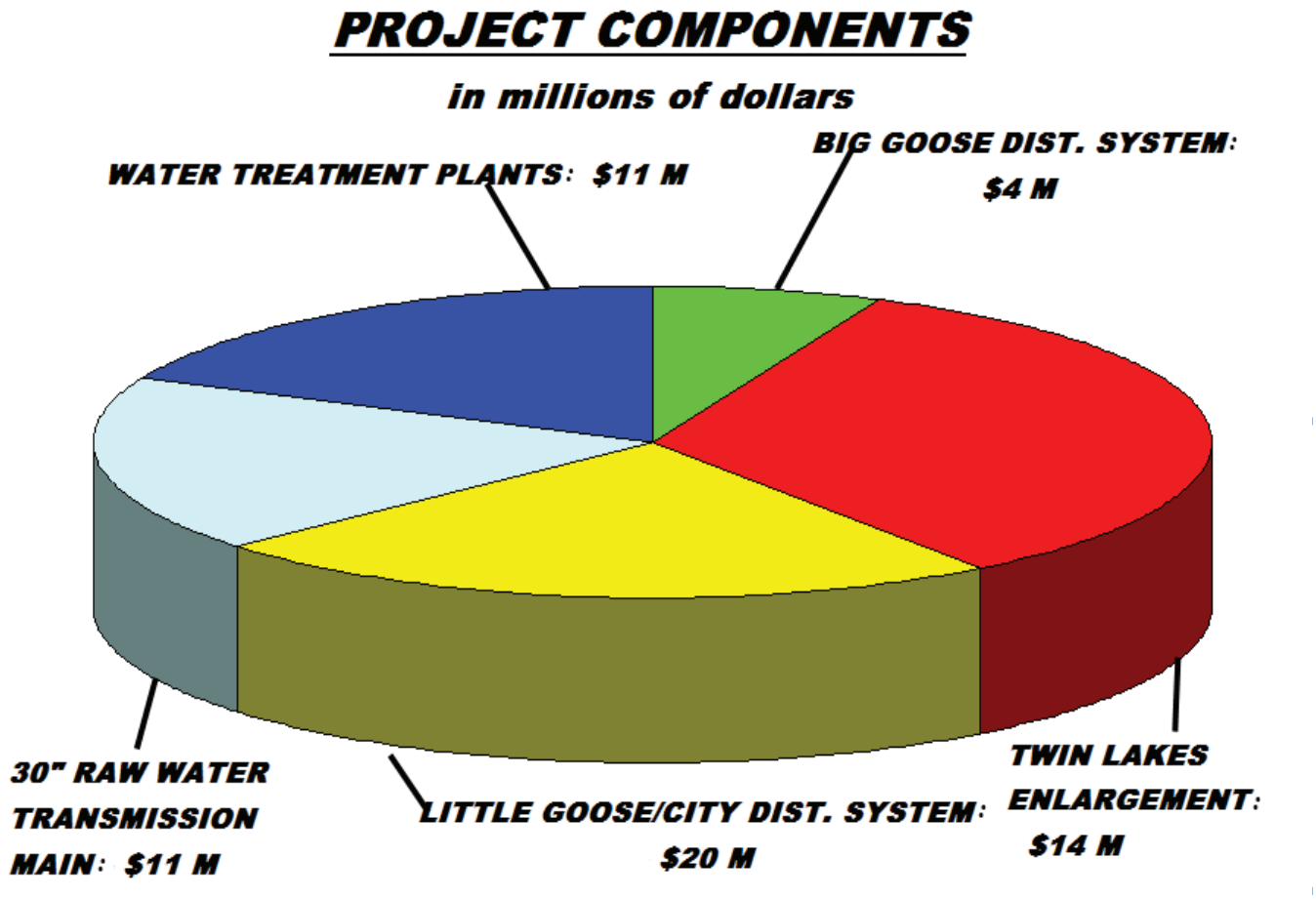
Additionally, there are cases of multiple users on a single meter, although this is discouraged by SAWS. There are also agricultural users, although only for stock tanks. These agricultural users are regarded and metered as a single residence (Stender, personal communication, Dec. 17, 2007).

In planning for SAWS, it was assumed water demand would remain constant at 260 gallons per capita per day (gpcd) but new population would use 190 gpcd. Based on these assumptions, 2007 estimates for water demand were 5,307,650 gallons per day (gpd) for the City of Sheridan; 902,880 gpd for the Little Goose Valley; and 273,600 gps for the Big Goose Valley. The projected water need for the project area by 2007 totals 6,484,130 gpd (HKM Associates, 1990), which is larger than the estimated demand.

Annual household consumption for SAWS water users (both rural and municipal) as of December 2007, based on billing data for the mean consumption per tap, is about 12,400 gallons per two month billing period. An engineering study by Entech predicted about 13,200 gallons per two month period (Stender, personal communication, Dec. 17, 2007).

As seen in the following chart (Figure 2), there are several components to the SAWS project, including water treatment plants, the distribution system along Big Goose Creek, the 30-inch raw water transmission line, the distribution system centered along Little Goose Creek and the Twin Lakes enlargement project. Understanding project costs requires looking at all components of the overall system.

Figure 2.
Cost of SAWS Project Components



Source: SAWS Office

SAWS Area Water Sources -Mapped water sources in the SAWS area (Figure 3) include wells (as permitted wells from the Wyoming State Engineers Office), streams, lakes, the SAWS pipeline, and the City of Sheridan water distribution system, and SAWS pipeline taps.

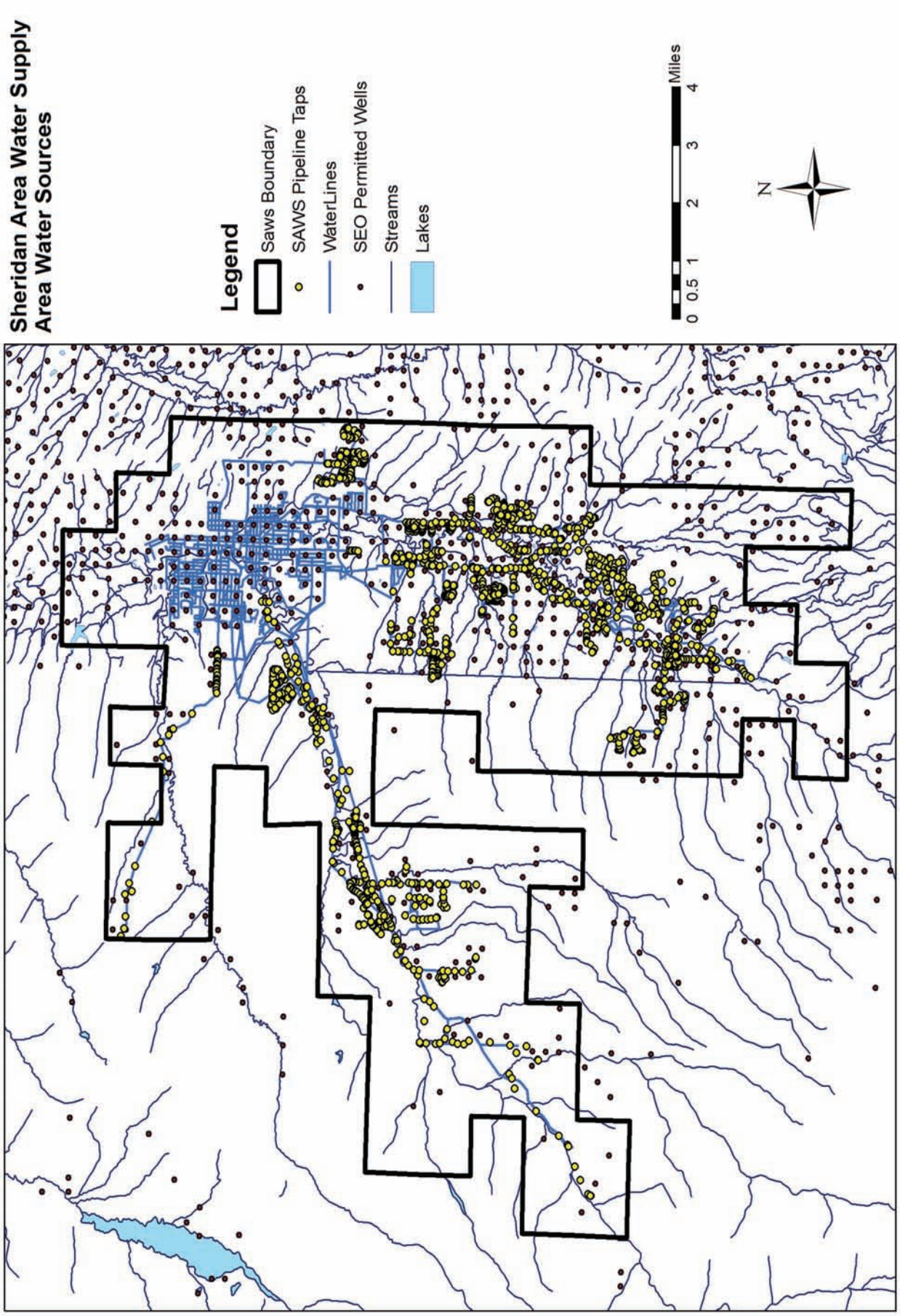
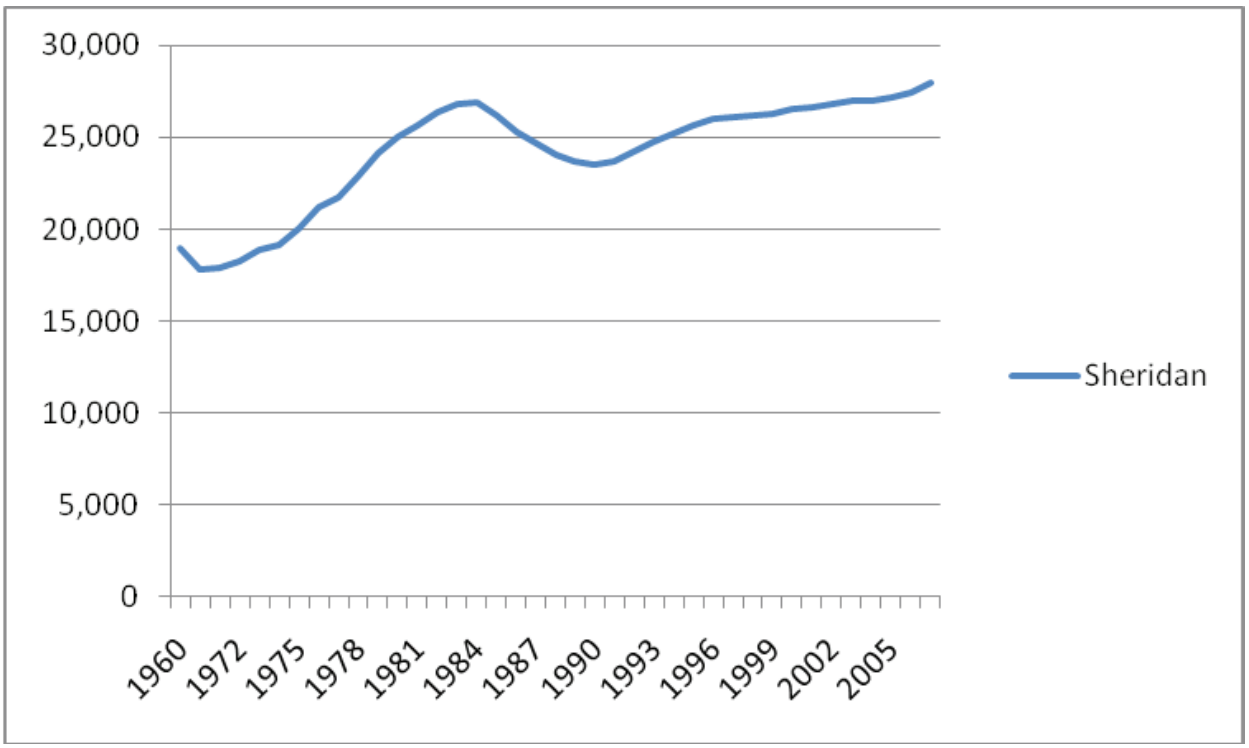


Figure 3.
SAWS Area Water Sources

SAWS Demographics – Population data (Figure 4) for Sheridan County, from the Wyoming Bureau of Economic Analysis, show both increases and declines for the population of the county for the time period 1960 – 2007.

Figure 4.
Sheridan County Population 1960 – 2007 (shows number of people vs year)

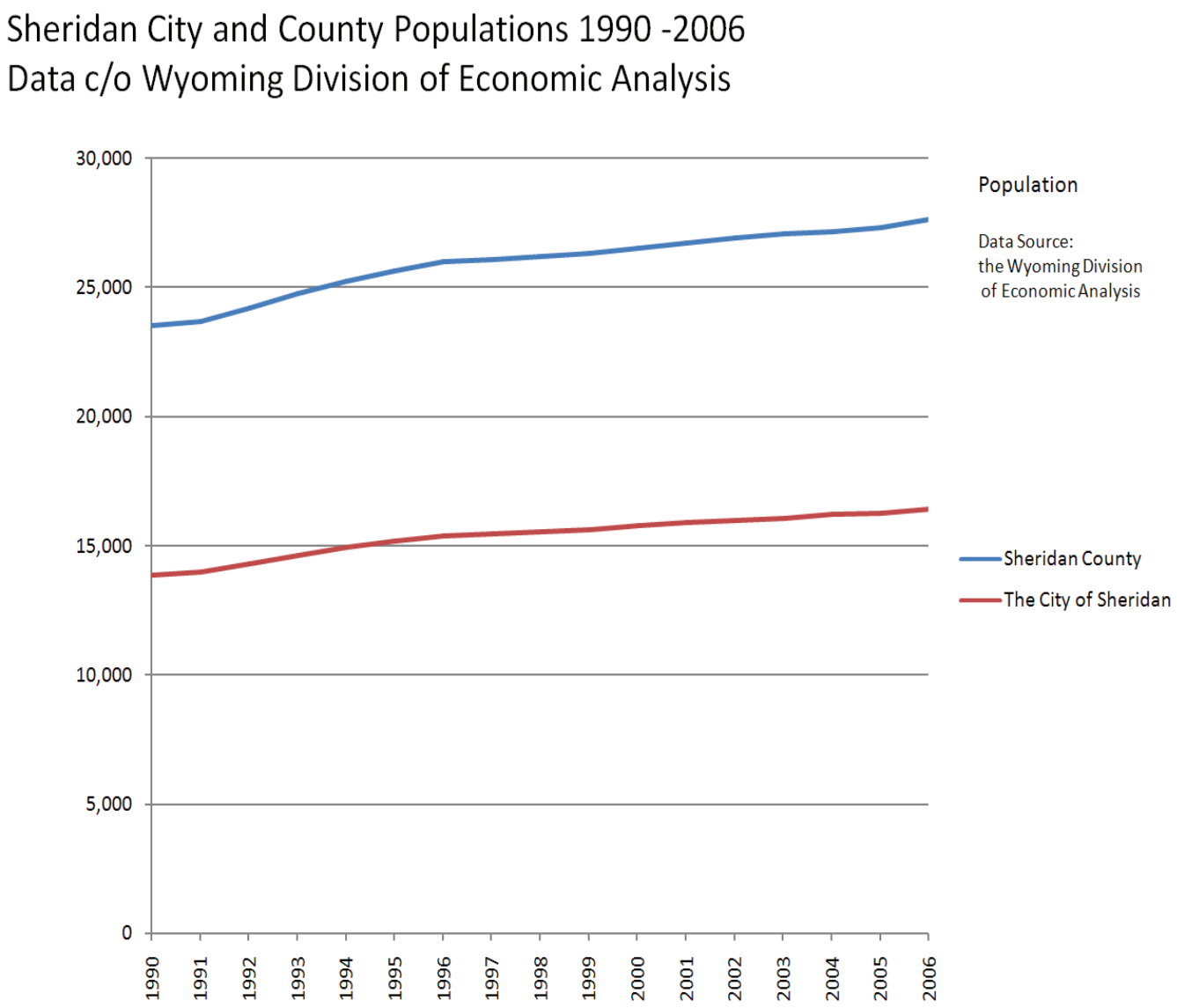


Source: Wyoming Bureau of Economic Analysis

Looking more closely at the time the SAWS pipeline was built shows steady population increases in both the City of Sheridan and Sheridan County (Figure 5). Figure 5 is based on data from the Wyoming Division of Economic Analysis on the population for Wyoming counties, cities and towns from 1990 to 2006.

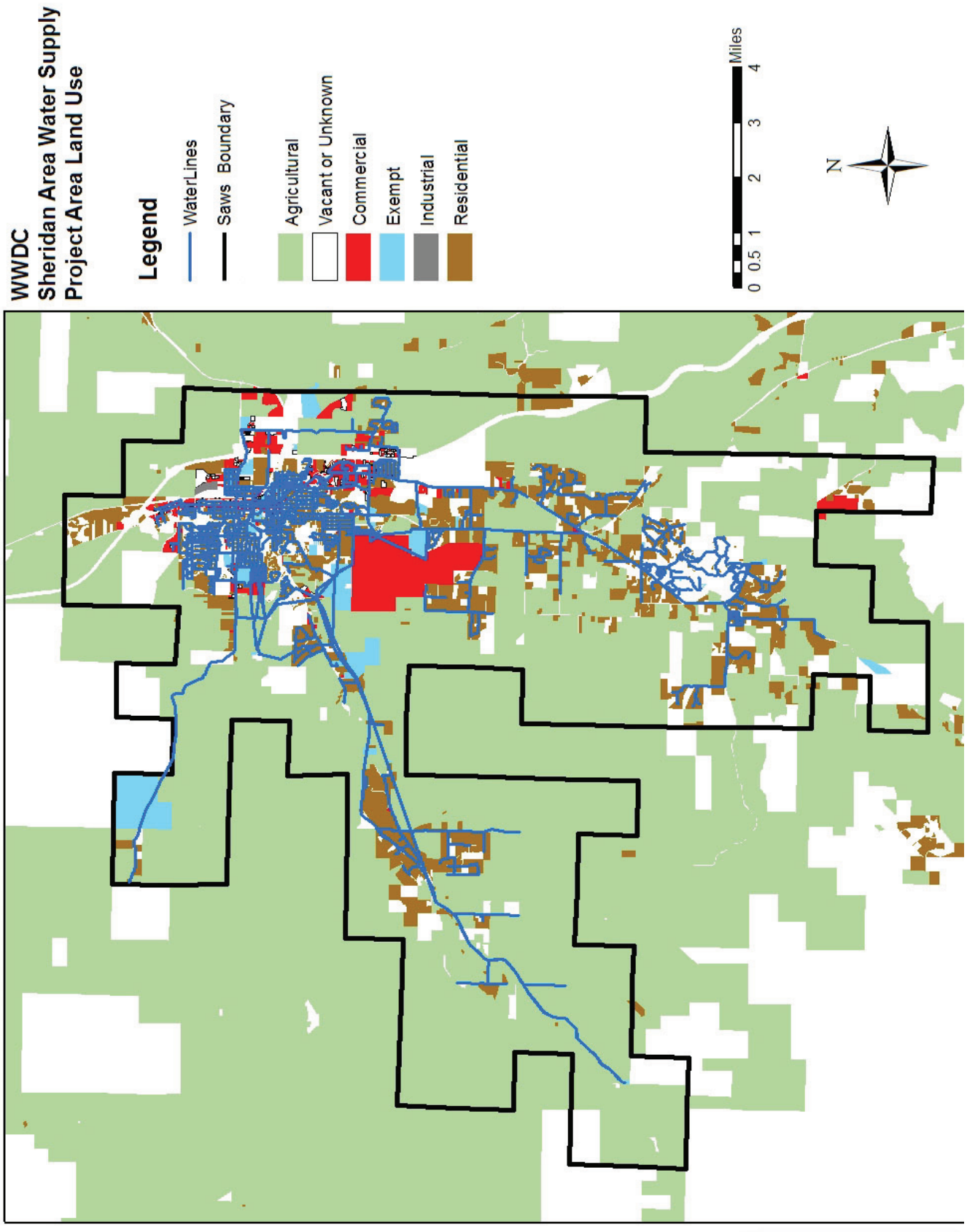
The population of Sheridan County grew at a rate of 12.7 percent between 1990 and 2000, exceeding the growth rates of the U.S. and the State of Wyoming (Taylor and Lieske, 2002). This shift reflects the demand for amenities offered by the various waterways and Bighorn Mountains on the west side of the county. Second, home purchases and in-migration shifts from urban to rural residences also contributed to the rate of growth.

Figure 5.
Population Change for Sheridan County and City of Sheridan, 1990-2006



SAWS Project Area Land Use – Project area land use (Figure 6) was determined by mapping Sheridan County Assessor tax classifications for parcels in and near the SAWS project area. The tax code classifications, which generally correspond to land use are: agricultural, commercial, tax-exempt, industrial, and residential.

Figure 6.
SAWS Project Area Land Use Map

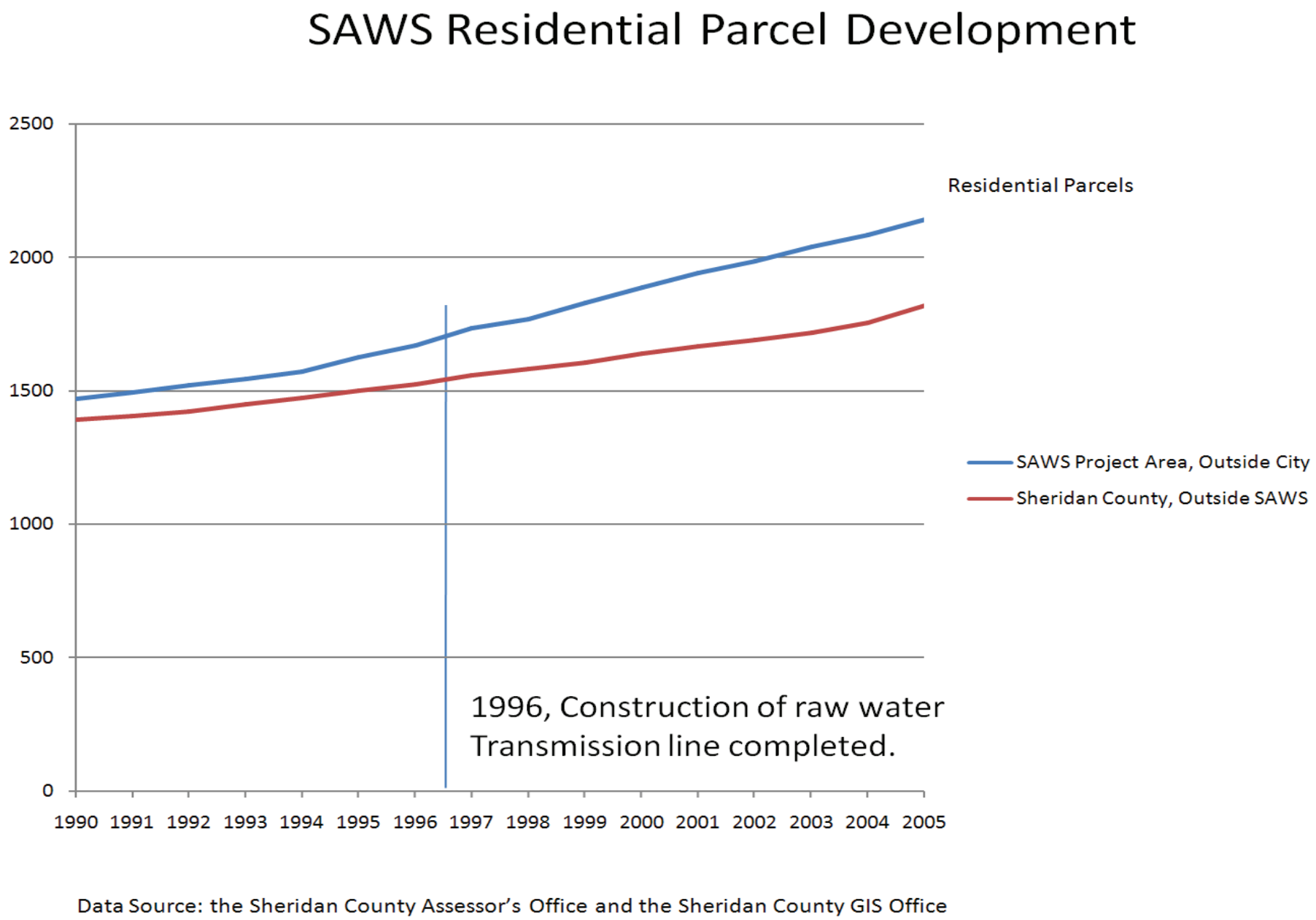


SAWS Residential Development Trends – Residential development trends for SAWS and Sheridan County show greater growth in the SAWS project area than outside the project area.

Figure 7, based on the SAWS project boundary, illustrates that more residential growth occurred in the SAWS area than in the remainder of Sheridan County. Significant growth occurred in 1992 when the water transmission line along Big Goose Creek was completed from Twin Lakes Reservoir to Sheridan and in 1996 when the distribution pipeline in Little Goose Creek was completed (from the City of Sheridan, south to the town of Big Horn).

The SAWS area residential parcel development analysis (Figure 7) is based on the parcel layer and associated assessor's data from Sheridan County. SAWS boundary data were provided by Jay Stender with the SAWS office. This data set defines the extent of the project in both its current and historical form. In order to be able to compare residential development trends with SAWS, the rest of Sheridan County and the City of Sheridan, a geographic information system (GIS) was used to count the number of residential parcels: (1) outside the SAWS boundary; (2) inside the SAWS boundary but outside the limits of the City of Sheridan; (3) inside the SAWS boundary, including the City of Sheridan and; (4) for the City of Sheridan.

Figure 7.
SAWS Project Residential Parcel Development



Data Source: the Sheridan County Assessor's Office and the Sheridan County GIS Office

SAWS Land Use Change Study – A temporal analysis of landscape change for the SAWS project area was undertaken in order to determine if there was any intensification of use brought about by the development of SAWS. A land classification scheme was developed to aid in determining land use changes resulting from the pipeline's implementation.

Airphotos taken from 1994, before the pipeline's construction, and post construction in 2000 and 2006 were supplied by the University of Wyoming's Geographic Information Science Center (WyGISC). These years were selected based on high spatial resolution imagery availability. Airphotos were chosen for this study due to their level of detail, which is necessary for the developed classification scheme; satellite imagery did not provide satisfactory resolution to be used with the scheme. Land use changes between the aforementioned years were characterized using a Kappa Index of Change (Campbell, 1996).

Parcel data, provided by the Sheridan County Assessor's Office, containing the year-built of edifices on each parcel, were used in validation of any residential-related land use changes revealed in the comparison of the airphotos for the areas within the SAWS service area. Water well permits issued in the study area were used as proxies for rural residential land use home sites. The airphotos were classified per the classification scheme detailed below (see Classification Scheme in Appendix J).

Table 1 shows SAWS area land use. All uses are measured in area (acres). Additionally, residential use is measured in terms of the number of residential parcels, and commercial uses are measured by the number of commercial structures for 1994 through 2006. The study demonstrates an increase in commercial and residential use.

Table 1. **SAWS Area Land Use Change 1994-2006**

	1994	2000	2006	Units
Bare Ground Soil	2,189	3,030	2,579	acres
Cemetery	57	57	57	acres
Commercial Structures	534	577	697	structures
Forested Lands	2,628	2,544	2,546	acres
Grassland	42,058	43,652	45,374	acres
Irrigated Crops	16,036	13,226	11,746	acres
Parking Lot	313	351	365	acres
Recreational	322	501	457	acres
Roads	1,625	1,678	1,770	acres
Rural Residential	1,456	1,694	2,069	county
Rural Residential	927	1,059	1,160	acres
Saws Boundary	68,622	68,622	68,622	acres
Urban Residential	1,379	1,406	1,464	acres
Water Bodies	706	706	665	acres

SAWS and Recent Land Use Planning – Sheridan County has engaged in several land use planning efforts in the past 10 years. Planning research by the University of Wyoming (McLeod et al., 2002) assisted the county in revisiting their comprehensive land use plan. These efforts resulted in a zoning resolution in 2004 that has yet to be implemented. The preamble to the resolution notes the intentions of the Sheridan County commissioners to "…protect surface and groundwater including the Powder and Tongue River and their tributaries and subtributaries...," and to "…preserve natural vegetation and scenic and wildlife values…" (Sheridan County, 2004 p. 2).

The current plan, entitled *Vision 2020: Sheridan County Growth Management Plan* (July 2001), is intended to act as a guide for helping elected and appointed officials of Sheridan County and the City of Sheridan as they make decisions on land use and zoning issues. Several sections of Sheridan's Vision 2020 are relevant to the SAWS project. Vision 2020 states the following factors contributing to the need for planning and growth management in Sheridan County and the City of Sheridan: (1) recognition that Sheridan must grow as an urban community rather than as a low-density rural area; and (2) realization that a growing number of individual septic systems bring with them potential concerns of health hazards (JGA Architects, 2001 p.3).

Vision 2020 explores a theme called "Enable Planned Growth Throughout Sheridan County." One of the goals of the theme is to plan public water and wastewater systems to facilitate community expansion into desired urban growth areas (JGA Architects, 2001 p. 11). The Vision 2020 theme further identifies where growth is most likely to occur and proposes strategies to encourage growth near recognized urban areas and guide it, as it occurs, in an orderly fashion. It also states that low density and cluster developments are to be utilized in critical wildlife habitat (JGA Architects, 2001).

The two land use categories relevant to the SAWS project area from Vision 2020 are the "Rural Transition Area" and "Agricultural Area." These are defined as follows:

- *Rural Transition Area – Limited development and long-term provision of public water and sewer services, respecting the values of Sheridan County residents (JGA Architects, 2001 p. 21).*

- *Agricultural Area – Areas that should retain an agricultural character consistent with the goals of the plan. No public water or sewer services are anticipated (JGA Architects, 2001 p. 21).*

Other land use implementation strategies identified in Vision 2020 include (JGA Architects, 2001):

- *Procure a guaranteed long-term water supply to accommodate projected growth.*

- *The City of Sheridan should establish hookup fees at appropriate levels to support growth.*

- *The city and county should support efforts to enable the regional water system to transition to single entity ownership.*

- *Assure that adequate water and wastewater treatment capacity remains available to support growth.*

As of January 2008, a process is underway to update Vision 2020 and create a comprehensive plan for Sheridan County. Details are available at http://www.plansheridancowyo.com/.

3.2 SHOSHONE MUNICIPAL PIPELINE (SMP)

The Shoshone Municipal Pipeline (SMP) is located (Figure 8) in northwestern Wyoming in Park and Big Horn counties. In 2007, Park County had an estimated population of 27,073 (Wyoming Division of Economic Analysis, 2008). The largest city in Park County is Cody with an estimated population of 9,217 (Wyoming Division of Economic Analysis, 2007, 2). The largest city in Big Horn County is Lovell with a July 1, 2006 population estimate of 2,288 (Wyoming Division of Economic Analysis 2). Other major towns are Basin, Burlington, Byron, Cowley, Deaver, Frannie (part), Greybull, and Manderson with a July 1, 2006 estimated populations of 1,242, 249, 550, 178, 182, 1,761 and 102 respectively (Wyoming Division of Economic Analysis, 2007, 2). Overall, the population in urban areas from 2000 to 2006 increased approximately 1.7 percent and the population in the rest of the two counties increased by 3.3 percent (Wyoming Division of Economic Analysis, 2007, 2).

Major economic activities in Park County include retail trade, health care and social assistance, educational services, construction, lodging and restaurant services, agriculture, forestry, and fishing and hunting (Headwaters Economics, 2007b). Major economic activities in Big Horn County include educational services, health care and social assistance, agriculture, forestry, fishing and hunting, retail trade, construction, and mining (Headwaters Economics, 2007c). Cody's economy is more dependent on Yellowstone National Park tourism than Lovell's economy. Although Lovell is close to the Big Horn National Recreation Area it is more dependent on agriculture.

For several years, communities along the Shoshone River informally discussed a water transmission pipeline, which would deliver water from the Buffalo Bill Reservoir to their communities rather than depending on groundwater wells that supplied water of questionable quantity and quality (http://wwdc.state.wy.us/legreport/1996/proj05.html). In December 1981, the communities of Cody, Powell, Byron, Lovell, Cowley, Deaver and Frannie created the Municipal Water Development Association.

SMP Background and Costs – The SMP project was initiated with a feasibility study in 1982 and completed in 1995 with the construction of two pipelines. The first pipeline delivers raw water from the Buffalo Bill Reservoir and Shoshone River to the water treatment plant west of Cody, while the second pipeline delivers water to the entities of the Shoshone Municipal Water Development Joint Powers Board (Wyoming Water Development Commission, 1987 *Legislative Report* 45, 2005). The project was designed so that treatment occurs near the source (by Buffalo Bill Reservoir) instead of requiring a treatment plant at each municipality.

The SMP project was designed to serve projected population growth through 2030. The projected population—including Cody, Ralston, Powell, Byron, Lovell, Deaver and Frannie — for 2030 was estimated at 41,350. Water use was estimated for each community and varied between 315 and 510 gallons per day (gpd). The total projected water demand in 2030 for the project was 21.41 million gallons per day (mgd). The WWDC Level III Interim Report indicates the design capacity of the pipeline is the same as the projected water demand of 21.41 mgd or 33.1 cubic feet per second (cfs). The system is designed so capacity decreases downstream to different user groups (Banner Associates, Inc., 1986).

A WWDC Level II study was performed in two phases. The Level II - Phase I report was completed in January of 1989, and delineated preliminary service areas, established economic parameters for service, and generated design criteria. Upon completion of Phase I activities, WWDC placed the Level II activities on hold to allow the sponsors time to form water districts and establish the service area boundaries. In January of 1990, the sponsors held public elections to establish the districts and their boundaries, and to elect rural water district board members.

The voters overwhelmingly approved the formation of the districts (http://wwdc.state.wy.us/legreport/1996/proj05.html).

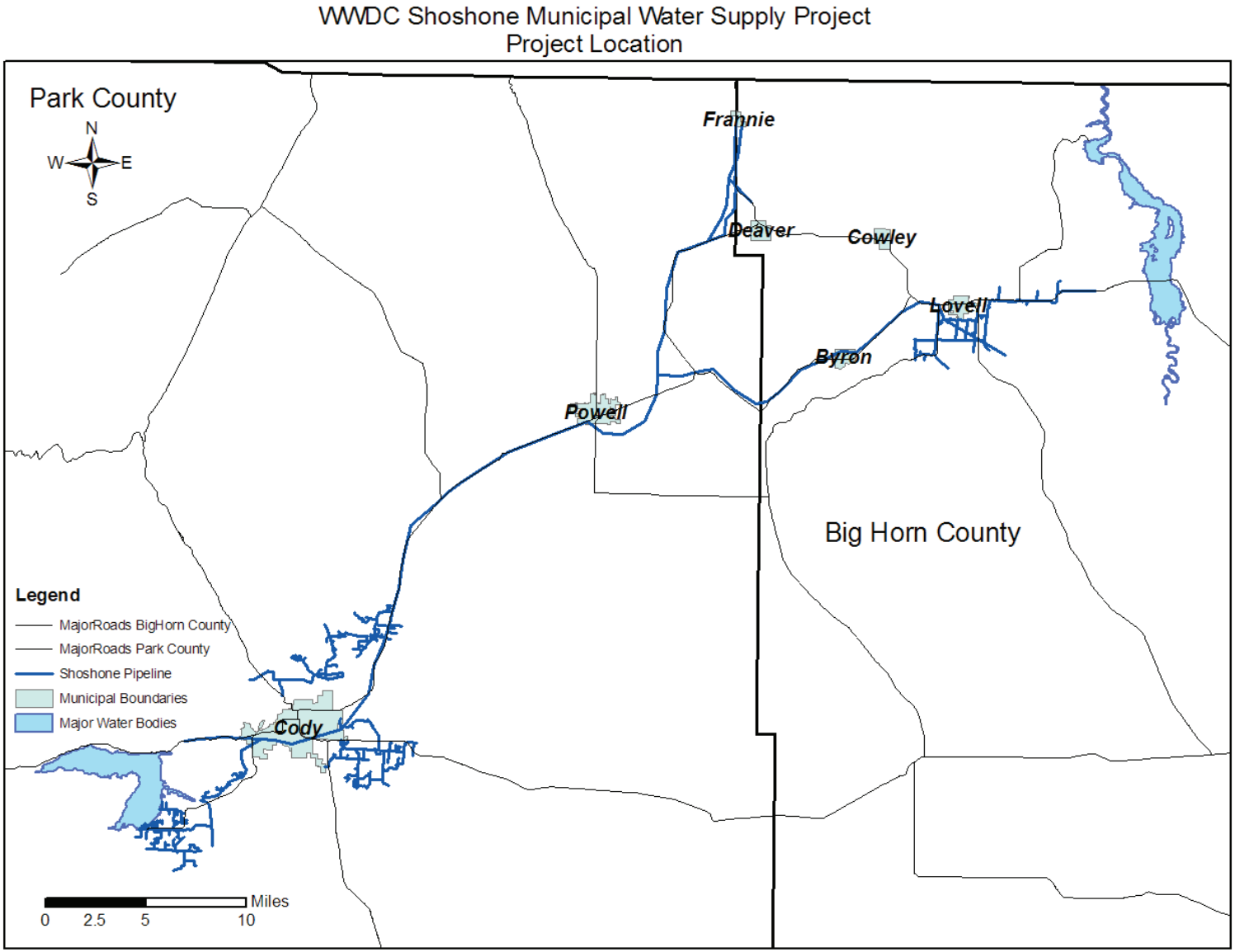
Based on criteria established by the district, the final service areas were delineated to serve water to 1,055 users in the following seven rural areas: South Fork, Sage Creek, North Cody, Heart Mountain, O'Donnell, Deaver-Frannie, and Lovell. Presently, the number of users has increased to 1,280 (http://wwdc.state.wy.us/legreport/1996/proj05.html).

In 1991, the district worked to secure funding from the Farm Loan Board and the Farmer's Home Administration for the distribution systems. In 1992, the final design process was completed for the first project component, the Heart Mountain system, which was placed into service in October of 1993. The O'Donnell and South Fork systems were placed into service on June 1, 1994 and Nov. 22, 1994 respectively. The Deaver-Frannie and Lovell systems were bid on in early-fall of 1994, and were completed in April of 1995. Presently, the Sage Creek system is under construction and plans and permitting are underway for the Cooper Lane and North Cody systems (http://wwdc.state.wy.us/legreport/1996/proj05.html).

State and local funding mechanism(s) for the SMP project included advance moneys provided by the municipalities, a Farm Loan Board loan to finance the treatment plant design, a Permanent Mineral Trust Fund loan for construction of the water treatment plant, a WWDC grant and loan for the pipelines. According to Lowell Anderson, manager of the Shoshone Municipal Pipeline, for financing purposes, the 5 million gallon reservoir at the water treatment plant was considered part of the pipeline (Anderson, Lowell, personal communication, Jan. 18, 2008).

Figure 8.

Shoshone Municipal Pipeline Area and Location



Approximate total project costs, with breakdown by sub-project/construction as available (excluding engineering costs) were:

- Bureau of Reclamation change order and pipeline extension – $2 million;
- Raw water pipeline, including emergency pump station and booster pump station – $4.3 million;
- Water treatment plant, including the 5 million gallon reservoir – $16 million; and
- Treated water pipeline, including six pressure control stations and six service connection buildings – $26.7 million (Anderson, personal communication, Jan. 18, 2008).

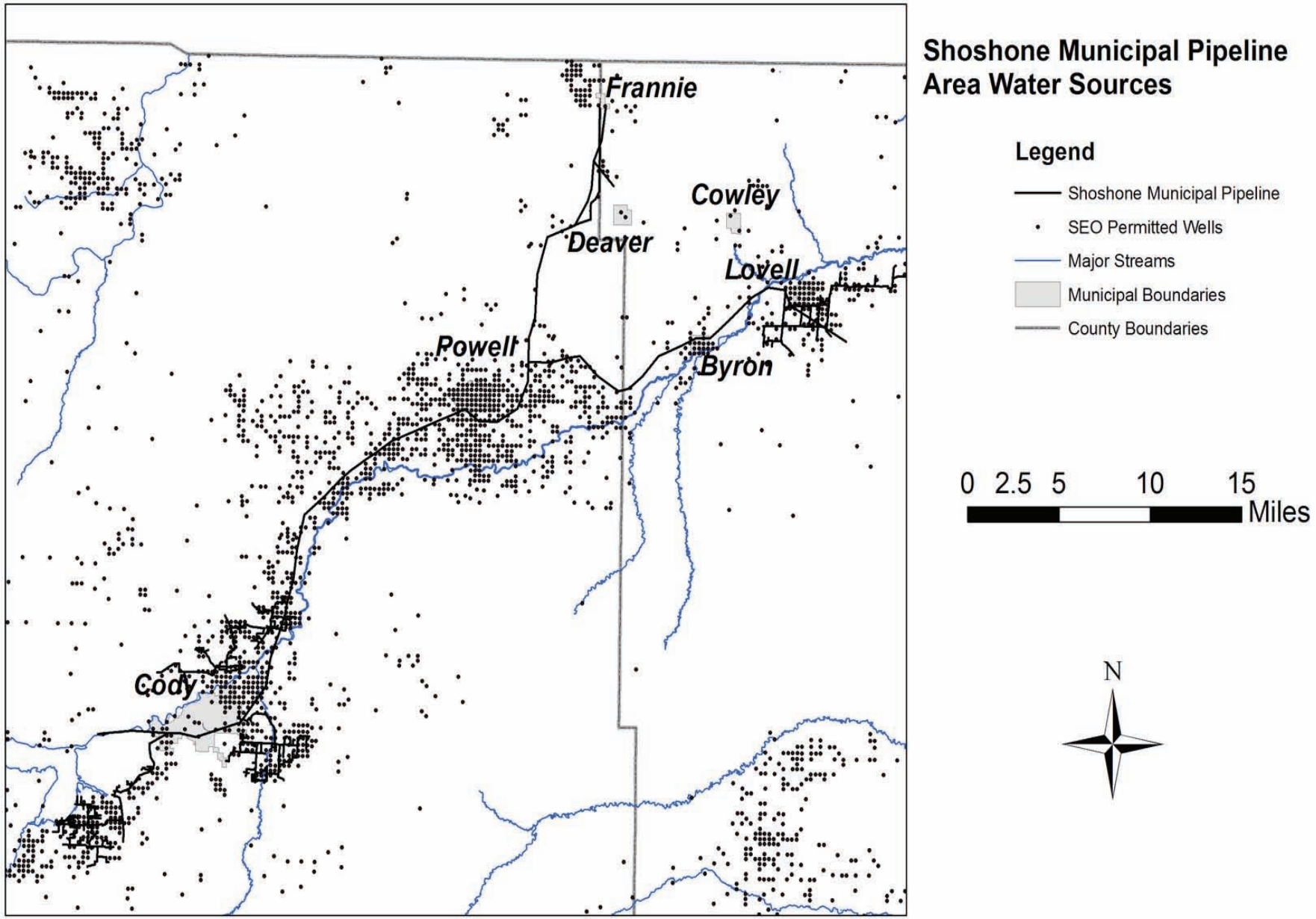
The average cost per mile of the entire SMP project, including pumping stations, laterals to taps and the treatment plant was $812,000. This amount includes six pressure control stations, service connection buildings for the six municipalities, and water storage facilities at Byron, Deaver, and Frannie (Anderson, personal communication, Jan. 18, 2008).

The gravity flow pipeline is 70.2 miles in length stretching from Buffalo Bill Dam to Frannie, Wyoming, and ranges in diameter from 8 to 36 inches. The pipeline system includes a water treatment plant situated at the foot of Cedar Mountain, west of Cody, and 354 stations to check the water flow. Water in the pipeline is tested annually for lead and copper (Minutes from the Wind/Bighorn Basin Advisory Group, Nov. 18, 2003). Six municipalities and five rural water districts are served by a single water-treatment facility at the mouth of the canyon and 67.8 miles of supply lines. The entire system runs on gravity, and the naturally soft water requires relatively little treatment to meet all applicable standards. The SMP has a contract for 9,750 acre-feet of storage in the reservoir, and several of the towns have independent storage contracts. A water supply of the highest quality is now assured well into the 21st century (Bonner, 2002 from an interview with Lowell Anderson, Manager of the Shoshone Municipal Pipeline; interview by Bonner, Cody, Wyoming, Jan. 15, 1996).

SMP Water Use – Water from the SMP serves all land uses in the project area. The Northwest Rural Water District, which serves seven rural areas (South Fork, Sage Creek, North Cody, Heart Mountain, O'Donnell, Deaver-Frannie, and Lovell) was originally intended to serve 1,055 users. By 1996, the project was serving 1,280 users (http://wwdc.state.wy.us/legreport/1996/proj05.html). By 2006, the Northwest Rural Water District served 2,200 rural users in Park and Big Horn counties (Overfield Interview, Aug. 17, 2006). As of 2002, the SMP serviced 21,200 people (http://waterplan.state.wy.us/plan/bighorn/techmemos/muniuse.html). Per capita use for the SMP is approximately 297 gpd. Data on consumption are aggregated so there is one number for all uses (Anderson, personal communication, Jan.18, 2008).

SMP Water Sources – The Shoshone Pipeline is one of several water sources available in Park and Big Horn counties. Mapped water sources in the SMP area (Figure 9) include wells (permitted wells from the Wyoming State Engineer's Office), streams, lakes, and the SMP pipeline.

Figure 9.
SMP Project Area Water Sources



SMP Demographic Changes – Demographics differ between Park County and Big Horn County. Figure 10 below indicates that while the population of Big Horn County has remained fairly even from 1960 through 2007 (the population in Big Horn County was 11,898 in 1960 and 11,263 in 2007), Park County has experienced steady population growth. The contrast of growth inside and outside of the SMP project area in Park County is addressed below in the discussion of residential development trends.

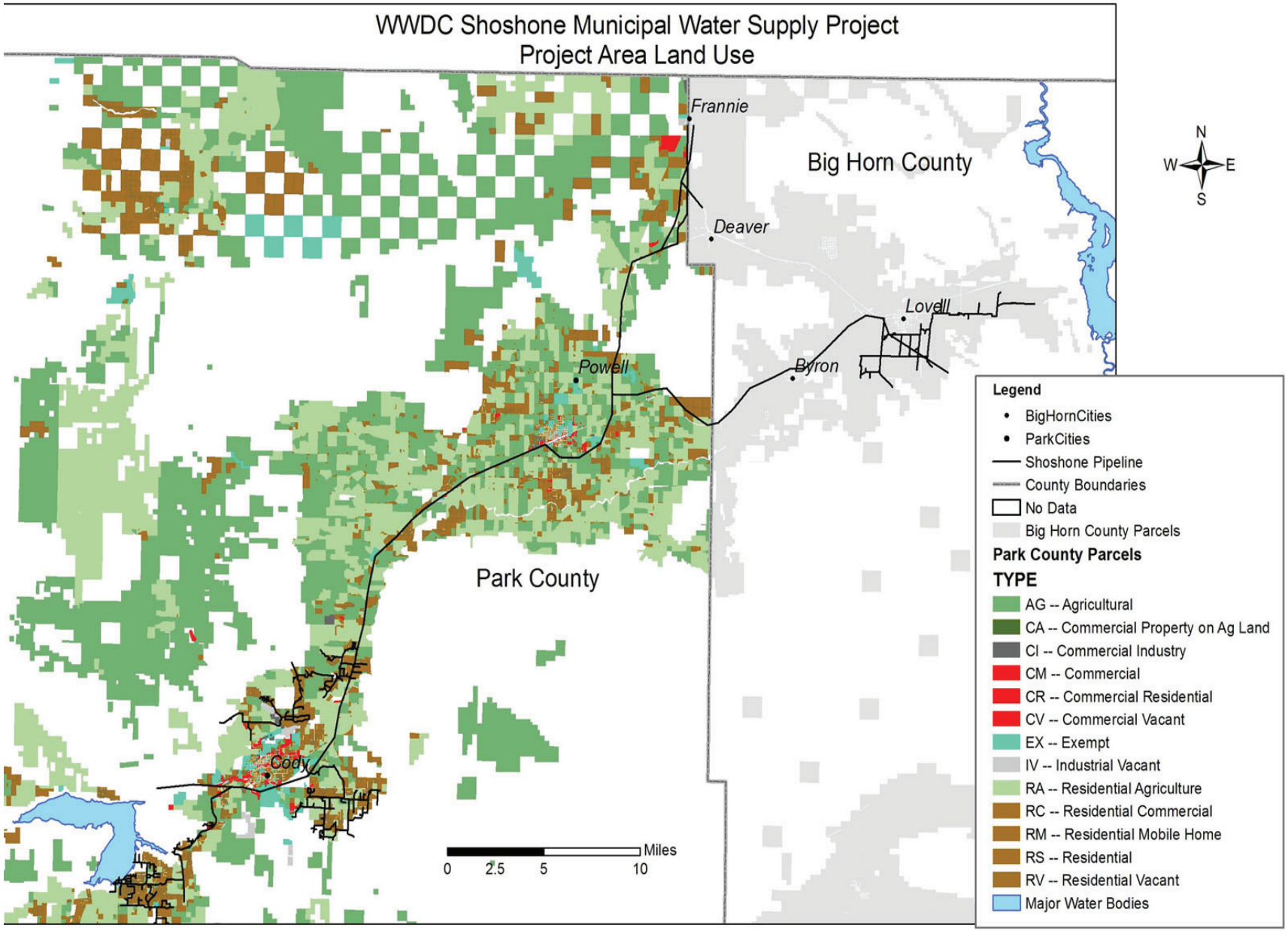
Figure 10.

Population Change in Park and Big Horn Counties 1960 – 2007 (shows number of people vs year)

Source: Wyoming Division of Economic Analysis, http://eadiv.state.wy.us/pop/pop.html.

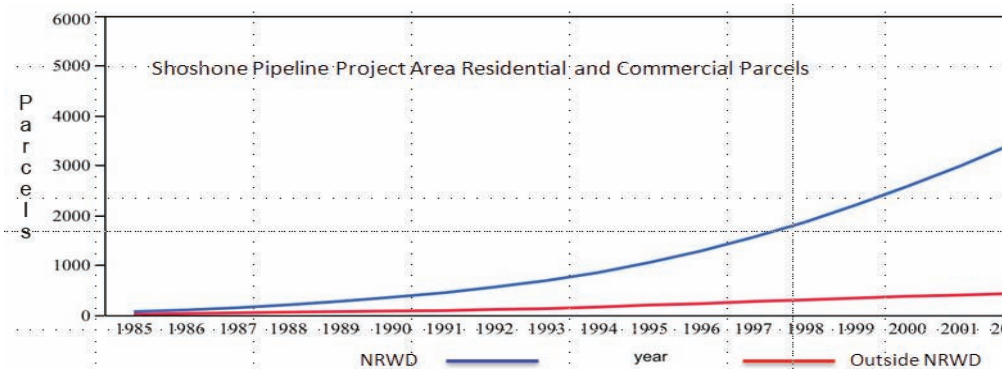
SMP Project Area Land Use – Land use in the SMP project area is based on the zoning codes used in Park County (Figure 11). (Note: Land use data were not of sufficiant quality for Big Horn County to map land use trends.)These codes are more nuanced than the tax classification codes used by Sheridan County. The land-use categories for Park County are: agriculture, commercial property on agricultural land, commercial industry, commercial, residential, commercial vacant, tax exempt, industrial vacant, residential agriculture, and residential, commercial, residential mobile home, residential and residential vacant.

Figure 11.
Shoshone Municipal Water Supply Project Area Land Use



SMP Residential Development Trends – Development trends, compared by increase in the number of parcels both within and outside of the SMP project area were compared (Figure 12). Parcel data were obtained from Big Horn County but there was a lack of information on tax classification (for example, classification by parcel as "agriculture," "commercial" or "residential"). Additionally, according to the Big Horn County GIS office, many of the data records in their parcel data are incorrect. Also, the Town of Cowley uses groundwater, not the SMP as its primary means of water supply even though it is located near the SMP project area (http://waterplan.state.wy.us/plan/bighorn/techmemos/muniuse.html). Figure 12 demonstrates that more development occurred in the SMP area than in other unincorporated areas in Park County. Even though more parcels have been developed within the Northwest Water Rural District (NWRD), the size of the parcels outside of the NWRD are larger than those within the district. The pattern of growth within the NWRD appears to tend toward greater housing density than in other parts of the counties (Figure 12). (Note: Data available for Big Horn County were not of sufficient quality to map residential development trends.)

Figure 12.
Built Parcels in Park County within the Northwest Water Rural District Region and Outside the Area, 1985 to 2005 (SMP)



STATE OF LAND USE AUTHORITY IN PARK AND BIG HORN COUNTIES

SMP and Recent Land Use Planning – Park County completed a comprehensive plan in 1998. It is unknown whether a current comprehensive plan exists for Big Horn County. The goals and objectives stated in the Park County comprehensive plan (Park County Land Use Plan, 1998) include:

- Review of development proposals for potential impacts to ground and surface water quantity and quality.
- Concentrate population growth in or near existing urban areas.
- Adopt regulations and develop infrastructure that makes urban development more attractive than rural development.
- Recommend imposition of impact fees commensurate with cost of county services.
- Encourage development in or near urban areas.

Chapter IV Impact Analysis and Methods

4.1 FISCAL ANALYSIS

The following section summarizes the results of the fiscal and water quality analysis for both case study areas. The SMP and SAWS are evaluated in this analysis with respect to both county expenditures and regional supply issues. The analysis evaluates the question of whether growth in rural parcels (connected or in the general region of the regional supply lines) is affecting county fiscal stability or supply considerations. The supply issue reported in this analysis is only for the SAWS region. Water supply capacities for the SMP are deemed considerable enough not to warrant more in-depth analysis. Added to this analysis for the SAWS area is an evaluation of fecal coliform contamination. Historical U.S. Geological Survey and DEQ data is available for the Goose Creek Watershed but not for the SMP.

Our analysis bifurcates county government expenditures into general and delivered services and evaluates parcel growth inside and outside of the area around the pipeline. The intention is to evaluate fiscal impacts relative to service delivery that require travel (emergency services, road, law enforcement, weed and pest, etc.). Services that were identified that had a significant component of delivery-based provision were separated into a separate category (see Table 2). While even the more delivery-based government services have a general component that is centrally located (e.g. 911 for emergency services), delivery-based government services are more likely to see increasing costs associated with dispersed exurban development. Separating out those services should allow for a more precise estimation of cost factors.

Table 2.

General Verses Delivery-based County Services

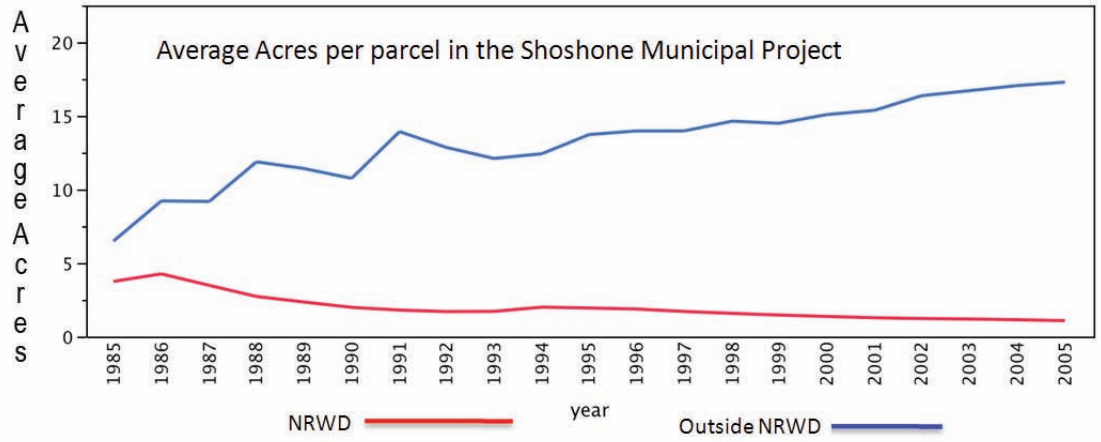
General	Delivery-based
Board of county commissioners	County sheriff
County clerk	County planner
County treasurer	County surveyor and engineer
County assessor	Agriculture department
County attorney	Road and Bridge
County coroner	Civil def/emergency/ mgmt/911
District court	County airports
Justice or circuit court	Fire protection
Courthouse	Protective inspections
Jail	Solid waste and landfill
Elections	Natural resources
Health (not hospitals)	Social services
Hospital Boards	Construction
Library Boards	Equipment, Land, Buildings
Fair Boards	
Parks, recreation, museums	
County administration	
Other Boards	

SMP Fiscal Analysis – The first case study assesses the impact of rural residential development in Park County. While the SMP covers Big Horn County as well as Park County, we focus exclusively on the latter because the GIS and assessors data in Big Horn are not sufficiently integrated to construct the necessary databases for the analysis. Figure 12 plots the number of built parcels added to the county total since 1985. Parcels within the SMP area are identified with GIS by creating a buffer around the approximate location of the pipeline. These parcels include both residences that are connected to the pipeline and those that are not, but are within the general area of the pipeline. Since the placement of the regional line is not based upon the extent of existing infastructure, then one has to conclude that overall associated development connected to the system encourages other development. For example, a road is constructed to nearby residents who tap into the SMP system. The road also facilitates development whether residences are connected to the SMP or not.

Parcel growth within the pipeline region far outstrips built parcel growth outside the SMP area. Annual average growth of built parcels within the SMP area is approximately 4.84 percent per year. Annual growth outside the SMP area is 1.35 percent per year. Clearly the pipeline is acting as an attractant, but not necessarily the only attractant to development. Other attractants include view, overall access, proximity to utility infastructure, and amenity attributes.

The question then is the degree to which development around the pipeline affects county fiscal stability. Previous work by Coupal, McLeod, and Taylor (2002) already established that exurban development on average generates county expenditures greater than revenues. So the question here is whether expenditures within the SMP region are significantly greater than expenditures outside the region. One potential mitigating factor could be the density of development – the higher the density, the more potential savings to the county. Figure 13 below shows average acres per parcel from 1985 through 2005. Density is higher in the rural areas surrounding the SMP project.

Figure 13.
Average Acres Per Parcel in the SMP



Results of the fiscal impact analysis are presented below. County expenditures are regressed within project parcels, outside the project area, local government employment, and an interaction term between parcels within and without. Both general expenditures and delivery-based expenditures are evaluated.

Regression modeling shows that the fiscal impact of parcel growth within the SMP is not significantly different than growth outside of the SMP. It is important to keep in mind that the lack of significance does not suggest the opposite of results from previous analyses; most notably Coupal, McLeod, and Taylor (2005), only that

growth in these areas have the same net fiscal impact as growth outside of the SMP. In this case, the analysis does not suggest that exurban development costs to taxpayers are higher (or lower) than overall exurban development. Only that it is a contributor to higher costs just like all exurban growth. So the increased fiscal costs incurred by county government are due primarily to planning and not the project itself, even though it is clearly an attractor of future growth.

Next, the relationship between delivery-based government services and parcel growth in the county was summarized. County services were disaggregated into those services that reach out into the county (e.g. EMS or law enforcement versus county clerk) to see if there is significant contribution to this class of county expenditures by Northwest Water Rural District (NWRD) parcel growth versus non-NWRD parcel growth. As with previous results, parcel growth in the SMP is not significantly different than parcel growth outside of the SMP. In addition, the modeling results of both of these equations suggest that growth near the SMP does not have a significantly different effect on expenditures than parcel growth outside the SMP.

There are two methodological notes that have implications for local and state database policies. First, various different alternative specifications were used and evaluated, though not reported here because the results are no better than the basic linear regression results reported above. None of the alternative experimental designs improved performance. The confounding aspect of this exercise is that there should be more significance in the parameters than there seems to be. An important reason for this is that the sample may be too small and not sufficiently geographically differentiated. Collecting annual data on households and service provision would improve the relationship.

Another important methodological or data implication is that counties need to construct and maintain annual time series conditions that are unique to the year. Keeping each year as a separate observation with spatial attributes would help with understanding trends in relationships between land use and expenditures (as well as improve modeling).

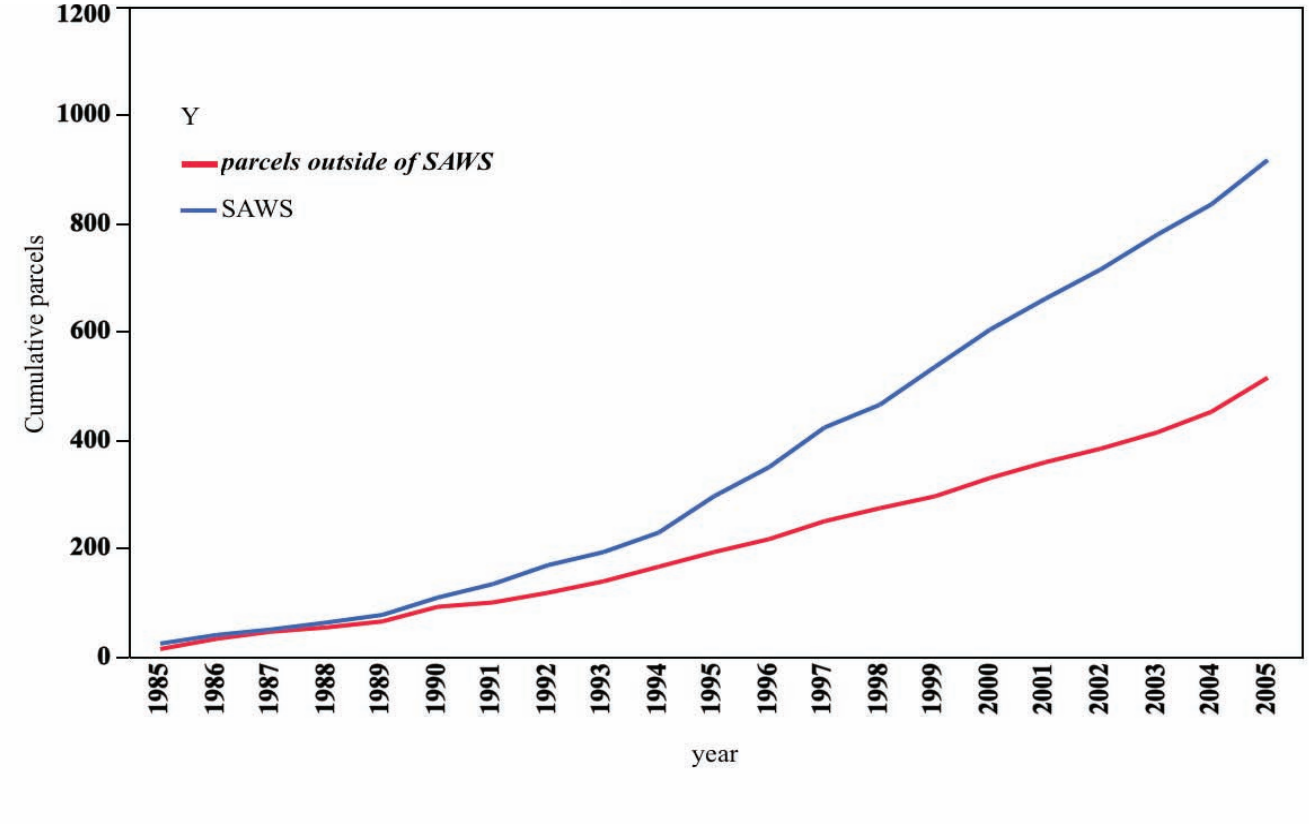
SAWS Fiscal Analysis – The results of the SAWS project are presented below. The analysis for SAWS follows the same approach as identified above except for one additional set of results. Unlike the SMP, the SAWS project is experiencing a capacity issue. Because of this, we evaluated the growth in demand including the parcels in the Goose Creek Watershed.

Fiscal impacts of exurban development in the Goose Creek Watershed include parcels tapped into the SAWS pipeline and parcels in the area but not tapped into the pipeline. As discussed above, we included both because of other infrastructure development that occurs in conjunction with water supply development (roads, electricity, other utilities, and amenities associated with the location). As in the SMP analysis, expenditures were bifurcated into general and delivery-based government services.

As in the SMP analysis, we first evaluated parcel growth in SAWS and compared them to the areas outside of SAWS. Figure 14 presents the results of that analysis. As in the SMP case study, there is a significant growth in the number of parcels connected to the SAWS water system. That growth includes those directly tapped into the supply system and those that are in the area but are not directly tapped into the system. The regional water supply system and the ability to allow exurban parcels to tap into the system are attractants for rural residential development.

Figure 14.

SAWS and Non-SAWS Parcels in Sheridan County



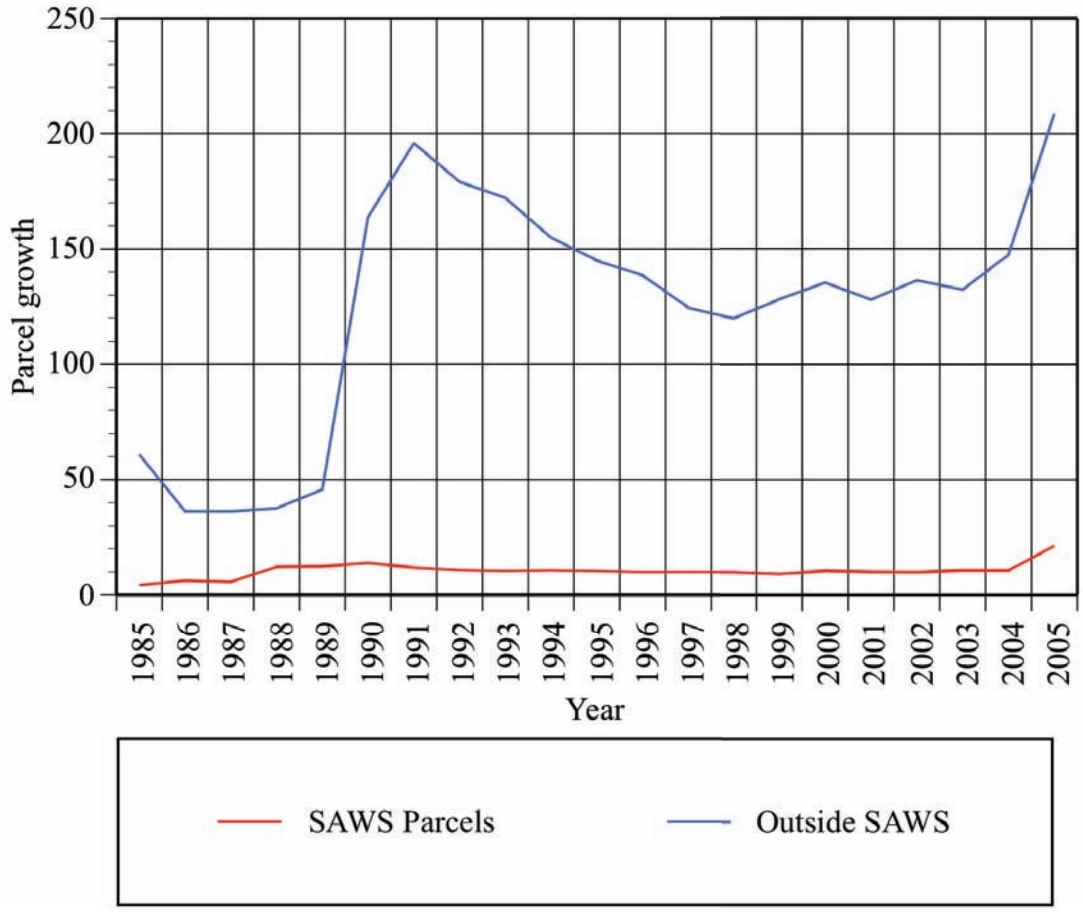
The fiscal impacts of this growth were evaluated to show the effect of lot development in the SAWS area on general county expenditures and in comparison with other areas of western Sheridan County. Due to the geographical aspects of Sheridan County, we only compared SAWS with growth on the west side. The results suggest that SAWS parcels do not generate more expenditures than non-SAWS parcels.

An evaluation of delivery-based government services has a similar result to the general analysis. The regression results again suggest that there is no significant difference between parcel growth in the SAWS area and parcel growth in rural areas outside of Goose Creek on the overall fiscal impacts on the county. In other words, whether these households are located in other areas of the county but outside of urban areas or in exurban portions of the SAWS area, the impacts would be the same. A potential mitigating factor is that as the density grows in these exurban areas there may be more economies of scale for the provision of delivery-based public services.

Again, previous research suggests that growth in exurban areas costs counties more than revenues generated. This result does not counter previous research. But it does suggest that development in the Goose Creek Watershed does not add to the cost of public expenditures any more than developing elsewhere in these rural areas. One possible reason for the lack of significance is the potential savings higher density development generates. A large body of literature states per capita or per unit costs will decrease with density. Costs will not necessarily decrease simply because there are more lots and/or houses (Capital District Regional Planning Commission, 2007; Deal and Schunk, 2004; Carruthers and Ulfarsson, 2003; Carruthers, 2002; Downing 1999, 1997; Bierhanzl and Downing, 1998; Parsons Brinkerhoff Quade & Douglas, 1998; Real Estate research Corporation, 1974; Gaffney, 1964; Isard and Coughlin, 1957).

Figure 15 summarizes the average acres per parcel in the SAWS area and outside of the SAWS area. As Figure 15 suggests, average parcel size is considerably higher outside the SAWS area. Parcel development is much denser within Goose Creek affording more economies to the provision of local government services. The above analyses suggest that while development in these areas is concentrated, the development is not at a level of density where economies of scale may occur for the provision of public services. However, what that "break-even" point might be is unclear. McLeod, Coupal, and Taylor (2003) estimated that urban costs of community services relative to tax revenues are not significantly different than one. So density may need to reach levels close to urban densities before economies of scale for delivery-based public services can be realized.

Figure 15.
Average Acres Per Parcel in the SAWS Project



SAWS Supply Capacity – The issue of whether or not there is a supply capacity problem as a result of exurban development in the Goose Creek Watershed is secondary to the legal question of who has first right to the water. That is a question that this analysis cannot address. There is clearly a supply capacity issue, but who has the highest right and how shared management of the SAWS system are structured remains to be addressed.

The results suggest that exurban development in SAWS is not significantly affecting water supply expenses for the city. Residences that tap into the system pay a sufficient amount to cover the added costs of the water supply.

However, the fact that there is a supply capacity issue at all does suggest that overall the system was not designed to cover both the increase in demand in the city and the increase in demand in the SAWS area. If residents in Goose Creek had not located in the Goose Creek but located within the city limits, the city would still be dealing with a supply issue. Whether exurban residents would have chosen to stay away from Sheridan County all together is unknown.

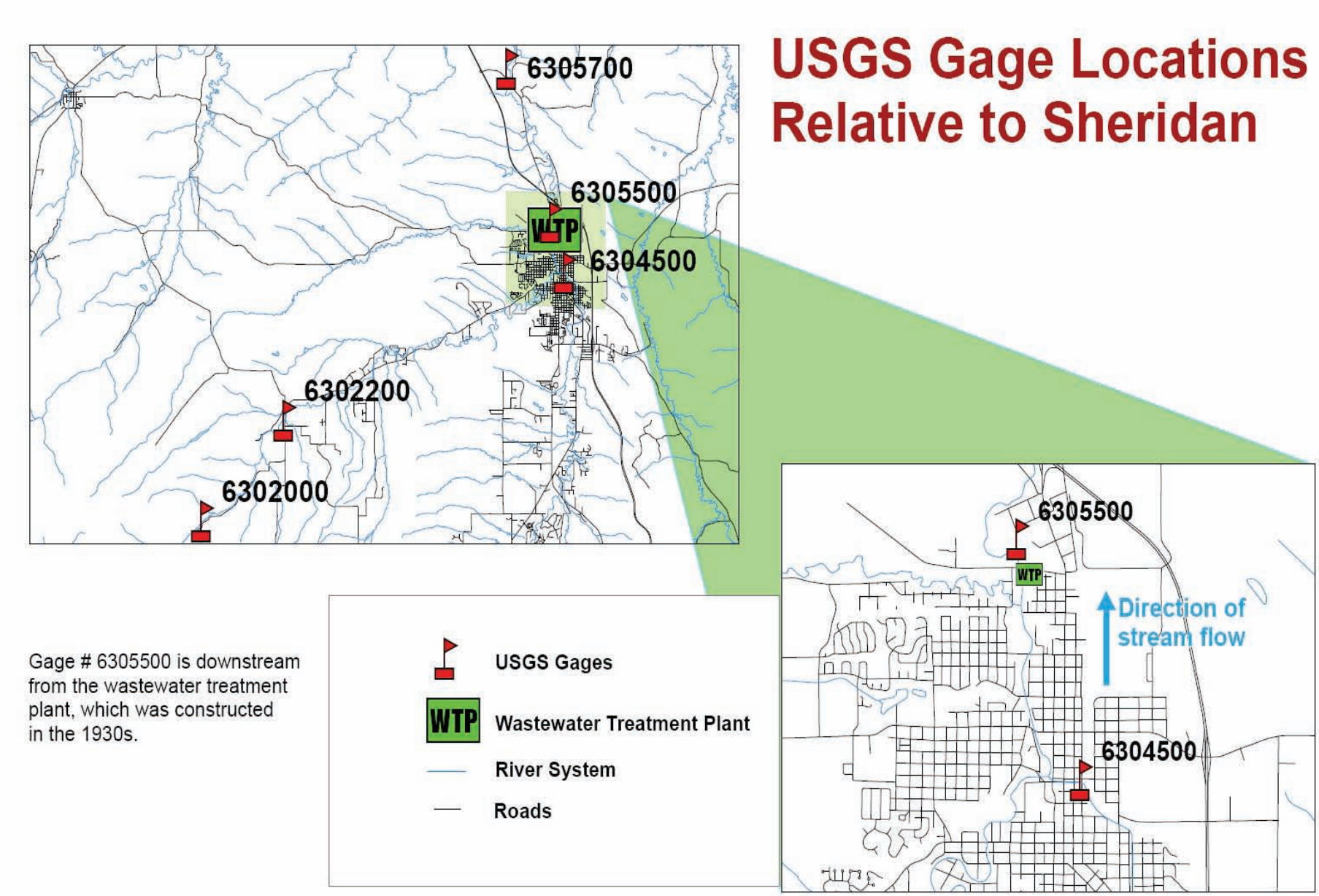
4.2 WATER QUALITY ANALYSIS

SAWS analysis of Fecal Coliform in the Goose Creek Watershed – One final component of our analysis is a water quality concern, which came to light in the process of land use data collection in the SAWS study area. That is, an issue exists with the presence of fecal coliform in the waters of Goose Creek.

In Goose Creek, rates of fecal coliform have been measured by both DEQ and USGS at levels higher than the minimum standards at three measuring stations across on the creek. Figure 16 is a map of the locations of the monitoring stations in the watershed.

Figure 16.

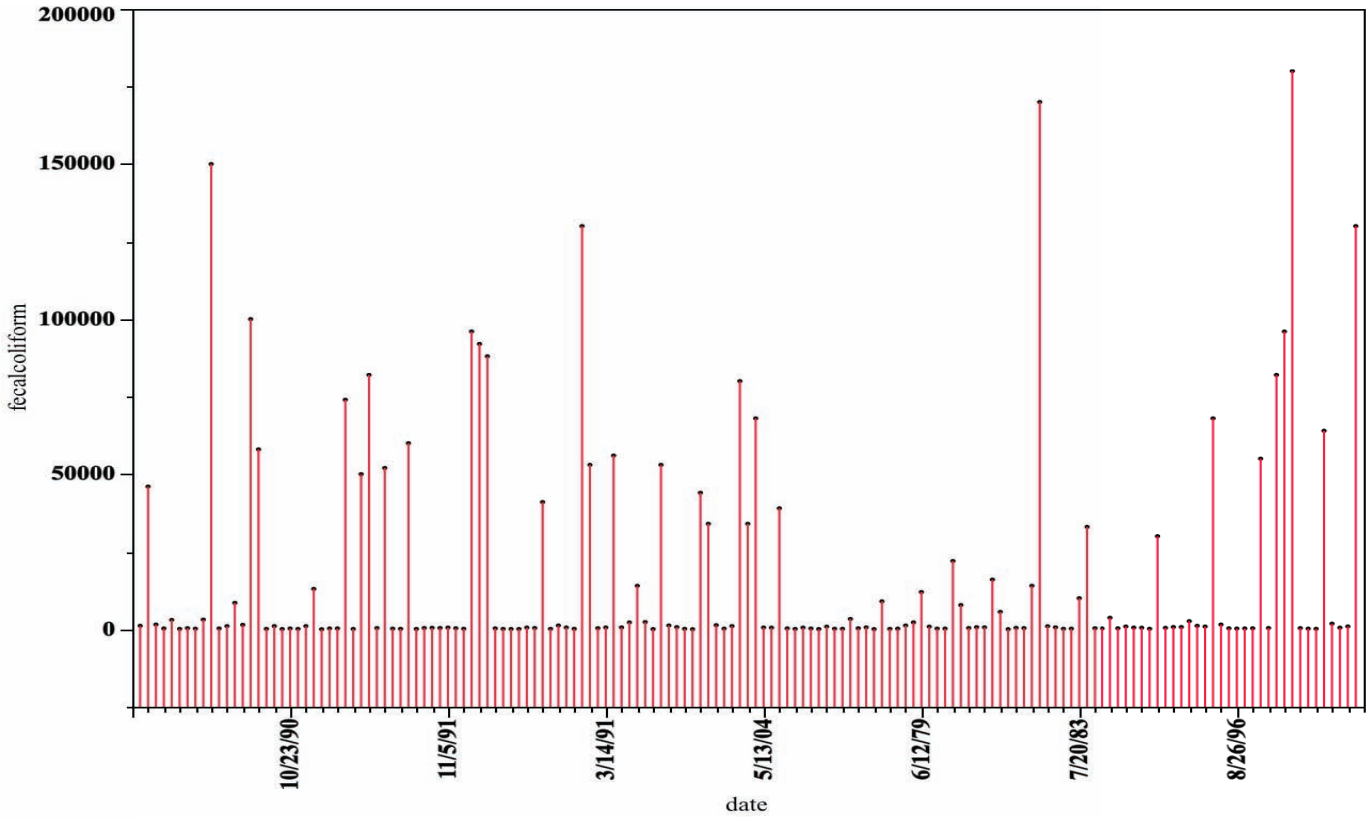
USGS Gage Locations Relative to Sheridan



Average values for fecal coliform rates show a pattern of low level contamination rates close to zero (Figure 17). Periodic fecal coliform blooms do occur at 95 percent above the mean level, 28 percent of the time. However, an evaluation of the data does not suggest an increasing likelihood of fecal coliform blooms, in terms of rate of occurrence as well as extent of the bloom. As long as the source is not increasing past a level that the natural system can effectively control, growth blooms and the public health implications are not an issue. Trend analysis suggests less of a growing problem, rather it is simply a random walk recurrence issue.

Figure 17.

Average Fecal Coliform Rates In The Monitoring Stations (GC1-GC6) Along Goose Creek (In Fecal Coliform Colony Forming Units Vs Year)



Blooms are a function of environmental factors such as precipitation rates and temperatures on one hand, and source on the other. There are two potential sources of recurring contamination of fecal contamination, agricultural and human. Both animal and human sources can occur from small acre residential development, though animal sources primarily come from larger-scale agricultural development.

To test the hypothesis that small acreage development is the source of fecal coliform blooms versus other sources (e.g. agricultural, wildlife, etc.), we regressed reported fecal coliform rates averaged across the three monitoring stations with a log-log relationship, the number of parcels in the Goose Creek Watershed and outside of the watershed. The results of the regression are presented in Table 7 in Appendix F.

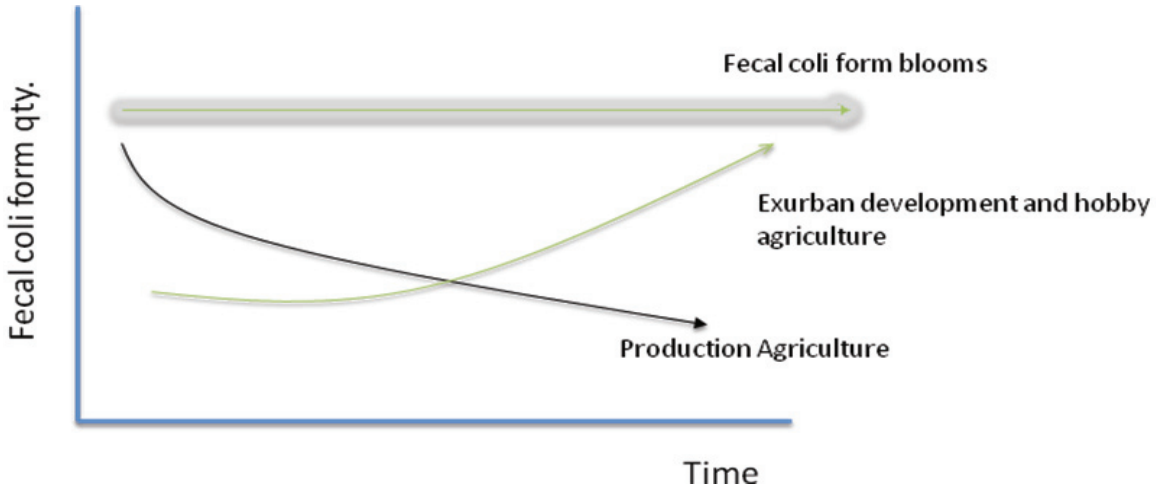
This analysis poses some challenges for policy makers. There is a significant problem of fecal coliform in the Goose Creek Watershed. Goose Creek winds its way down through the SAWS project area where residents tap into the line and use septic systems and sub-surface runoff (for animal waste or lawn watering) as outflow. The end results are periodic fecal coliform blooms that can become hazardous to the general public. Unfortunately, for policy makers, there is uncertainty as to the source of the contamination.

As land is converted from agriculture to exurban uses there is no perceptive trend from year-to-year. One possible explanation (though certainly not the only one) is that one source of fecal coliform is being replaced by another source, from agriculture to exurban sources. Figure 18 suggests this possible explanation.

The location of the monitoring stations and the type of ongoing monitoring are not conducive to really identifying the source of fecal coliform in the water. It is clear that to construct policy around solving the problem requires a more comprehensive monitoring network.

The set of analyses summarized above identify several important but subtle issues related to state and local planning efforts. First, clearly regional water supply projects do act as an attractant to exurban growth, especially when water availability is a factor. However, road and utility development in and around those areas also contribute. Whether the supply system facilitates creation of the road and utility system, or whether the latter facilitates development of the other is not certain. But regardless along with regional supply systems and the corresponding water availability comes roads and utility networks and overall development that further encourages development in the area both directly and indirectly.

Figure 18.
Fecal Coliform Replacement from Shifting Land Uses



The fiscal effects of such development, while no worse than other exurban developments, are nonetheless costly to county taxpayers in general. The above analysis does not suggest that development in the SAWS or SMP is fiscally efficient; it is not. Nor does the analysis imply that the density of development and potential economies of scale of public service provision are being realized. However, this is an issue that the counties have to address, not the WWDC. The question is are counties willing to subsidize exurban development.

Finally, there are clearly potential environmental spillovers that others in the county are forced to confront. Exurban development in the SAWS area is a suspected contributor to fecal coliform levels in Goose Creek, though the relationship is not statistically significant given the way in which the data was collected. If the county is going to allow dispersed development in an area it needs to account for increases in sources of pollutants. One septic system is not a problem, but many septic systems can be.

4.3 ALTERNATIVES ROUTE ANALYSIS

An alternatives analysis for the SAWS (Figure 19) and SMP (Figure 20) projects was developed in order to evaluate the natural resource management implications of project development and alternatives, and to gauge the cost implications of alternative developments. An analysis of the effects of alternative pipeline locations for the SAWS project looked at three pipeline locations, one existing and two hypothetical, all located within the four level sub-watersheds that are, broadly speaking, upstream from the City of Sheridan. The existing supply pipeline for SAWS is 13.7 miles long. Alternative A, trending roughly north of the current pipeline is 11.8 miles long. Alternative B, trending roughly south of the current pipeline, is 11.7 miles long. The two alternatives are shorter than existing conditions because spur and parallel lines were not built in to the alternatives (Figure 19). An analysis of the effects of alternative pipeline locations for the SMP also considered three locations, one existing and two hypothetical. The length of the existing SMP, again less spur and parallel lines, is 72.8 miles. Alternative A, located north of the current pipeline location is 76.6 miles. Alternative B, located south of the current pipeline is slightly longer at 78.06 miles (Figure 20).

The parameters of the SAWS alternatives analysis are:

- Buffers approximately 2 miles in radius.
- Existing Conditions: 13.7 miles long.
- Alt A: 11.8 miles.
- Alt B: 11.7 miles.

Figure 19.

Three Alternatives for the SAWS pipeline location

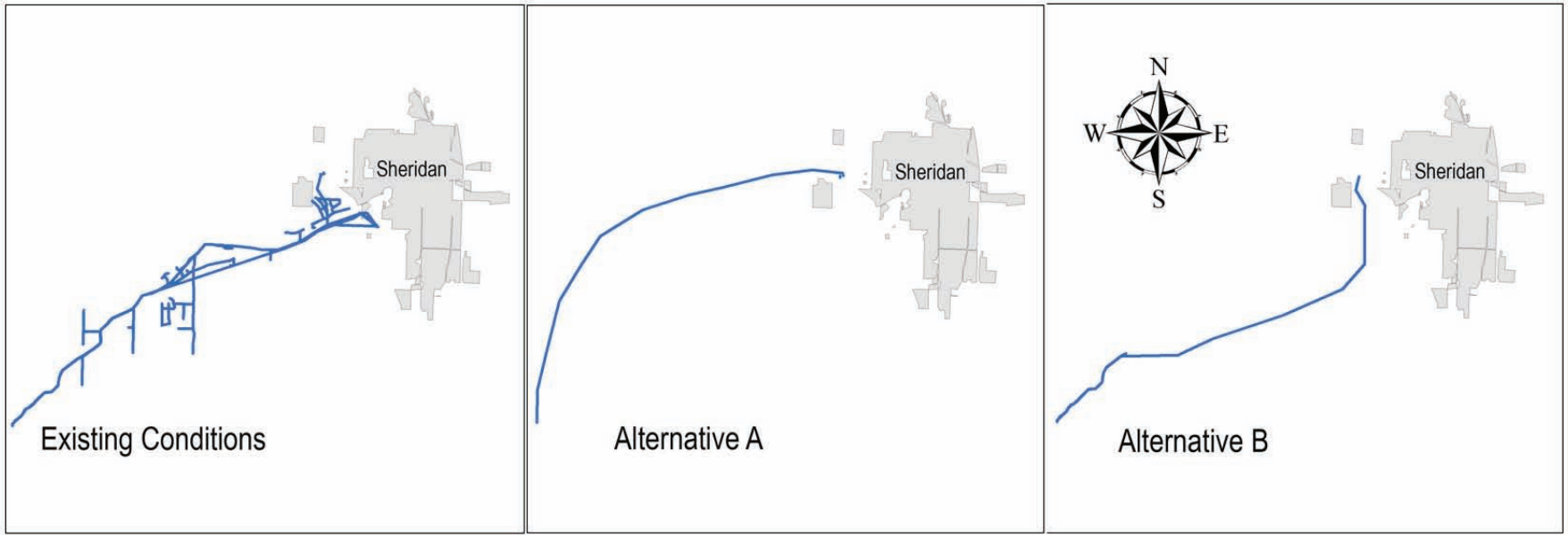
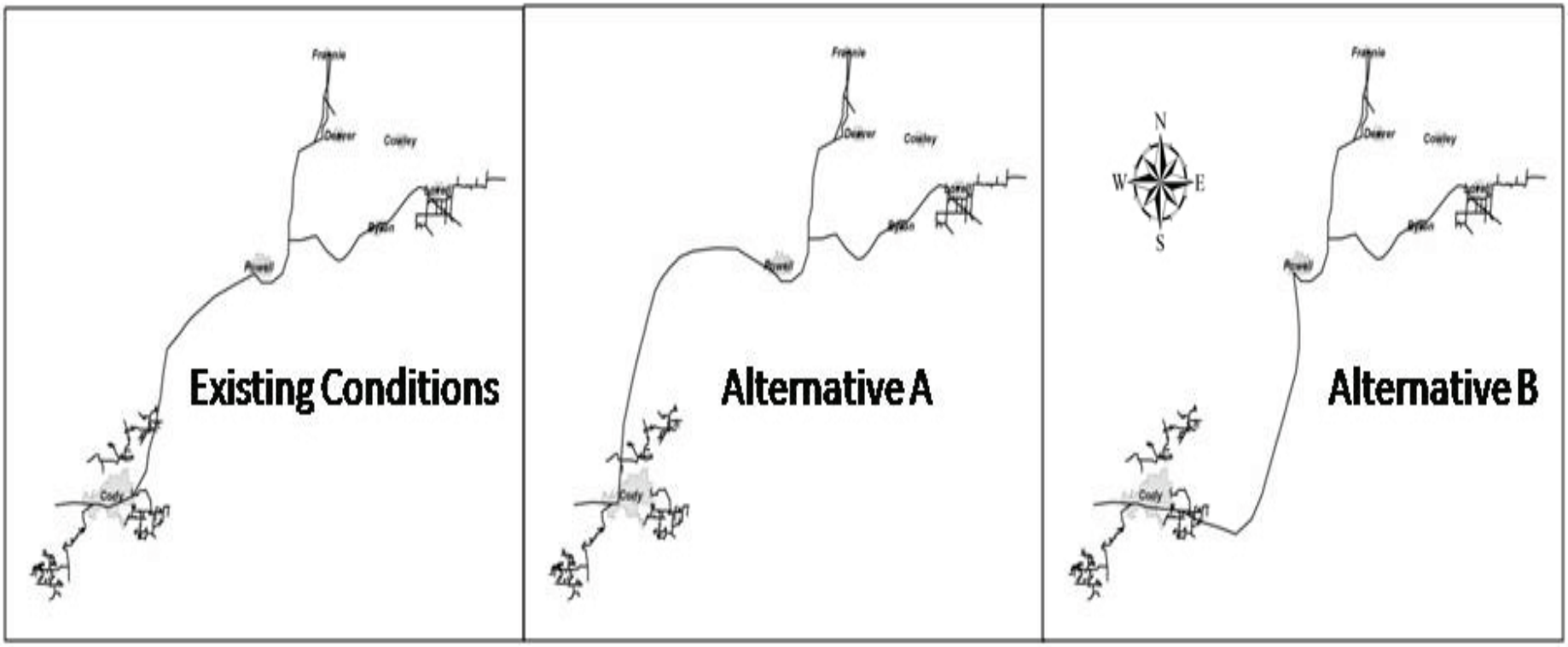
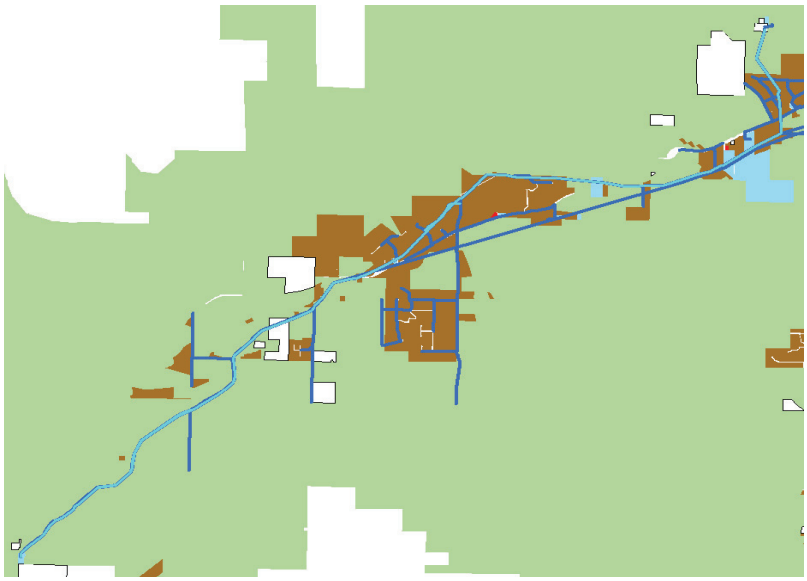


Figure 20.
Pipeline Locations used in the SMP Alternatives Analysis



The SAWS raw water transmission line, from Twin Lakes to the City of Sheridan Water Treatment Plant, is measured in less distribution lines in the Big Goose Creek drainage. The raw water transmission line is identified as the segments in the map below (Figure 21), which total in distance to 13.56 miles.

Figure 21.
SAWS Raw Water Transmission Line Used in the Alternatives Analysis (highlighted)



Construction costs for SAWS are based on information provided by the SAWS office. The cost of the raw water transmission line (estimated above at 13.56 miles in length) can be used to estimate the cost of pipeline development in alternative locations. This alternatives analysis attempts to measure distances for alternative pipeline locations connecting Twin Lakes to the City of Sheridan Water Treatment Plant. (Note: lateral lines, which are not included in the measurement of existing conditions, may in fact be critical to the project.) With alternative pipeline locations, the cost of developing critical laterals may need to be included and would add to the estimates for alternatives A and B below (Table 3).

The estimated pipeline lengths and costs are:

Table 3. **SAWS Alternatives Cost Analysis**

	Raw Water Transmission Pipeline length (miles)		
	Length	Cost per meter	Cost
Existing Conditions	13.56	$811,286.40	$10,999,912
Alternative A	11.81	$811,286.40	$9,584,815
Alternative B	14.36	$811,286.40	$11,652,367

A similar alternatives analysis was developed for the SMP (Table 4). In buffering the SMP pipeline, the procedure is slightly different than the 2 mile radius used in buffering the SAWS pipeline. All pipelines are buffered at a 2 mile radius and all subsidiary pipes are included in the area of analysis. But, the subsidiary pipes are not buffered or included in the length analysis.

The parameters of the SMP alternatives analysis are:

- Buffers approximately 2 miles in radius.
- Existing Conditions: 72.79 miles.
- Alt 1: 76.57 miles.
- Alt 2: 78.065 miles.

Table 4.

SMP Pipeline Alternatives Cost Analysis

	Raw Water Transmission Pipeline length (miles)		
	Length	**Cost per meter**	**Cost**
Existing Conditions	72.79	$525,676.12	$38,265,000
Alternative A	76.57	$525,676.12	$40,251,303
Alternative B	78.065	$525,676.12	$41,037,201

The alternatives are presented in contrast to the existing route. The above assumes uniform costs per mile length of pipeline, regardless of route. This means that no additional pumping, construction or land acquisition costs are incurred for the alternate routes. The implications of differing pipeline routes, in terms of cost and potential resource impacts (provided in a subsequent section) are the items of interest.

Note that the cost of alternative pipeline routes serve as one part of several trade-offs involved in pipeline siting. Changes in cost can then be balanced against wildlife habitat trade-offs that arise due to specific pipeline routes. The policy question then is does avoiding some wildlife and other natural resource impacts justify additional pipeline costs due to alternative routes and the adjacent rural residential development.

4.4 WILDLIFE IMPACTS SCENARIO ANALYSIS

This effort utilized a GIS to inventory existing conditions and developed alternatives for the SAWS and SMP pipelines by evaluating natural resource amenity bundles based on several scenarios, including existing and alternative pipeline locations and pre-built conditions.

The alternative scenarios analysis of amenity change involved development of a quantitative assessment of benefits and impacts for both the SAWS and SMP projects. Scenarios were based on plausible alternatives to the existing pipeline location. Analysis of amenity change required the acquisition and/or development of several base data sets, including the baseline (existing) route for the pipelines, determination of two plausible alternative routes, a pipeline buffer, and determination of overall study area.

In order to gauge the impacts of alternative pipeline location on natural resource management issues, the existing and alternative pipeline locations for the SAWS and SMP projects were buffered at a 2 mile radius. The buffered area is an estimate of the area of influence of the pipeline both during and after construction. The alternative scenarios analysis used the buffers for the existing and two plausible alternatives to analyze areas impacted for each mapped amenity. The analysis of mapped amenities was then used to quantify benefit measures for pipeline alternatives.

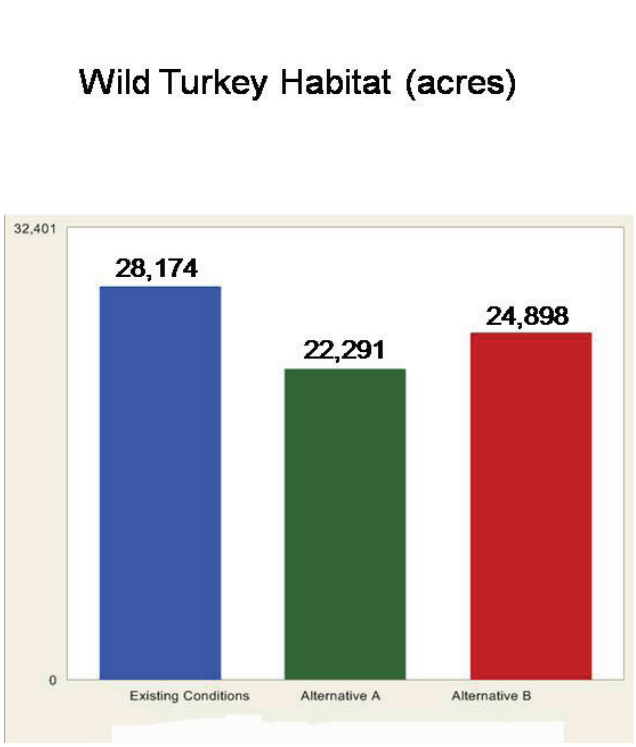
Primary amenity categories of interest are wildlife, soil and water quality. Wildlife related amenities may include the general categories of fisheries, upland game birds, waterfowl, big game critical habitat and migration corridors, and threatened and endangered flora and fauna. Soil related amenities are quality based, reflecting Natural Resource Conservation Service (NRCS) attributes such as percolation tests for septic development, suitability for residential construction, and suitability for irrigated agriculture. For the analysis, the quantity of habitat of representative species was then calculated within the buffered areas. The primary source for wildlife habitat data used in the analysis was the Wyoming Gap Analysis Predicted Terrestrial Vertebrate Species Distributions for Wyoming (Merrill et al., 1996).

For the SAWS project, there are more than 330 vertebrate species, but no known threatened or endangered species. Several representative species were chosen for this analysis. Also used were Wyoming Game and Fish Department data on big game seasonal ranges. Of the six big game species, antelope and white tail deer are included in the analysis. Moose, elk, mule deer and bighorn sheep are not present in the SAWS study area.

The SMP pipeline, located in Park and Big Horn counties, has two endangered species which fall within the alternative buffers, whooping crane and grizzly bear. The same species as with the SAWS analysis were chosen for analysis: wild turkey, wood duck, antelope (winter range) and white tail deer (winter range) with the addition of whooping crane and grizzly bear.

Figure 22.
SAWS - Wild Turkey Habitat *(within the water pipeline)*

Wild turkey was selected as being representative of an upland game bird. The bar graph indicates area of habitat type in question within the buffer or pipeline impacts.



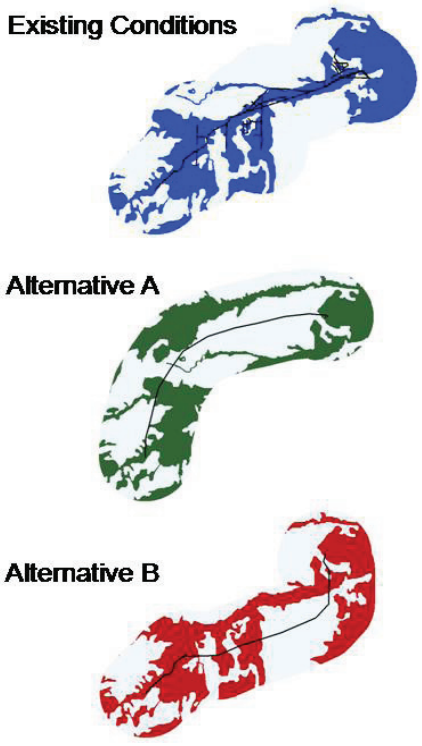


Figure 23.

SAWS - Wood Duck Habitat *(within the water pipeline)*
The wood duck was selected for analysis as representative of a species requiring waterfowl habitat.

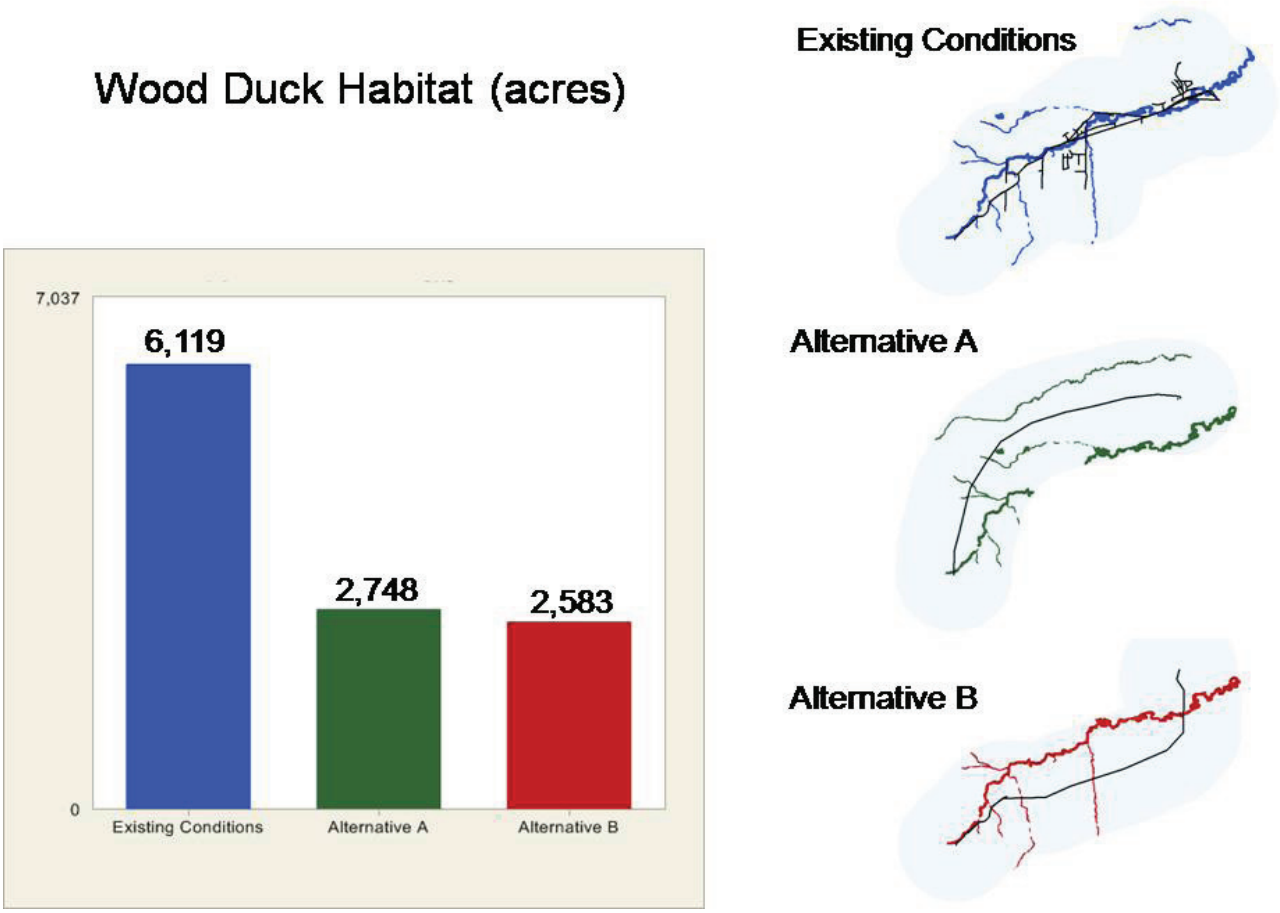
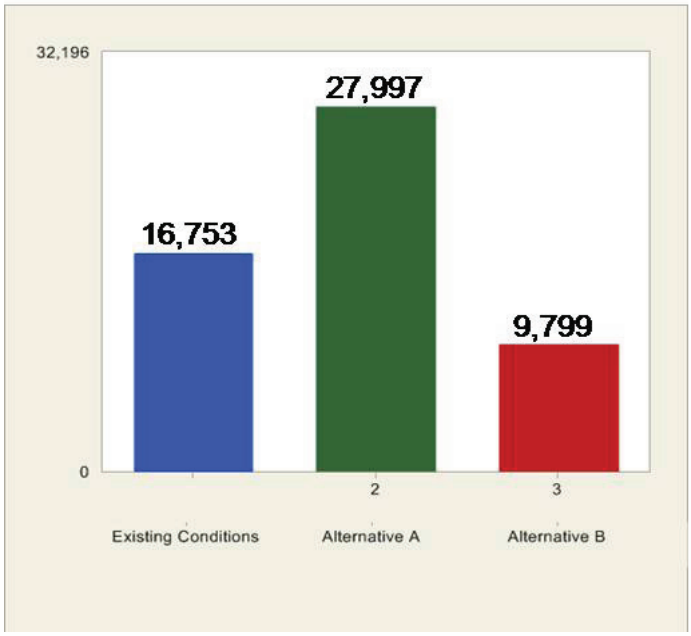


Figure 24.

SAWS - Antelope Winter Range *(within the water pipeline)*

Antelope (Pronghorn) was selected as being representative of a plains big game species. Data are from the Wyoming Game and Fish Department Big Game Habitat Seasonal Range.



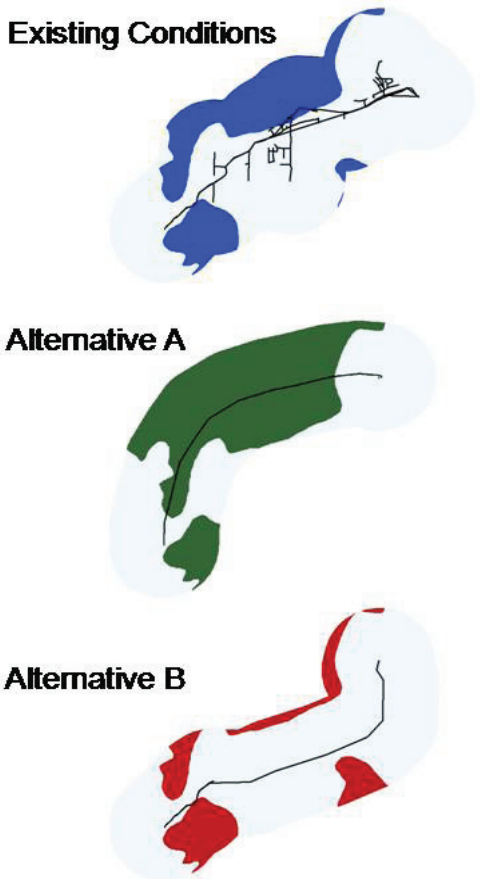
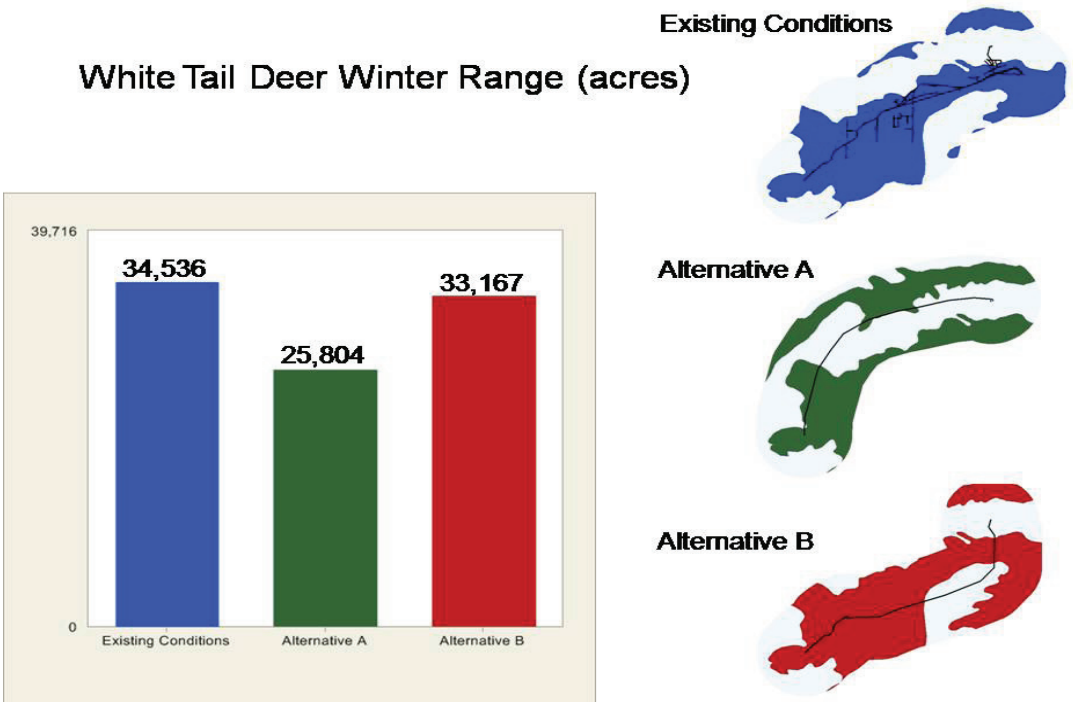


Figure 25.

SAWS - White Tail Deer Range *(within the water pipeline)*

White tail deer winter range was selected as being representative of foothills/draw big game habitat. Data are from the Wyoming Game and Fish Department Big Game Habitat Seasonal Range.

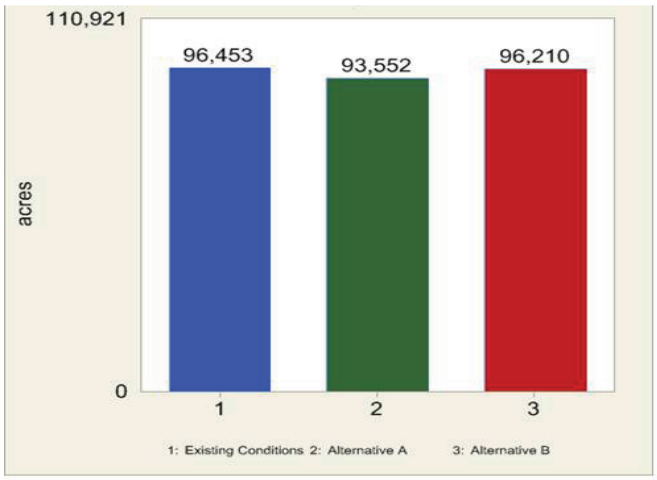


The location of the SAWS project is important for several reasons. The pipeline crosses different sets of land and water attributes, given its route. It has been shown that growth has occurred adjacent to the pipeline route. Thus, the growth may impact soils, water resources, or in the cases shown above for SAWS, wildlife habitat. Several species representative of valued big game species, upland game birds and waterfowl all have habitat in the existing pipeline route as well as the two alternatives. The connection between rural residential development and wildlife viability is certainly a function of the importance/quality of the habitat and available nearby substitutes. In most cases, the existing pipeline route overlaps with more acres of habitat (considering the growth buffer delineated around the route) than the alternatives presented. This is just one example of potential resource impacts that may or may not have been considered in the pipeline route.

Figure 26.

SMP - Wild Turkey Habitat Shoshone *(within the water pipeline)*

Wild turkey was selected as being representative of an upland game bird in the Shoshone or SMP pipeline project area. The bar graph indicates the area of habitat type in question within the buffer or pipeline impacts.



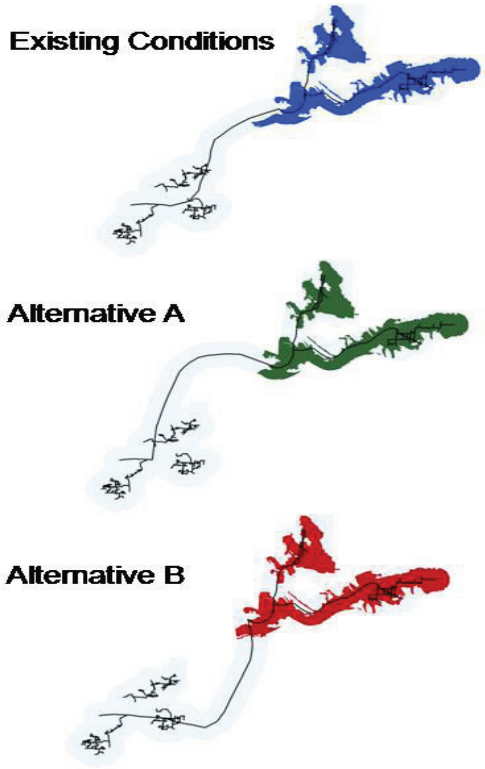
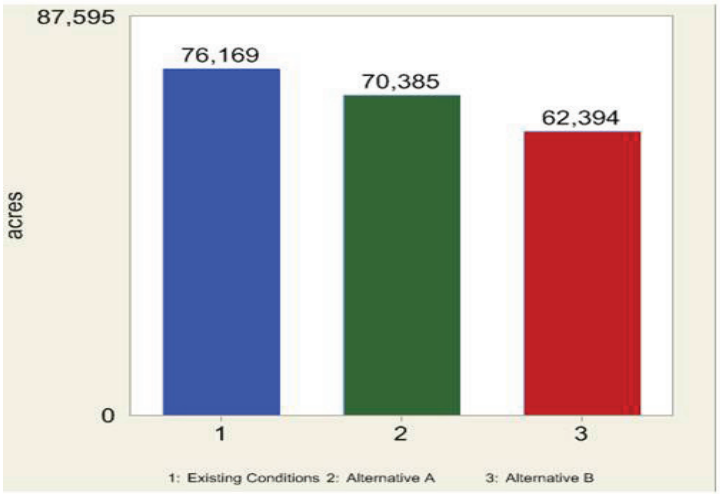


Figure 27.

SMP - Wood Duck Habitat Shoshone *(within the water pipeline)*

The wood duck was selected for analysis based as being representative of species requiring waterfowl habitat in the Shoshone or SMP pipeline project area.



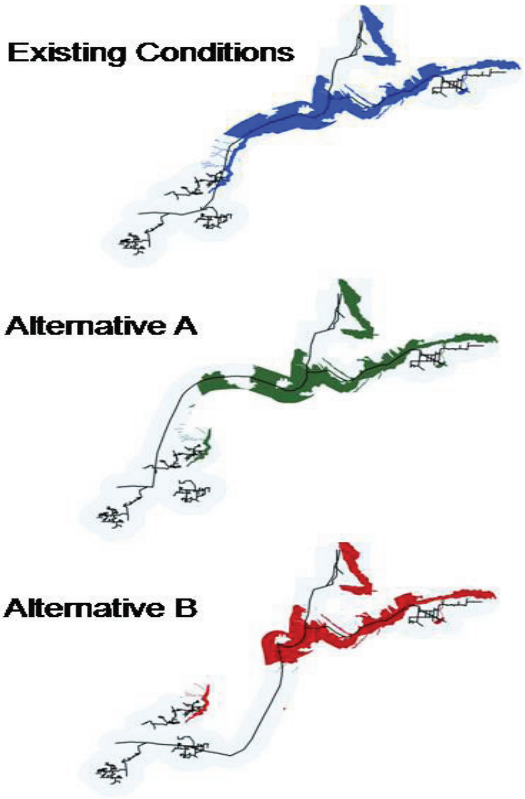
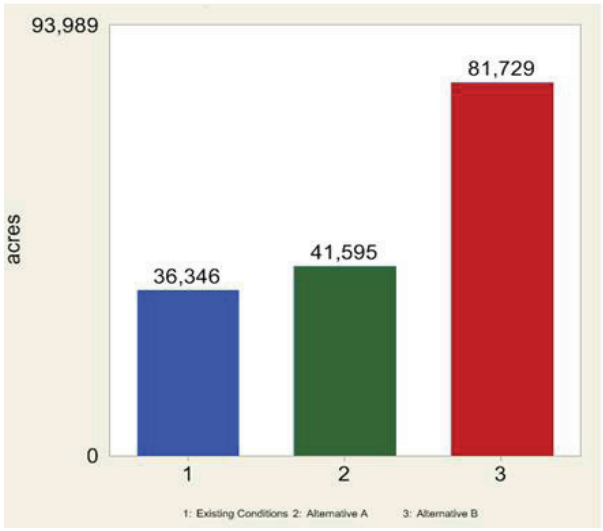


Figure 28.

SMP - Antelope Winter Range *(within the water pipeline)*

Antelope (Pronghorn) was selected as being representative of a plains big game species. Data are from the Wyoming Game and Fish Department Big Game Habitat Seasonal Range.



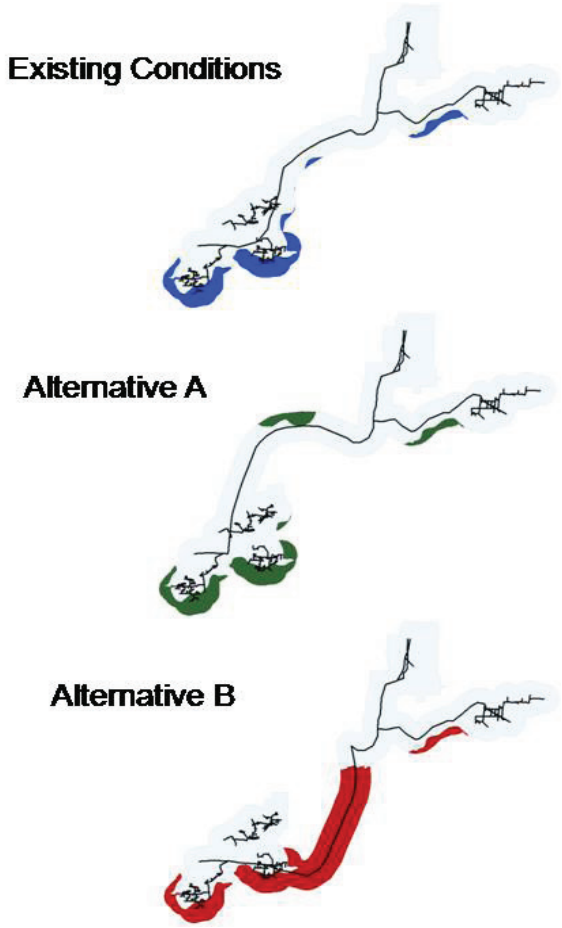
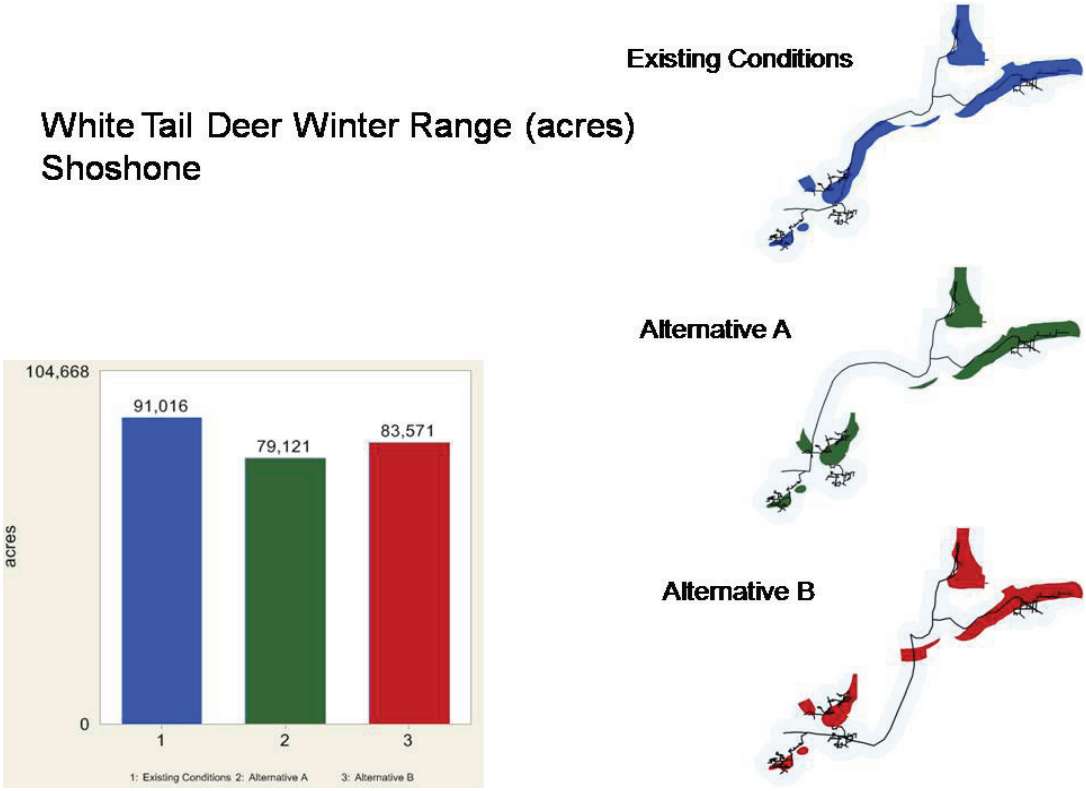


Figure 29.

SMP - White Tail Deer Winter Range *(within the water pipeline)*

White tail deer winter range was selected as being representative of foothills/draw big game habitat. Data are from the Wyoming Game and Fish Department Big Game Habitat Seasonal Range.



The location of the SMP project reveals an overlap with wildlife habitat. The pipeline also crosses varied landscapes along its route. It has been shown that growth has occurred along the pipeline route. Thus, the growth may have various resources and particularly as demonstrated in the cases shown for SMP wildlife habitat. Several species representative of valued big game species, upland game birds and waterfowl all have habitat in the existing pipeline route as well as the two alternatives. The connection between rural residential development and wildlife viability is certainly a function of the importance/quality of the habitat and available nearby substitutes. In most cases (considering the growth buffer delineated around the route), the existing pipeline route crosses more acres of habitat than the alternatives presented. This demonstrates potential resource impacts that may or may not have been considered in determining the pipeline route.

Figure 30.

SMP - Grizzly Bear Habitat *(within the water pipeline)*

The grizzly bear habitat data were based on the Wyoming Gap Analysis Predicted Terrestrial Vertebrate Species Distributions for Wyoming.

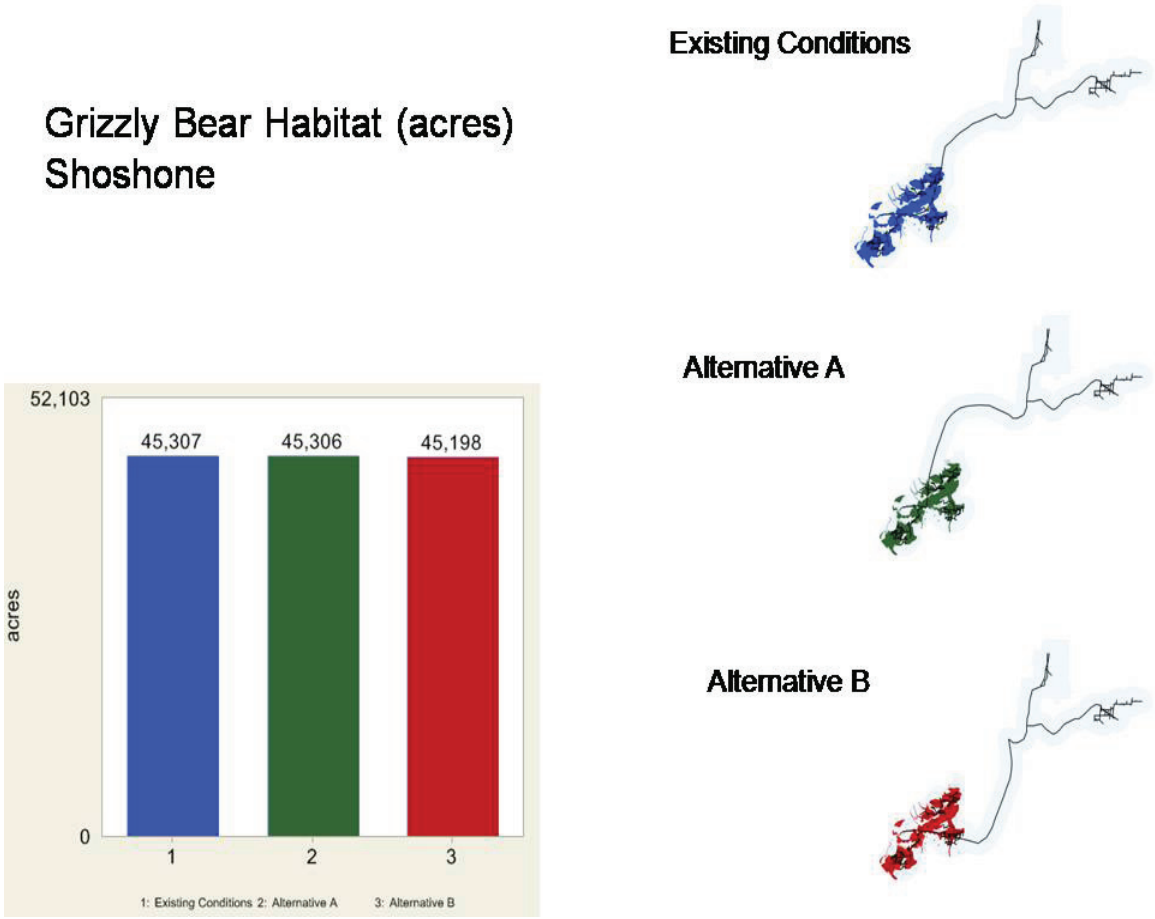
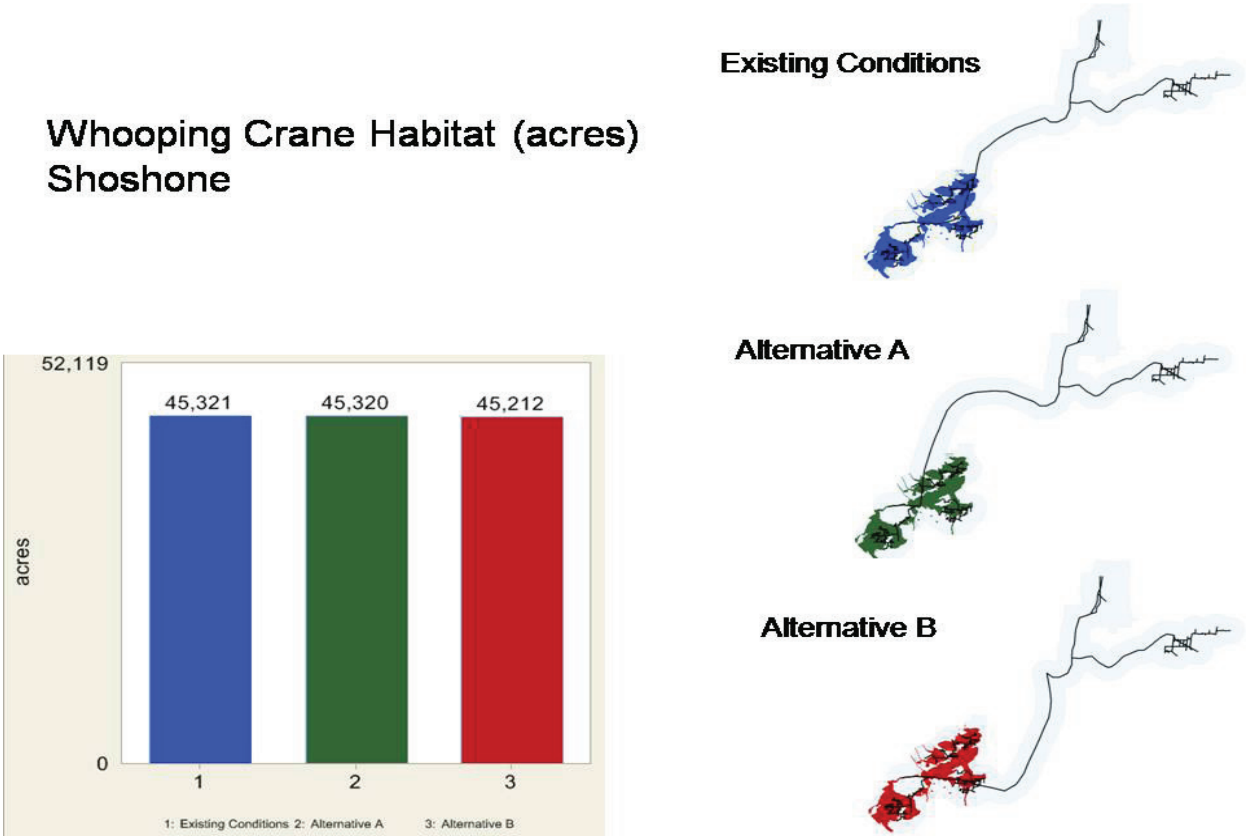


Figure 31.

SMP - Whooping Crane Habitat *(within the water pipeline)*

Whooping crane habitat data were also based on the Wyoming Gap Analysis Predicted Terrestrial Vertebrate Species Distributions for Wyoming.



The existing SMP route (and associated growth buffer) has no effect relative to the provided alternatives for the grizzly bear or the whooping crane as per overlapping with habitat.

This proposed geospatial analysis provides a comprehensive basis for understanding the potential impacts of SAWS (or other regional water project sitings) by identifying spatial impacts to amenities and the landscape. The different pipeline routes offer insights into the varying amounts of habitat impacted for the example species. The importance of comparing pipeline cost by route (given the assumption that cost is strictly a function of pipeline length as mentioned earlier) and wildlife habitats involved can be seen in the following example. Consider the SMP existing and alternative A routes. The cost difference is about $2 million more for the alternative route. Now consider the habitat affected for the White Tail Deer winter range. Note the difference between the two is approximately 12,000 acres of affected habitat. If one assumes uniform habitat quality, then the choice is whether reducing the habitat affected by the pipeline route is worth spending an additional $2 million.

The spatial analysis for both the SAWS and SMP regional water projects indicates that the placement of the projects is important. The implications are that wildlife habitat components and quite possibly migration corridors are impacted. This analysis is one of several potential pieces of research into project location. Other resources that may be affected include but are not limited to prime soils, irrigated agricultural lands, ground and surface water resources, riparian areas and the potential for invasive species.

Chapter V Analysis Impact Results and Public Perceptions

This chapter provides a summary of findings related to the legal framework for water-land development relationships and fiscal and natural resource considerations. It continues with an overview of an opinion survey conducted with local administrators, elected officials, members of joint powers boards, and citizens closely involved in the development and past and current management of the two case study water systems.

5.1 ANALYSIS RESULTS

The following is a summary of results from the various components of the case study impact analyses:

LEGAL BASIS FOR WATER-LAND PLANNING

The current regulatory framework, of federal and state water development authority, as well as land use and planning authority, operates on two separate state and local tracks with little regulatory overlap.

On the water resource end, all waters within state boundaries are the property of the state, with water allocation and use prioritized through a permit system. There are three main state agencies charged with management of water: the State Engineer's Office, Wyoming Water Development Commission (WWDC), and the Wyoming Department of Environmental Quality (DEQ).

In contrast, local authority in water development is not clearly defined, with authority granted generally to municipal or county operations. In this capacity, municipalities and counties rely on individual grants of water authority and have the power to establish water rates.

The main delegation of land use authority is to county commissioners, with planning and zoning commissions assisting in the process. Municipalities also have authority for planning and zoning within their city limits and in the one mile exclusion zone around the city. The Wyoming Joint Powers Act grants authority for interagency cooperation and assistance and allows counties and municipalities to exercise powers jointly, which were previously separately.

Land use authority also exists with the State Land Use Commission guided by the Land Use Planning Act, which in 1975 established a statewide system of land use. The Commission developed the State Land Use Plan, which is Wyoming's land use policy but it lacks any laws, rules or regulations. However, while the provisions of the Commission remain in Wyoming statute, the entity remains inactive because no financial support has been provided for the Commission or the Office of Land Use Administration.

FISCAL IMPACTS ASSOCIATED WITH THE PROJECT AREAS

- Increases in rural subdivisions have a negative impact on county finances. However, the differenc in impacts between general rural population growth and growth tied to regional water supply development are not significant.

- There may be economies of density in service provision such that compacted rural growth in the water project area offers cost savings.

- Impacts on city supply capacity is significant only in the sense that an increase in population creates more demand. However, there is no empirical significant difference between rural versus city growth.

LAND USE CHANGES IN THE SAWS PROJECT AREA

- The SAWS project area witnessed land use changes whereby rural residential uses grew and irrigated cropland uses diminished. (Note: This analysis was not conducted for the SMP since SAWS analysis was done as part of one of the co-authors master's thesis.)

This chapter also includes an additional discussion on the impacts of water systems on rural growth and land use.

WATER QUALITY IMPACTS IN THE PROJECT AREAS

- Water quality was identified as a resource at risk in the SAWS due to rural residential development.

- The SAWS project revealed fecal coliform blooms in Goose Creek (Figure 17, p. 47. There is no apparent trend or correlated land use that could be identified as a responsible phenomena. Declining agricultural land use, supplanted by growing rural residential development, has led to a no net change in the occurrence of coliform blooms (Figure 18, p. 49).

- Assessment of the SMP demonstrated minimal water quality issues. The primary decline was in groundwater quality but at a level well within EPA and state DEQ limits.

WILDLIFE HABITAT OVERLAPS WITH ORIGINAL AND HYPOTHETICAL PIPELINE ROUTES

- Both the SAWS and the SMP regional projects (and the relevant buffer of surrounding development) pass over big game and game bird habitat.

- The existing routes tend to cross more acres of habitat (except in the case of pronghorn habitat) than the alternatives.

- The SMP was also examined for threatened and endangered species. It was determined that the existing pipeline route had no greater impact relative to the other routes.

These results are indicative of the variable environmental impacts that potentially loom as a function of pipeline route. The definition, assessment and comparison of resource impacts provide a potential set of project criteria for both water and land use planning.

5.2 PUBLIC PERCEPTIONS OF WATER PROJECT IMPACTS

To gain a local perspective on positive and negative impacts of regional water development projects, the study also included conducting an opinion survey to learn about the perceptions of local administrators, elected officials, members of joint powers boards, and citizens closely involved in the development and past and current management of the two case study water systems.

METHODOLOGY

The primary survey topics were identified by the WWDC. Topics were then further defined via conversations with managers of the respective projects. These individuals identified the people "in the know" as per each project. Thus the survey methodology was a combination of a Snowball and Delphi sampling strategies and response collection.

The Delphi method (Skulmoski et al., 2007) focuses on specific knowledgeable people. They may or may not be involved with a given project but they are experienced and trained in a related discipline of interest. These individuals form a collective panel whose responses are deemed to be essential input to an information gathering effort. They need not represent a segment of society or an interest group, rather they are important resources.

The survey was conducted using a structured phone interview format. Protocols for collection of data were based on approval of the Internal Review Board, Office of Research, at University of Wyoming. A list of prospective survey participants was provided by Jay Stender, administrator of the Sheridan Area Water Supply Joint Powers Board, and Dossy Overfield, district manager of the Northwest Rural Water District, Shoshone Municipal Pipeline. Individuals were then contacted by phone and invited to participate in the survey. If they chose to do so, an interview time was scheduled and they were emailed or faxed an information sheet as well as the survey questions for their review prior to the interview (Appendix G). All interviews were conducted by phone and were approximately 20 to 30 minutes in length. Subjects could decline to answer any or all questions and terminate the interview at any time. Subject identity was confidential in all reporting of results, unless explicit permission was given by an individual subject to identify his or her responses by name or position title (e.g., "city planner"). Information on informed consent was provided in the information sheet provided to the subject prior to their interview (Appendix G), and was confirmed during the introductory remarks at the start of the interview.

RESULTS OF SURVEY

Fourteen of approximately 20 of the identified potential respondents were contacted and interviewed in each project area. They were called in November and December of 2007, after an initial contact and delivery of project summary and survey questions. Each project's set of respondents had the same survey administered to them in order to facilitate combining the results, if it was deemed important to generalize across projects. Questions ranged from reasons for the projects' respective development - to positive and negative fiscal and natural resource impacts - to opinions on improved local-state coordination (see Appendix H for draft interview script). The results are analyzed below and detailed in Appendices I (SAWS) and J (SMP) by project.

Sheridan Area Water Supply Project (SAWS)

Respondents pointed out that the SAWS is a "good example of city-county cooperation" as well as providing "a safe and reliable source of treated water," "while adding new users."

Respondents also identified several benefits, including an "increased tax base from property taxes resulting from increased growth, avoiding "the cost and problem of drilling wells" and with the goal of providing an upgraded operating system "for providing treated water to the community and rural users."

The majority of respondents indicated that the original SAWS project goals were met, but some people said the goals had changed, including a "new goal for how to accommodate more development," and an added "goal for the acquisition of more water sources because of drought." It appears that land use planning issues and

discussions about expanding the original SAWS system have modified the project goals.

Respondents indicated that EPA actions over raw water, insufficient water supply, the need to repair the water source, and rural/urban water needs spurred the initiation of the SAWS project.

Many of the respondents did not find any issues in defining the target user group(s) for the SAWS project. Those who did have issues responded that there were problems with the following:

- Forecasting future total/rural use;
- Determining who would finance the project besides WWDC; and
- That SAWS water permitted unplanned rural growth by unknown users (at the initiation time of the project).

Respondents were split about issues concerning SAWS location. Some thought that there were no issues, while others indicated that "water treatment plant location and storage reservoirs played a part in location." Others spoke of "issues crossing private property with project and easements and how the "pipeline took the most direct routes," and that the best location resulted from public input that considered "cultural, wetlands, geological, slope, land ownership and water rights."

Responses were also mixed with respect to whether alternate pipeline routes were considered. Just over half of the respondents pointed out that several routes were considered.

According to respondents, growth "promoted development close to [the] water lines; the project continues to eliminate local prime agricultural land for rural development;" and that "[they] knew there would be new development along the pipeline, but [they] didn't expect the magnitude of development that has happened." Respondents were divided as to the value or benefits of the rural growth taking place in the project area.

Respondents cited a variety of negative issues including cost problems with the SAWS system itself as well as the ensuing residential sprawl. Additional items included inefficient local water project organization and conflict between governmental entities.

Nearly all of the respondents answered "no" that SAWS did not fall short of its goals.

It was also noted that current water issues (associated largely with SAWS) have led to county and city planning activities that incorporate water demand and use into the process.

Respondents also offered several types of negative impacts to natural resources that they thought were associated with SAWS, including how "higher density of development without sewage and thus septic and higher density affected wildlife habitat and water quality." It was also noted that the SAWS project had "taken away good irrigated agricultural land and changed it into subdivisions."

SAWS was seen by respondents to have led to "more development due to available water," and what has occurred is "higher density development in project area and targeting sprawl near project." Also, the SAWS area is growing faster than other parts of the county. It was also noted that density is the "difference in development due to SAWS," and that "growth would follow the pipeline; and Little Goose developed more than expected due to the provision of water."

Reactions by respondents related to the impacts of alternate SAWS project sites were varied.

Respondents looked on city, county and WWDC's role in the SAWS project in a variety of ways. Some indicated that the city was the principal player in the project, while others thought the JPB and the county had equal standing with the city. Many felt that the WWDC provided technical and financial assistance to the city and county.

Respondents also pointed out the importance of better coordination across all participating entities. Ideas to improve coordination (SAWS) included the following:

- Creating a single entity made up of both city/county to own and oversee entire water and sewer systems both rural and municipal.
- Providing better coordination so long range water plans and land use plans can be submitted to the state by both the city and county. The state planning office could collect the plans as preparatory efforts for water projects and in terms of applying entities that are knowledgable about the impacts on county/city.
- Recognition by the city and county concerning ownership of the infrastructure and how "resource means nothing other than providing a service to the citizens of the city and county."
- Clarification as to who owns and who is responsible for pipeline and SAWS facilities.

Respondents also offered some suggestions on gaining public input, including the importance of "long range plans," providing information from studies to help raise citizen awareness, and a "comprehensive planning process that occurs every six months."

Shoshone Municipal Pipeline (SMP)

Respondents indicated that water quality, the need for "upgrading water treatment plants" and a "joint effort as [being] more cost effective," were some of the reasons for the SMP. It appears that a safe water supply that exploited treatment efficiencies near the water source and offered increasing returns to scale or joint benefits across users, appealed to many of the respondents.

It is unclear in the overall responses if the SMP was conceived to benefit only municipal users or rural users as well. The core rural beneficiaries do not appear to be identified or forecasted at least to the responding individuals.

The positive aspects of the SMP include "providing quality water and a secure supply to avoid drilling deep wells; for both rural and municipal," according to several of the respondents. The respondents also identified property value benefits accruing to landowners due to the access to drinking water. There was near unanimous assent by the respondents as to SMP meeting its original goals. Responses to SMP goals changing over time , however, were mixed.

Respondents indicated that negative impacts (if any) of SMP included "loss of agricultural land;" how "the pipeline guarantees good water, which spurs development; and "stressing county and impacting county government provision of improved roads." Others indicated problems with JPB representation when compared with water consumption. A nearly unanimous response occurred, denying any SMP shortfalls in meeting its original goals.

Most respondents did not find issues with the location of the SMP or consideration of alternate routes. There appeared to be little consideration of alternate routes. They identified a reliance on an efficient or least cost route for the SMP, based on town locations and gravity considerations to avoid pumping to and from the water treatment plant.

Most respondents indicated that there is more development in the project area, and most agreed that subdivisions were developed adjacent to pipeline due to "water availability" and "greater development density."

There was a prevailing opinion that the development was beneficial in terms of land use, development densities, development with water delivery, and in the context of overall county growth and planning.

Responses were mixed as to SMP natural resource impacts. Those identifying impacts provided several categories. Impacts included loss of wildlife habitat, water quality concerns and loss of agricultural lands. Others thought

that impacts were minimal and not unique to the chosen SMP location. Some said "development would have occurred along the pipeline regardless of location."

Most thought that an SMP located elsewhere would have led to about the same natural resource impacts. "The project would lead to natural resource impacts wherever located."

The impacts of current water consumption on future water planning prompted a range of comments. Some respondents replied that the project was "depreciating faster than anticipated." Other respondents felt that water supply and quality could be concerns. Some did not see any problems at all while others sensed some uncertainty about future water needs.

Responses were also mixed as to current water use, future water needs, and water considerations as part of local land use planning. Concerns included "depreciating faster than expected," and "development exceeding what was or may exceed original plan." Others thought that water issues had spurred planning efforts.

Cities were thought to play a major role in the planning and maintenance of the SMP; counties less so; and the WWDC was viewed as the technical support entity and the "financier."

Respondents indicated that there was either no need to improve coordination between stakeholders or offered several suggestions on ways to enhance coordination. Suggestions consisted of joint planning, monthly meetings, and leadership as well as cooperative agreements. Some ideas offered included utilizing basin advisory committees, forming special water planning committees involving county planning and zoning boards, and improving information systems and accessibility.

More advertising and community meetings appeared to be the chief mechanisms suggested to enhance public involvement.

Chapter VI Recommendations, Limitations and Future Research

This research study examined issues associated with impacts of state-funded regional water projects on community and rural land development. In this chapter, recommendations are provided for improving coordination between local and state government in water planning efforts, and potential new state and local policy mechanisms to better support responsible land and water resource development and use. This chapter concludes with a short discussion of study limitations encountered and needs for potential future research.

6.1 RECOMMENDATIONS

There were several issues that came out of the analysis related to rural growth and land use. Probably the most important one is that these regional water supply systems do in fact act as an attractant to exurban growth because of the ability to access water. As such, counties need to decide beforehand how much growth around these systems they are willing to accept. Smaller parcel sizes have the potential for increased local government program efficiency, but can also have more serious impacts on the broader environment, ranging from wildlife habitat loss to water quality issues.

It is not clear what considerations were taken into account for locating the system, other than engineering. For the most part there were no real concerns raised as to the locations of either supply system. However, it is clear that the location of the systems and the associated development around the systems have disrupted some environmental aspects of the area, especially with respect to water quality in Goose Creek related to SAWS. Residents who were allowed to tap into the SAWS water line were not required by the county to install sewer systems only septic systems. This is sufficient for a small number of residents, but may be a cumulative problem in the future for many residents with septic systems as the number of houses grow in the watershed. While water quality issues were not an issue for the SMP, it could be a problem in the future as developments with septic systems grow.

Currently there is no process that looks at the potential impacts beyond direct construction and right-of-way considerations. Water development boundaries are often not the same boundaries that water is connected to, so the impacts in one area can have impacts in other areas as water moves downstream.

A need exists to better understand the relationship between state-funded regional water projects and rural residential growth, and facilitating local planning efforts that incorporate water resource development issues and use in Wyoming. Several issues arise as follows:

- The possible unintended consequences (both positive and negative of current and future WWDC-funded regional water supply systems) need to be identified and defined.

- The implementation of these systems has impacts on local land use. The impacts then need to be identified and defined especially with regard to unplanned rural residential development (possibly stimulated by increased water availability).

- The resulting land use pattern may then impact future water demands and water quality, agricultural lands, wildlife habitat, and the county tax base. The impacts need to be described and quantified to the extent possible.

The following is a list of potential policy options for building better linkages between land use decisions and

water supply planning. They include suggestions adapted from a number of previously published sources (Tarlock and Lucero, 2002; Travis, 2003; Cohen, 2004; Coulson, 2005; Public Policy Research Institute, 2007), and also reflect insights gained by the co-authors in conducting this research project.

State Water Policies

- Public participation should be increased to assess long-term trade-offs of planning, resource management, fiscal impacts, and infrastructure capacity with public value choices.
- Cross-jurisdictional collaboration is a necessary principle for successful project planning, development, implementation and operation.
- Projects must be documented to include a facility and delivery description.
- Criteria must be identified, defined and described particularly as it was used to determine capacity, scale, location and consequences and impacts associated with the project.
- Management policies need to be defined and described.
- Planned versus as-built project comparisons also need to be documented and catalogued.
- Better information infrastructure (e.g. statewide GIS data) is needed to support local planning and development efforts.

Local Water Planning

- Integrated land use and water planning should occur between city, county and state entities.
- More accurate population projections are needed to determine capacity in relation to projected demand.
- Demand may not always materialize as projected, therefore sensitivity analysis and other risk management tools need to be utilized in local demand analysis.
- Realistic cost forecast and pricing for water users and management of water supply needs to be employed.
- Social and environmental costs typically borne by society as externalities need to be included in the project benefit cost analysis to capture a total cost of project by type and location.
- Attempts should be made at reliable estimates of project costs.

- Pricing (both urban and rural) ought to be converted to an avoided cost approach.

- Regional coordination across and involving local entities is essential.

- Conservation measures such as incentives or fees should be employed to slow project capacity utilization, rapid growth and the need for acquisition of new water sources.

- Watershed-sensitive planning should include the consideration of stream setbacks, clustering development, water quality considerations, and environmental assessments for other important or sensitive resources.

- Minimize the impacts to wildlife by considering several pipeline routes and their varied impacts. This kind of analysis should be made available to the local public at local meetings so that they can choose pipeline route based on such impacts rather than based on pipeline costs alone.

- Water availability review should be a component of a subdivision review.

- Water development project review should consist of an assessment of water use issues with other land use and environmental laws and policies.

- Examine any existing land use plans for the areas to be affected *before* the projects are built, as well as the consistency of the projects with those plans.

Land Use Authority

- The state Legislature should consider providing funding support and reconstituting the State Land Use Commission and the Office of Land Use Administration so that these entities can carry out the provisions in Wyoming statute for a statewide system of land use (Land Use Planning Act, 1975). While current enforcement of land use plans are carried out by local entities through their powers granted by the state Legislature, reconstituting the Commission could prove to be an effective means for enhanced coordination between local and state planning entities.

6.2 DATA LIMITATIONS

There were several limitations of this study due to data availability or databases not specifically designed to address the questions the WWDC requested. Engineering data for SAWS were available and were easily converted to a GIS framework. However, the specifications for the SMP were not available and we had to approximate the location of the pipeline and associated line taps. Consequently, the spatially-specific analysis results were, in some cases, based upon approximations.

Fiscal data collected by both counties were of limited use since they were countywide and there were insufficient data series to construct a statistically valid trend of costs and revenues. General accounting procedures (GAP) were adopted in the early 1990s, which means that pre-GAP data was of uncertain classification. Categories changed and shifted over years that were available after GAP periodically adding to the complexity of the

interpretation. Finally our task was essentially to look at sub-county areas in both counties. Fiscal data reported is not set up for this kind of analysis, and as a result it was more complicated and involved higher uncertainty in the evaluation of county trends with components of sub-county factors.

Water quality data suffered from similar problems. The monitoring stations were not optimally located to evaluate the effect of subdivision development on surface water quality along the SAWS's Goose Creek or within the SMP. As a result, the question of the source of high levels of fecal coliform could not effectively be studied with confidence.

6.3 FUTURE RESEARCH

For future efforts to evaluate and monitor regional supply systems impacts, the study offers a number of recommendations. First these systems need to recognize that they are in an area larger than the immediate location of the pipeline and water source. There are potentially downstream impacts to water quality and quantity, broader fiscal effects that go beyond just the residents who are served, and even economic base issues.

Related to this larger area issue is that there needs to be cross-county standards for cadastral databases configured into a statewide geospatial information infrastructure. In this respect, if there are cross-county, cross-basin, or any other political or geographical boundary issues that arise in the construction and/or operation of the system, there is a comprehensive database to facilitate information development.

Finally, there needs to be a collective state and local effort for monitoring environmental and fiscal issues as development grows along pipeline corridors. Unintended consequences are always an issue with major projects that span multiple ecological areas and multiple communities and political subdivisions. Leaving problems to fester can be a problem as opposed to addressing them when they start to surface or before citizens become skeptical of local and state government agencies. As has already been successfully demonstrated by the WWDC, SAWS and SMP, open and inclusive communication from project inception and beyond is critical in addressing such issues.

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